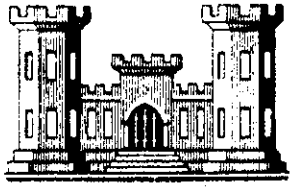
MAJOR REHABILITATION PROJECT

CAPE COD CANAL BRIDGES

CAPE COD CANAL

BOURNE, MASSACHUSETTS

DESIGN MEMORANDUM



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

DECEMBER 1978

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:

NEDED-E

10 January 1979

SUBJECT: Cape Cod Canal Bridges
Major Rehabilitation Project, Design Memorandum

HQDA (DAEN-CWE-B)
WASH DC 20314

1. In accordance with ER-1130-2-417, there is submitted for review and approval the Design Memorandum for Cape Cod Canal Bridges, Major Rehabilitation Project.

2. Reconnaissance Reports for the project were submitted in July and August of 1977 and the project accepted under the Major Rehabilitation Program.

3. A supplementary environmental impact statement has been prepared for the project and will be forwarded under separate cover.

4. It is recommended that the project plan submitted in this memorandum be approved as the basis for preparation of contract plans and specifications.

5. It is recommended that authority for review of the plans and specifications for the Bourne Bridge be delegated to the Division Engineer. This will permit an earlier award and ensure sufficient lead time for full construction activities to begin 5 Sept 1979.

FOR THE DIVISION ENGINEER:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

Incl (10 cys)
as

DAEN-CWE-BB (NEDED-E, 10 Jan 79) 1st Ind
SUBJECT: Cape Cod Canal Bridges
Major Rehabilitation Project, Design Memorandum

DA, Office of the Chief of Engineers, Washington, D.C. 20314 12 February 1979

TO: Division Engineer, New England, ATTN: NEDED-E

1. The subject design memorandum is approved, subject to the comments furnished in the following paragraphs.

2. The design memorandum should be supplemented for the record to provide information as to the ownership of the Bourne and Sagamore Bridges and whether or not additional permanent or temporary interests in real estate will be required. The information should include a brief Attorney's Report establishing the present ownership (compensable interest) in the existing bridge facilities and the right-of-way in which they are located (see ER 1180-1-1, paragraph 73-204).

3. Paragraph 16e. The last sentence in this paragraph should be modified to include lightweight concrete aggregates produced by the sintering process.

4. Paragraph 16i. This paragraph should include data on the bondability of epoxy bituminous waterproofing to steel grid and lightweight concrete as well as data on the bondability of the waterproofing to the bituminous pavement.

5. Paragraphs 21, 22 and page 30. Although the Bourne Bridge has almost twice the square footage as the Sagamore Bridge, item A2 shows the same unit price. The schedule also shows the same construction time for both bridges. These apparent time and cost inconsistencies should be rectified.

6. Basic letter, paragraph 5. The recommendation that approval authority for the plans and specifications be delegated to the Division Engineer is not approved. However, an expedited review by OCE staff, including on-board review, if required, will be arranged to minimize any adverse impact on the construction schedule.

FOR THE CHIEF OF ENGINEERS:

Jack R. Thompson

JACK R. THOMPSON
Acting Chief, Engineering Division
Directorate of Civil Works

Incl
wd

MAJOR REHABILITATION PROJECT

CAPE COD CANAL BRIDGES
CAPE COD CANAL
BOURNE, MASSACHUSETTS

DESIGN MEMORANDUM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS

DECEMBER 1978

MAJOR REHABILITATION PROJECT

CAPE COD CANAL BRIDGES

CAPE COD CANAL
BOURNE, MASSACHUSETTS

DESIGN MEMORANDUM

CONTENTS

LIST OF TABLES

LIST OF APPENDICES

LIST OF FIGURES

LIST OF FIGURES

LIST OF FIGURES

MAJOR REHABILITATION PROJECT
CAPE COD CANAL BRIDGES
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BOURNE, MASSACHUSETTS

A. PERTINENT DATA

PROJECT NAME Cape Cod Canal

PURPOSE Navigation

PHYSICAL FEATURES

Total Length including Dredged Approaches	17.4 miles
Length in Land cut	7.7 miles
Minimum Channel Width	500 feet
Minimum Depth at Mean Low Water	32 feet

VESSELS TRANSITING - 1977

Commercial	6,981
Recreational	22,225

FEATURES TO BE REHABILITATED

Bourne Highway Bridge

Number of Lanes	4
Width of Lane	10 feet
Total Length	2684 feet
Number of Spans	7
Maximum Span Length	616 feet
State Highway	Route 28
Vertical Clearance above MHW	135 feet min.

Sagamore Highway Bridge

Number of Lanes	4
Width of Lane	10 feet
Total Length	1833 feet
Number of Spans	3
Maximum Span Length	616 feet
State Highway	Route 6
Vertical Clearance above MHW	135 feet min.

ESTIMATED COST OF REHABILITATION

Bourne Highway Bridge

Repairs to Structural Steel	$ 1,160,000
Remove and Replace Concrete Deck	4,406,800
Paint Superstructure	400,000
Contingencies	1,183,200
Preparation of Plans and Specifications	350,000
Supervision and Inspection	600,000
Sub-Total	$ 8,100,000

Sagamore Highway Bridge

Repairs to Structural Steel	370,000
Remove and Replace Concrete Deck	2,640,000
Paint Superstructure	270,000
Contingencies	650,000
Preparation of Plans and Specifications	250,000
Supervision and Inspection	320,000
Sub-Total	$ 4,500,000
Total Estimated Cost of Rehabilitation	$12,600,000

B. AUTHORIZATION

1. Project Authorization. - Reconnaissance reports were prepared and submitted to the Chief of Engineers on 3 August 1977 for the Sagamore Bridge and on 31 August 1977 for the Bourne Bridge. The first endorsement to these reports, Office of the Chief of Engineers to Division Engineer, New England, dated 5 December 1977, states that the proposed project qualified under the Major Rehabilitation Program and was included in the FY 79 President's Budget request to Congress. This memorandum was prepared as required by paragraph 6c. of ER 1130-2-417 and its scope and content is in accordance with Appendix B of that regulation.

C. LOCATION AND DESCRIPTION

2. Project Location. - The Cape Cod Canal is a sea level canal located about 50 miles south of Boston, Massachusetts, crossing a narrow neck of land which joined Cape Cod to the mainland. The canal extends from Cape Cod Bay at the east end to Buzzards Bay on the west end. Cape Cod became an island with construction of the canal. Communities adjacent to the canal are the Towns

of Bourne and Sandwich, Massachusetts. State Highways 6 and 28 and a single track rail line cross the canal on three separate bridges. The highway bridges are high level structures providing for the project vertical clearance of 135 feet above mean high water. The railroad bridge is a single span vertical lift bridge which is lowered to pass trains but is normally kept in its up position to provide the required vertical clearance for shipping. The two highway bridges, known as the Bourne Bridge (carrying Route 28) and the Sagamore Bridge (carrying Route 6), the superstructures of which are the features of the Cape Cod Canal to be rehabilitated under the current project are the subject of this memorandum.

3. Description of Bourne Bridge. - The Bourne Bridge traverses the canal in the Town of Bourne, Massachusetts carrying State Highway Route 28. It provides one of the two crossings for motorists and pedestrians traveling to and from the Cape. The bridge is located approximately two miles from the western entrance to the canal as shown on the Location Plan, Figure 1. The bridge carries four ten-foot wide traffic lanes plus a sidewalk and provides a minimum vertical clearance of 135 feet over a horizontal distance of 480 feet for shipping using the canal. The bridge consists of seven spans. Simple truss spans of 240 feet and 270 feet on the south side and 240 feet and 208 feet on the north side, flank the three continuous channel spans. The trusses in the center of the channel span are arched, reaching a height of 120 feet above the roadway, with the roadway suspended by wire rope hangers. The substructure consists of two channel piers, four intermediate piers and two abutments, all of reinforced concrete. The total bridge length between centerlines of abutment bearings is 2,384 feet. In addition, each abutment provides a concrete framed deck, 150 feet long, making the total structure length 2,684 feet. Figure 2 is a photograph of the bridge and Figure 4 is a key plan identifying major features of the bridge. In addition to its highway function, the bridge carries telephone lines and a natural gas pipeline.

4. Description of Sagamore Bridge. - The Sagamore Bridge traverses the canal in the Town of Bourne, connecting State Highway Route 3 on the mainland with State Highway Route 6 on Cape Cod. It provides the second of the two crossings for motorists and pedestrians traveling to and from the Cape. The bridge is located approximately two miles from the eastern entrance to the canal at Cape Cod Bay as shown on the Location Plan, Figure 1. The bridge carries four ten-foot wide traffic lanes plus a sidewalk providing a minimum vertical clearance of 135 feet over a horizontal distance of 480 feet for shipping using the canal. The main support of the structure consists of two three span continuous trusses, identical to those of the three center spans of the Bourne Bridge, supported

by concrete abutments and two concrete channel piers. The approach spans are 396 feet long and the center span across the canal is 616 feet long for a total length of 1408 feet between centerlines of abutment bearings. In addition, concrete framed decks of 225 feet in length at the south side and 200 feet on the north side are provided by the abutments, making the total structure length 1833 feet. Figure 3 is a photograph of the bridge and Figure 5 is a key plan identifying major features of the bridge. In addition to its highway function, the bridge carries telephone lines and a natural gas pipeline.

D. HISTORY OF BRIDGES

5. Original Construction. - The Cape Cod Canal was originally constructed by private interests, being completed in 1916. The United States Government purchased it in 1928. The canal was placed under the supervision of the Corps of Engineers and was widened and deepened to its present capacity under the National Industrial Recovery Act of 1933. The War Department authorized funds in 1933 for the construction of three new bridges made necessary by the widening of the channel. A total of $2,967,000 was expended on the construction of the two highway bridges; $1,603,000 on the Bourne and $1,364,000 on the Sagamore, which were opened to traffic in 1935.

6. Original Design. - The structures were designed substantially in accordance with the Standard Specifications for Highway Bridges and Incidental Structures adopted by the American Association of State Highway Officials, published in 1931, extended to cover silicon steel. The main truss members are composed of built-up members of riveted construction with numerous lacing bars and stay plates. The use of high strength (silicon) steel, lightweight (Haydite) concrete and continuous design of the trusses for the Sagamore and center three spans of the Bourne, contributed to the graceful lightweight appearance of the bridges. The concrete roadways are supported by longitudinal steel stringers, spaced 5 feet on centers, which in turn are supported by transverse floorbeams located at truss panel points. The bottom surface of the roadway slab is flush with the underside of the stringer flanges thereby providing lateral support for the top (compression) flanges. Details of the superstructure framing are shown on Figures 6 thru 16. The center 550 feet of span one on each bridge is suspended from the arched trusses by 3¼-inch diameter wire rope hangers. The geometric design of the bridges provides for a roadway width of 40 feet (4 - 10-foot lanes) flanked by a 6 foot 8 inch wide sidewalk on one side and a 2 foot wide safety curb on the other. Sixteen-inch high vertical

granite curbing separates the roadway from the sidewalk and curb. A heavy duty combination traffic and pedestrian railing is located on the outsides of the safety curbs and sidewalks. The approach roadways to span 1 over the canal are on a six percent vertical gradient with a 700 foot long vertical curve which has its point of intersection (crown) at the center of span 1 (Panel Point 16).

7. Effects of Storm Damage. - There is no evidence that the bridges have ever suffered storm damage. The bridges have withstood the effects of several hurricanes without apparent distress.

8. Progressive Deterioration. - Progressive deterioration has occurred at both bridges to more or less the same extent. Most of the deterioration which has occurred can be attributed to either the salt atmosphere or to the effects of deicing salts used on the roadways during winter. The original roadway concrete was waterproofed with an unreinforced cut back asphalt. The waterproofing did not function well and allowed salt-contaminated water which penetrated the bituminous concrete wearing surface to enter the concrete, deteriorate the reinforcing steel embedded in it and cause spalling, especially in the areas adjacent to the curbs. This necessitated considerable patching of the roadway slab and replacement of five foot widths of slab adjacent to the curbs in 1962 at the Sagamore Bridge and in 1963 at the Bourne Bridge. The salt atmosphere, water penetrating the roadway and water leaking thru the open roadway joints has made maintenance of the paint system difficult and some deterioration of the supporting steel has occurred. An additional factor contributing to the current poor condition of paint on the structural steel, is the details of construction of the truss and bracing members. The built-up box type members with numerous lacings and plates are very difficult to clean properly before painting. Evidence of areas of poor consolidation of the lightweight concrete in the roadway slab has been apparent since shortly after construction was completed, with the occurrence of several holes in the roadway slab, the first being at the Bourne Bridge in 1937. Deterioration has reached the stage where normal maintenance procedures will not suffice making the current rehabilitation project necessary.

9. Repairs Previously Made. - Tables 1 and 2 present chronologies and costs of maintenance work contracted during the life of the Bourne and Sagamore Bridges respectively. Not included are costs of periodic inspections and maintenance performed by government personnel, administrative costs or fees of consultants retained to perform inspections and prepare condition evaluation reports. Previous major rehabilitation of the bridges was carried out during 1962 at the Sagamore and during 1963 at the Bourne as shown in the tables.

TABLE 1

BOURNE HIGHWAY BRIDGE

CHRONOLOGY OF EXPENDITURES FOR MAINTENANCE AND REHABILITATION

FISCAL YEAR	CONTRACT TITLE	DESCRIPTION OF WORK	COST
1938	PAINTING	PAINT SUPERSTRUCTURE	$ 14,046
1938	PAVING	SEAL COAT - SHEET ASPHALT	8,838
1947	PAINTING	PAINT SUPERSTRUCTURE	34,550
1949	PAVING	REPLACE BITUMINOUS PAVEMENT	29,490
1952	PAINTING	PAINT SUPERSTRUCTURE	65,879
1958	PAINTING	PAINT SUPERSTRUCTURE	44,494
1959	REPAIRS TO BOURNE AND SAGAMORE BRIDGES	REPLACE 4 ANCHOR BOLTS - PIERS 3 AND 5	1,468
1963	BOURNE HIGHWAY BRIDGE MAJOR RENOVATION	RESURFACE ROADWAY AND SIDEWALK, INSTALL NEW CURBING, REPLACE 5-FOOT STRIPS OF DECK CONCRETE ADJACENT TO CURBS, ELECTRICAL WORK, NEW ROADWAY SCUPPERS, REPAIRS TO CONCRETE, ACCESS LADDERS, PLATFORMS AND DOWNSPOUTS	1,039,848
1967	PAINTING	PAINT SUPERSTRUCTURE	144,400
1969	SAGAMORE AND BOURNE HIGHWAY BRIDGES STRUCTURAL REPAIRS	PRESSURE GROUTING OF CRACKS IN ABUTMENTS AND PIERS	27,455
1971	PAINTING	PAINT RAILINGS	21,497
1973	PAINTING	PAINT SUPERSTRUCTURE	260,970
1976	STRUCTURAL REPAIRS TO BOURNE BRIDGE	REPAIRS TO 2 STRINGERS - SPAN 4 REPLACE SIDEWALK BRACKET - SPAN 1	40,720
1976	REMOVAL OF BIRD EXCREMENT FROM ABUTMENTS	--	$ 6,835
1976	HANGER CABLE REPLACEMENT	REMOVE 2 PAIRS OF CABLES FOR TESTING AND REPLACE WITH NEW CABLES	146,370

TABLE 2

SAGAMORE HIGHWAY BRIDGE

CHRONOLOGY OF EXPENDITURES FOR MAINTENANCE AND REHABILITATION

FISCAL YEAR	CONTRACT TITLE	DESCRIPTION OF WORK	COST
1938	PAINTING	PAINT SUPERSTRUCTURE	$ 8,000
1938	PAVING	SEAL COAT - SHEET ASPHALT	5,149
1942	PAINTING	PAINT RAILINGS	4,314
1947	PAINTING	PAINT SUPERSTRUCTURE	18,000
1952	PAINTING	PAINT SUPERSTRUCTURE	36,000
1955	PAVING	REPLACE BITUMINOUS PAVEMENT	22,985
1959	REPAIRS TO BOURNE AND SAGAMORE BRIDGES	REPLACE ROLLER NEST WEST TRUSS BEARING AT NORTH ABUTMENT	4,000
1962	RENOVATION OF SAGAMORE HIGHWAY BRIDGE	RESURFACE ROADWAY AND SIDEWALK, INSTALL NEW CURBING, REPAIR EXPANSION JOINTS, REPLACE 5-FOOT STRIPS OF DECK CONCRETE ADJACENT TO CURBS, ELECTRICAL WORK, NEW ROADWAY SCUPPERS, REPAIRS TO CONCRETE	560,747
1963	PAINTING	PAINT SUPERSTRUCTURE	35,090
1963	BOURNE AND SAGAMORE HIGHWAY BRIDGES MAJOR REHABILITATION-STRUCTURAL	ADD ACCESS LADDERS AND PLATFORMS, SCUPPER DOWNSPOUTS, REPAIR UNDERDECK CATWALK, REPLACE RAILING BOLTS	80,000
1969	SAGAMORE AND BOURNE HIGHWAY BRIDGES STRUCTURAL REPAIRS	REHABILITATION OF SIDEWALK AND CURB, REPAIR CRACKS IN SUBSTRUCTURE	90,000
1969	PAINTING	PAINT SUPERSTRUCTURE	154,200
1974	SAGAMORE BRIDGE RENOVATION	REPAIR STRUCTURAL MEMBERS, CONCRETE, EXPANSION JOINTS, RAILINGS AND MISCELLANEOUS WORK	679,308

10. Current Condition. - In-depth inspections of the bridge superstructures were conducted during 1975 and 1976. The results of the inspections and related investigations are contained in two Condition Reports filed with the Chief of Engineers on 18 April 1977. Those reports are entitled, "Sagamore Highway Bridge, 1976 Condition Report" and "Bourne Highway Bridge, 1976 Condition Report." They constitute the source for the descriptions of current conditions and recommended repairs described in this memorandum. The current condition (1976) of the various general categories of components of the bridges are summarized below.

a. Abutments and Piers. - The abutments and piers are in good condition with no serious cracking. Hairline cracking evident at most of the piers was determined to be structurally insignificant. A spalled area on the west pylon of Pier 6 at the Bourne Bridge will require repair. Foundation stability of the substructure components was evaluated as part of the 1969 Condition Survey of the Sagamore Bridge and the 1971 Condition Survey of the Bourne Bridge. It was concluded in the reports of those surveys that the foundations were in a stable condition. Horizontal and vertical controls have been established for abutments and piers and are surveyed periodically. The results of these surveys and soundings taken at the channel piers indicate that the conclusions regarding foundation stability at the two bridges are still valid.

b. Truss Bearings. - Truss bearings are functioning properly and are generally in good condition being maintained yearly. Certain truss bearing anchor bolts at Piers 3, 4 and 5 of the Bourne Bridge are bent and will be modified.

c. Truss Members and Connections. - The plates and shapes which make up the truss members are in good condition although a number of rivets, lacings and stay plates require replacement. Truss connections are in good condition mainly requiring the replacement of a limited number of rivets whose heads have deteriorated beyond an acceptable level. Additionally at the Bourne Bridge, several stiffener plates and a gusset plate require repair.

d. Truss Bracing Members and Connections. - The bracing for the trusses is comprised of the upper lateral, lower lateral and sway bracing systems. The upper and lower lateral systems account for the greatest number of deteriorated members on the bridges. Numerous rivets and lacings

require replacement. Many horizontal gusset plates and the ends of the bracing members connected to them have deteriorated due to moisture and guano deposits and require reinforcement or replacement. Heavy rusting between back to back angles has distorted many of the angles making up the bracing members. Many of the upper lateral bracing members of spans 4, 5, 6 and 7 of the Bourne Bridge are sagged due to their own weight, in some cases as much as 7 inches. These members and the lower lateral bracing in the same spans do not meet the slenderness ratio requirements of current specifications and will be stiffened by adding additional steel to them. The stiffening will also provide strengthening to those members which have lost significant area due to deterioration. Certain vertical sway bracing requires strengthening in the same manner.

e. Cable Hangers. - The cable hangers which support the suspended roadway of span 1 were the subject of intensive investigation and testing. The pairs of cables at panel points 12'W and 16E on the Bourne Bridge and at panel points 14'W and 15E on the Sagamore Bridge were removed and replaced with new cables. The removed cables were subjected to physical and metalurgical testing to determine their strength and probable remaining life. The results and conclusions of the investigations are contained in a report entitled, "Sagamore and Bourne Highway Bridges - Suspended Cables 1976 Condition Report." In summary, the report states that the tested cables still possess their originally specified strength and that the galvanized coating has started to breakdown, particularly at the bottom of the cables where they enter the bottom socket. These areas are subject to roadway sand and drainage from salt contaminated snowmelt. They are difficult to clean and practically inaccessible for maintenance. The report further states that it will be 10 to 15 years before extensive corrosion may be expected to occur. Continued regular inspection is recommended in order to detect accelerating corrosion which might occur and certain maintenance procedures are outlined. Eventual replacement of the cables is foreseen as no known maintenance procedure will completely arrest the deterioration of the galvanized coating and subsequently the wire strands at critical locations. The Reconnaissance Reports excluded the replacement of these cables from the current rehabilitation project in accordance with project guidelines. The first endorsement to the Reconnaissance Reports received from the Office of the Chief of Engineers on 5 December 1977, suggests that a waiver of the guideline requirements (ER 1130-2-417) could be requested if justified by economies of scale resulting from early replacement and inclusion in the current rehabilitation project.

Further study indicates that while such economies of scale might be achieved, other considerations make it advisable to defer replacement at this time. The seasonal traffic volumes carried by the bridges limit the length of construction season, useful for deck replacement, to such an extent that inclusion of cable hanger replacement would extend the construction period an additional year at the Bourne Bridge. With experience gained from work at the Bourne Bridge, the first to be rehabilitated, consideration will be given to including cable replacement in the rehabilitation of the Sagamore Bridge. Cable replacement when not done in conjunction with the rehabilitation, would not require closing down lanes of the bridges for long periods and the bridges could be fully open for heavy weekend traffic. Recommended maintenance procedures relative to the cables will be closely followed to slow deterioration and extend their useful life.

f. Roadway Supporting Steel. - The 60-inch deep floor beams spanning 50' between trusses, spaced at distances from 26 to 44 feet apart in the various spans of the Bourne Bridge and at 44 feet at the Sagamore Bridge, are generally in good condition. Typical corrosion in the floor beams has occurred at the top flanges beneath the sidewalk areas and at those floor beams located beneath the roadway expansion joints. The brackets attached to the floor beams supporting the sidewalk and curb channels at the ends of the suspended spans are in poor condition and require repair. There are nine lines of stringers supporting the roadway between floor beams. They are spaced at 5 feet and are either 24-inch or 27-inch deep beams of various weights depending on the spacing of the floor beams. Typical corrosion at the stringers has occurred on the top of the bottom flange and bottom of webs on the outside roadway stringers, a result of water leaking through the roadway at the gutter lines. The worst of this corrosion has occurred at the point where the stringers connect to the floor beams and the worst two were repaired in 1976.

g. Suspended Floor Bracing. - The bracing for the suspended floor consists of longitudinal wind chords at each side of the deck connected to the ends of the floor beam and diagonals. At panel points 10 and 10' on the Bourne Bridge leakage through the roadway joints has caused significant deterioration to the lacings and rivets of the end struts connecting the wind chords. Another area at which corrosion has occurred in both bridges is at the diagonal members where the catwalk grating rests upon them. The diagonals must be reinforced where significant loss of mental has taken place.

h. Sidewalk Supporting Steel. - The channels supporting the sidewalk are in good condition except for deterioration at the clip angles which support them at the top of floor beams. Corrosion is also common in the angles and connecting gussets of the sidewalk bracing. Most of the space between upper and lower horizontal bracing connecting the two sidewalk support channels is occupied by wooden telephone ducts. These ducts will have to be moved temporarily to properly clean and repair the bracing.

i. Deck Concrete. - Condition of the deck concrete was determined by visual inspection of the underside of the deck and by tests made on six 4-inch diameter cores taken from the decks of each of the bridges. The deck between the exterior stringer and the first interior stringer on each side of the bridges were rebuilt during the 1962 and 1963 renovations of the Sagamore and Bourne Bridges, respectively. Buckle plate construction was used in these areas and the underside of the concrete could not be visually inspected. The bituminous concrete wearing course precluded inspection of the top surface of the deck concrete. The under deck inspections revealed numerous areas of spalled concrete and exposed reinforcing steel. The typical areas of spalling occurred along the top flanges and the floor beams, between stringers and at areas where patching has been done previously. It is estimated that 5 percent of the area of under deck concrete is spalled. The deck concrete was constructed with lightweight (Haydite) aggregate. The core samples indicate extensive honeycombing of this concrete and deterioration of the reinforcing steel in it. Four cores at the Bourne Bridge and one core at the Sagamore Bridge exhibited excessively high chloride contents. Eight of the twelve cores were described as being either honeycombed or poorly compacted, with one of the cores from the Bourne Bridge, tested for strength, exhibiting extremely low (1320 psi) compressive strength. The following paragraph is contained in the report on core sample investigations by the Construction Technology Laboratories of the Portland Cement Association and summarizes their conclusions regarding the existing deck concrete:

"In terms of materials and type of application, the Haydite concrete is obviously inadequate due to lack of consolidation, greatly facilitating cyclic freeze-thaw damage and paste deterioration via deicer chemicals. Petrographic observations of the paste revealing microcracks, some open or partially filled with ettringite suggest continuing deterioration."

It is concluded that the concrete decks of the structures are in poor condition throughout and in need of complete replacement at this time.

j. Bituminous Concrete Wearing Course. - The 2¼-inch thick bituminous concrete pavements on the roadways were replaced as part of the renovations of 1962 and 1963. Currently there are numerous cracks in the pavement which allow water to penetrate.

k. Miscellaneous Items. - The following is a listing of miscellaneous bridge components together with a summary of their general condition.

Catwalks - A limited number of support angles and gratings are deteriorated and require repair or replacement. Some sections of grating require refastening. Generally the catwalks are in good condition and provide safe access.

Railings - The main structural elements of the railings are in good condition. The 1-inch square palings are subject to roadway spash and require continual maintenance and repair.

Light Standards - Some rivets, bolts and lacings are deteriorated and require replacement.

Roadway Expansion Joints -

Sagamore Bridge - The original roadway joints (a total of four) were replaced in 1974 with transflex type joints. They have performed well except for damage to the tops of the larger joints by the action of plow blades during snow removal.

Bourne Bridge - The roadway joints (a total of eight) were replaced as part of the 1963 renovation with sliding plate or open finger joints similar to the original joints. The existing joints still allow passage of water resulting in continued deterioration of supporting steel. Epoxy coatings and the addition of baffle plates has slowed the rate of deterioration of the steel beneath the joints.

l. Painting System. - The original painting system protecting the structural steel on the bridges consists of two coats of red lead and linseed oil and a finish coat of white lead and linseed oil. The finish coat had the following formulation by weight:

White Lead, basic sulphate	67.6 Per Cent
Linseed Oil, raw	23.6 " "
Tinting Color	6.1 " "
Drier	1.8 " "
Turpentine	0.9 " "

Subsequent repaintings have been done with a ready-mixed paint consisting of aluminum paint, tung oil and phenolic varnish. The steel within 10 feet of the roadway joints was coated with a coal tar epoxy. The Sagamore Bridge has been repainted five (5) times since its construction. The painting contracts were awarded in fiscal years 1938, 1947, 1952, 1963 and 1969. The Bourne Bridge has been repainted six (6) times since its construction. Painting contracts for the Bourne Bridge were awarded during fiscal years 1938, 1947, 1952, 1958, 1967 and 1973. The latest repainting contracts at the bridges specified the following:

Surface Preparation and Pretreatment	Fresh water jetting, solvent cleaning and wire brushing (or equivalent)
First Coat	Fed. Spec. TT-P-86, Type II (Red Lead - mixed pigment - alkyd varnish - linseed oil paint)
Second Coat and Third Coat	Aluminum Paint, Tung oil - Phenolic Varnish (Ready Mixed)

The paint on the bridges is currently in poor condition. Flaking, blistering and surface rust is evident to some degree on all members. The problem is especially evident on horizontal connection plates and at areas where water has leaked through the roadway. Improper cleaning prior to repainting is a serious cause of continued deterioration. Much of the steel work consists of built up members with numerous lacing bans, stay plates, rivets and connection plates. This type of steel construction is very difficult if not impossible to clean by ordinary methods. Certain areas, such as the insides of truss members, present difficult working conditions and have not received adequate attention during repaintings.

11. Suitability of Original Design. - The bridges as originally designed were suitable for the intended project purpose. They were designed and constructed in accordance with the most advanced state of the art at that

time and have carried all of the vehicular traffic to and from Cape Cod for the 43 years since they were built. The deficiencies which are apparent today are a result of increased traffic volume, high speed travel, size of vehicles, increased use of truck transportation and use of deicing salts, all of which could not have been projected 40 years into the future by those who conceived the structures that were built.

12. Adequacy for Current Conditions. - As stated previously the bridges are links in major state highways with approximately 8,000,000 vehicles crossing the Bourne Bridge and 9,500,000 vehicles crossing the Sagamore Bridge each year. The number of vehicles has increased substantially since the bridges were constructed and is projected to continue to increase in the future with further development in the Cape area and increasing use of recreational facilities available there. The roadways on each bridge provide four 10-foot wide traffic lanes, two in each direction, with no provision for shoulders or breakdown lanes. The average daily traffic during the months of July and August can run as much as one and one-half to two times the average daily traffic for the year. Numerous delays occur during peak travel hours of the peak months due to vehicles breaking down on the bridges. The substandard lane widths, lack of shoulders, steep vertical grades and roadway circles on the north approaches to the bridges impede the flow of traffic even when there are no obstructions on the bridges. Repairs to the structures which would affect traffic movement must be scheduled during off-peak periods. This requirement restricts the prime construction season for such work as deck replacement to approximately three months in the spring and three months in the fall. From the latter part of December to the end of February, climatic conditions and the exposed environment limit meaningful progress. Even during off-peak seasons, the weekend traffic can be heavy with long delays to motorists resulting if any lanes are closed. Eventually, increasing traffic volumes will necessitiate an additional bridge across the canal. There are no current plans for an additional crossing and the Bourne and Sagamore Bridges must continue to perform their functions within their geometric limitations. The bridges as constructed are capable of carrying present traffic volumes with the peak period travel delay mentioned above. It is not feasible to add to the roadway width of the existing structures to an extent which would appreciably increase current design highway loadings without significant overstress.

13. Necessity for Proposed Rehabilitation. - It is necessary that the rehabilitation project be undertaken at this time so that required work can be accomplished during a reasonable time span with inconveniences to the traveling public kept to a minimum. The bridges are essential links in the state highway system and critical to the region they serve. Their project purpose would not be served by making limited repairs which would increase in frequency, resulting in disruption of traffic including commuter transportation, school buses, emergency vehicles and higher ultimate costs. The proposed rehabilitation project will ensure the ability of the bridges to perform their function an estimated 40 years into the future with normal maintenance. It is most probable that the impetus for a new or additional bridge will materialize within this time and that the existing bridges will have served their purpose or have their use somewhat diminished.

E. PLAN FOR REHABILITATION

14. General. - The intent of the rehabilitation project is to repair or replace those portions of the structures which have deteriorated to an extent where their integrity is affected or could be affected if deterioration is allowed to continue. The major features of the project include removal and replacement of the concrete deck which accounts for seventy (70) percent of the estimated cost, repairs to deteriorated steel and strengthening of certain bracing members which will require approximately twenty (20) percent of the project cost and cleaning and painting of the steel superstructure which accounts for the remaining ten (10) percent of the cost.

15. Repairs to Structural Steel. - Required repairs to the structural steel at the Bourne Bridge are listed on Figures No. 19 thru 22 and at the Sagamore Bridge on Figures No. 23 and 24. Details of strengthening the lateral bracing systems on the approach spans (spans 4, 5, 6 and 7) of the Bourne Bridge are shown on Figure 25. The slenderness ratio of these bracing members is above that allowed by current code and they have sagged considerably. The proposed strengthening consists of adding angles or channels to the existing members which will remain in place. Figure No. 26 shows typical details for repairs to stringers and for repair or replacement of brackets at panel points 10 and 10' at both bridges. The temporary support systems depicted have been utilized in previous repairs and proven satisfactory. A summary of the number and types of steel repairs required at the bridges is tabulated below. Where the percentage of rivets being replaced at a member connection exceeds 50, all of the rivets in the connection will be replaced.

TYPE OF REPAIR	SAGAMORE	BOURNE SPANS 1-3	BOURNE SPANS 4-7	TOTAL
Replace Rivet with H.S. Bolts	929	2126	372	3427
Repair or Replace Plates	102	144	31	277
Replace Lacings	878	2249	339	3466
Repairs to Members	46	88	125	259

It is anticipated that additional steel repairs will be required in areas which are now obscured by the deck and which will become apparent when the decks are removed. The estimate of costs for steel repairs includes an allowance of 20 percent of the cost of known repairs for this contingency. Certain truss bracing members in spans 1, 2 and 3 of the bridges must also be strengthened due to the torsional effects of phased deck removal.

16. Removal and Replacement of Concrete Decks. - Removal and replacement of concrete decks must be accomplished in a sequence which will allow maintaining one lane open for traffic at all times and all lanes open during the peak summer travel season. Procedures for removal and replacement together with necessary restrictions are discussed in the paragraph on construction procedures. Details of the recommended replacement decks are shown on Figure No. 27. The proposed concrete filled steel grid deck was selected after study of the eight alternative systems listed in Table 3 with their approximate weights and relative costs. The reinforced concrete alternatives (I thru IV) were developed from guidelines set forth in the "Federal-Aid Highway Program Manual," Volume 6, Chapter 7, Section 2, Subsection 7, "Concrete Bridge Decks." Consideration was also given to orthotropic steel plate and precast concrete systems. An orthotropic plate deck would require the addition of a system of sub-floorbeams between stringers to brace their top flanges and make it possible for the rib elements to be oriented in the direction of traffic. This alternative was thusly eliminated from further consideration despite obvious advantages due to prefabrication. The precast concrete system was eliminated from serious consideration because of its inherent multiplicity of joints which could cause future maintenance problems. Alternate I is the same system used in the original construction except for the waterproofing membrane. This system has performed well considering its age and considering that adequate waterproofing was not installed until some 26 years after construction. Alternate II was discounted because it is considered inadvisable to have water which penetrates the bituminous wearing course in contact with an unprotected lightweight concrete slab. Alternates III and IV, if adopted, would result

TABLE 3

SUMMARY OF ALTERNATIVE DECK SLAB SYSTEMS

	SYSTEM	WEIGHT / SF	COST / SF *
I - *	7 Inch Reinforced Lightweight concrete and membrane waterproofing + 2 Inch Bituminous Concrete Wearing Surface	90	$10.38
II -	7 Inch Reinforced Lightweight Concrete and Epoxy Coating of Top Reinforcement + 2 Inch Bituminous Concrete Wearing Surface	90	7.53
III -	7½ Inch Reinforced Normal Weight Concrete Including ½ Inch Integral Wearing Surface + Epoxy Coating of Top Reinforcement	97	7.24
IV -	7½ Inch Reinforced Normal Weight Concrete Including ½ Inch Integral Wearing Surface + Cathodic Protection of Reinforcement	97	12.24
V -	6½ Inch Reinforced Lightweight Concrete + 2 Inch Low Slump Dense Concrete Overlay	80	7.15
VI -	7 Inch Reinforced Lightweight Concrete + 1½ Inch Polymer (Latex) Modified Concrete Overlay	83	8.73
VII -	** 5 Inch Lightweight Concrete Filled Steel Grid + Membrane Waterproofing + 2 Inch Bituminous Concrete Wearing Surface	88	20.09
VIII -	5 Inch Lightweight Concrete Filled Steel Grid + 1½ Inch Polymer Modified Concrete Overlay	81	18.61

* Same As Existing Decks

** Selected Replacement Deck

*** Costs Include Only Those Items Which Are Variable Between Alternates

in an increase in slab deadload of 8 percent with attendant decrease in live load capacity. This was unacceptable and those alternates were rejected. Alternates V and VI were compared with Alternate I to select the most acceptable reinforced concrete system. Alternates V and VI consist of a reinforced lightweight concrete slab overlain with a layer of special concrete which acts compositely with it. The overlays, in effect, replace waterproofing and the bituminous wearing surface of Alternate I. The overlays are not considered to be experimental and are recommended by the Federal Highway Manual which also permits membrane waterproofing systems as acceptable alternatives provided reliability of service can be established. Because we feel that the waterproofing system developed and installed on the bridges in the early 1960's has proven to be effective, the major damage to the decks having occurred before their installation, and due to the rather short service history of concrete overlays on major structures, Alternate I was concluded to be the best of the reinforced concrete alternates. Alternates VII and VIII are concrete filled steel grids overlain with membrane waterproofing and bituminous or polymer modified concrete respectively. Both of these systems offer some reduction in dead weight and unprotected steel grid decks have proven durable over a period of 40 years on major structures, although not without some difficulties. The chief advantage of Alternates VII and VIII is their constructability. They can be installed more rapidly than conventional concrete decks, do not require lengthy curing time before supporting traffic and can support traffic prior to installation of the top protection system. Disadvantages include the extensive welding required to attach them to the supporting steel, reduced depth of slab which makes more difficult the accommodation of large movement expansion joints and the probable eventual rusting out of metal form pans. Alternate VII was selected as the better of the steel grid alternates again because of the short history of polymer overlays. The final step in selecting the preferred alternate was making a choice between the reinforced concrete deck, Alternate I and the steel grid, Alternate VII. Both are considered to be adequately durable and relatively maintenance free with the exception of periodic renewal of the bituminous wearing course. The two remaining parameters to be compared are cost and constructability. Estimates indicate that the cost of steel grid systems installed at both bridges would exceed the total cost of reinforced concrete decks by $1,500,000. This is a significant premium to pay for the selected steel grid alternate and is justified by comparing the constructability of the two systems. Because of the limitations placed on traffic interference, the prime summer construction season is lost for work on the decks. These restrictions are most critical in the construction of the reinforced concrete decks and an additional year of construction would be required for work at the Bourne Bridge beyond that required for a steel grid deck. Cost factors which would be affected by an additional year of construction would include contract administration, traffic control, additional vehicle detour miles and economic impacts on the area. The cost to the

traveling public for the additional detour miles, estimated at $3,000,000, is enough to justify the additional expenditures for the grid deck without attempting to quantify the other factors. It is also felt that the restrictions which require construction during the early spring and late fall would be detrimental to the quality of a reinforced concrete deck. Based on constructability considerations and cost factors affected by them, the steel grid system is the most cost effective of the acceptable alternates and was selected as the proposed replacement deck for Bourne and Sagamore Bridges. Items of work associated with the removal and replacement of the decks are described below.

a. Removal. - The existing deck can be removed in sections by excavating a narrow band around the periphery of each section and burning off the reinforcing steel. The deck is not composite with the stringers and should come free of the stringer flanges without difficulty. The space between stringers will be boarded over at the bottom flange level to prevent any material from falling to the ground or canal below. The buckle and 1/4-inch steel plates located at the bottom of the existing slab in the fascia bays will be removed. The bolt holes in the top flange will have to be filled where not covered by grid steel to prevent new concrete fill from leaking through. The granite curbs will be removed with care, cleaned, stored and reused in the replacement deck. Stage removal sequence is shown on Figure No. 27 and described in the paragraph on construction procedures. The disposal of the demolition material will be the responsibility of the contractor.

b. Barricades. - Traffic barricades will be bolted to the decks to prevent vehicles from entering the work area. In addition to providing protection against traffic, the barricade will provide a solid barrier extending a minimum of 4 feet above the roadway surface for protection against flying debris.

c. Supporting Steel. - After the deck has been removed required repairs will be made to the stringers, floorbeams and sidewalk supporting steel. The steel will be inspected by a representative of the Contracting Officer to determine if any repairs in addition to those specified are required. The top flanges of the stringers and floorbeams will be blast cleaned in addition to any other areas which need such cleaning in preparation for painting.

d. Sidewalks and Safety Curbs. - Sidewalks and safety curbs will be constructed of cast-in-place reinforced lightweight concrete topped with a combination epoxy waterproofing wearing course. This system will permit encasement of the conduits and railing anchor bolts. Stay-in-place forming will be used for the sidewalk slab because of the limited space between the bottom of slab and top of telephone ducts which must remain in place during construction.

e. Grid System. - The grid will be constructed of 5-inch deep "I" beams at 10-inches on center welded to cross bars top and bottom. Each "I" bar will be welded to the supporting stringers with special requirements for welding to the silicon steel stringers at the Sagamore Bridge and spans 1, 2 and 3 of the Bourne Bridge. A588 steel will be specified for the grid and it will be filled, full depth, with lightweight concrete. Painted form pans will retain the concrete at the bottom of the grid between stringers with the concrete coming into contact with the tops of the stringers and floor beams. The lightweight concrete will be made with an expanded aggregate, rotary kiln type, producing a concrete weighing approximately 100 pounds per cubic foot and with a minimum ultimate compressive strength of 4000 pounds per square inch.

f. Roadway Joints. - The roadway joints will be replaced as part of the project. Federal Highway guidelines recommend one piece seals for deck joints. Such joints are not possible for these bridges because of the limited space available from top of roadway to top of floorbeam and the required phasing of construction. Segmental traffic seals such as the transflex or Waboflex SR types will be specified at the larger joints whereas one piece compression or strip seals can be used at the smaller joint openings. The transflex type was installed previously at the Sagamore Bridge and has proven effective in excluding water. The major problem with the joints has been the damage done to the surface of the larger joints by snow plow blades. Recent improvements to this type of joint provides armoring of the surface with steel for use in areas where plows operate and the armoring will be specified for the joints used in this project. Tension devices will also be provided at the larger joints to hold them down and prevent slapping under traffic.

g. Palings. - The palings and their pipe supports will be removed from the railings on both sides of the bridges. The existing posts and channel rails will be retained to support new palings spaced at 6-inch centers which will extend 11 feet 9 inches above the sidewalk to provide a suicide deterrent in addition to the traffic and pedestrian function. Post anchor bolts currently embedded in the sidewalk and curb concrete will be cleaned and inspected. Those which show appreciable deterioration will be replaced.

h. Scuppers. - New drainage scuppers will be provided at the location of existing ones and connected to existing down-spouts which will conduct water away from the supporting steel.

i. Waterproofing. - Deck, sidewalk and curb concrete will be waterproofed with a multi-layered coal tar epoxy glass-reinforced membrane. Flashing will be provided at roadway scuppers and be mopped into the layers of waterproofing. The membrane will be turned up behind the granite curbs and at expansion joints. Weep holes will be provided at the edge of the membrane behind the curbing on the high side of deck joints to allow water migrating between the wearing course and waterproofing to escape.

j. Wearing Course. - The wearing course will be constructed by placing a prime coat on the waterproofing followed by a 1-inch binder course, a bitumen tack coat and a 1-inch thick surface course. The binder and surface course will consist of dense, airfield pavement-type asphaltic concrete.

k. Utilities. -

(1) Existing Communication Circuits. Each of the bridges carries telephone circuits. They are located in banks of six wooden ducts located under the sidewalks. The cables, owned by New England Telephone Company run the entire length of each superstructure between concrete pylons. They must remain in service during construction and precautions will be taken for their protection. The owners have been notified of the proposed rehabilitation work in order that they may specify any special protection required and coordinate any work relative to them in conjunction with the project. A Government owned multiconductor cable for intercommunication between the North and South banks of the canal is supported along the catwalk below the road surface of span 1 of the Bourne Bridge. It will remain in service during construction.

(2) Gas Lines. - Ten inch diameter gas pipes are located beneath the deck at the approximate centerline of each bridge, supported by the stringers adjacent to them. The gas line extends between abutments at the Sagamore Bridge and between piers 3 and 4 at the Bourne Bridge where they descend to the ground surface and continue underground. The gas lines will be protected and remain in service during construction.

(3) Existing Electrical Circuits. -

Bourne Bridge. - Electrical circuits on the bridge consist of (a) series lighting for the south bank of the Cape Cod Canal, 616 feet of multiconductor cable being supported along the catwalk below the road surface of span no. 1 only, (b) series lighting for the bridge, 4848 feet of single conductor cable run in one of two fiber ducts extending from end to end along each side of the bridge, within the concrete curb on the east side and within the sidewalk on the west side, including 22 rectangular steel handholes with covers, one at each bridge light location for enclosure of transformers, and (c) navigation lighting for marking the channel and obstruction lighting at the highest point of the bridge, 1181 feet of multiconductor cable run in the second of the above-mentioned two fiber ducts under the walk along the west side from the north pylon to the center of the bridge.

Sagamore Bridge. - Electrical circuits on the bridge consist of (a) series lighting for the south bank of the Cape Cod Canal, 616 feet of multiconductor cable and 3 conductor #4-5KV power cable being supported along the catwalk below the road surface of span no. 1 only, (b) series lighting for the bridge, 2896 feet of single conductor cable run in one of two fiber ducts extending from end to end along each side of the bridge, within the concrete curb on the east side and within the sidewalk on the west side, including 14 rectangular steel handholes with covers, one at each bridge light location for enclosure of transformers, (c) wiring for future receptacles; 2 conductors #6, 600 volt type RR run in the second of the above-mentioned two fiber ducts, and (d) navigation lighting for marking the channel and obstruction lighting at the highest point of the bridge, 784 feet of multiconductor cable run in a third fiber duct from the north pylon to the center of the bridge.

(4) New Electrical Work.

Bourne Bridge. - A third duct will be added between the center of span no. 1 and the north pylon. This will permit running a 120 volt receptacle circuit in one of the two ducts along the entire length of each side of the bridge. The third duct, 1161 feet in length, will be incorporated in the rebuilt sidewalk section and curb section of duct line between the center of span no. 1 and the north pylon. In all, 2446 feet of new 2E duct and 2322 feet of new 3E duct will be installed; approximately 4848 feet of new single conductor bridge lighting cable (circuit b) and approximately 1181 feet of new three conductor navigation and obstruction lighting cable (circuit c) will be installed.

Existing electrical handholes and any missing or corroded covers, angles frames or cover screws will be replaced; new neoprene gaskets will be furnished for all electrical handholes. Lighting transformers in 11 west side and 11 east side handholes will be removed, reinstalled in the new handholes and reconnected to the new series lighting cable. Figure No. 29 shows electrical details for the bridge.

Sagamore Bridge. - A third duct will be added between the center of span no. 1 and the north pylon on both sides. This will permit reinstalling a 120 volt receptacle circuit in one of the two ducts along the entire length of each side of the bridge. The third duct, 704 feet in length, will be incorporated in the rebuilt sidewalk section and curb section of duct line between the center of span no. 1 and the north pylon. In all, 1408 feet of new 2E duct and 1408 feet of new 3E duct will be installed, approximately 2896 feet of new single conductor bridge lighting cable (circuit b) and approximately 724 feet of new three conductor navigation and obstruction lighting cable (circuit c) will be installed and existing 2 conductor #6 will be removed and reinstalled (circuit d).

Existing electrical handholes and any missing or corroded covers, angle frames or cover screws will be replaced; new neoprene gaskets will be furnished for all electrical handholes. Lighting transformers in 7 west side and 7 east side handholes will be removed, reinstalled in the new handholes and reconnected to the new series lighting cable. Figure 28 shows electrical details for the bridge.

(5) Temporary Electrical Work. No interruption to canal lighting navigation and obstruction lighting can be tolerated and one side of the bridge lighting must be kept in operation during the construction period. Temporary construction power and power for highway barricade lighting may be obtained by the contractor from the Plymouth County Electric Company in the vicinity of the north pylons and from the Cape and Vineyard Electric Company in the vicinity of the south pylons.

17. Cleaning and Painting. - The bridges will be repainted as part of the rehabilitation project. In accordance with recommendations contained in the condition reports, the reconnaissance reports prepared for the rehabilitation project stated that the existing paint systems would be completely removed and a new, long life, vinyl system applied. Subsequent investigation has shown that this approach would be impracticable, very costly and unnecessary. A coatings expert, from the Construction Engineering Research Laboratory, (CERL), visited the bridges evaluated the condition of the existing paint and made recommendations which have been included herein as Appendix B. In summary they recommend that the existing paint system be retained and that the bridges be repainted with certain changes to the specification which have been used previously. It is recommended that blast rather than water jet cleaning be used, that type I red lead primer be used in lieu of type II previously specified and that particular consideration be given to the amount and compentency of inspection work. The recommendations contained in the CERL Memorandum will form the basis from which the specifications for repainting the structures are developed.

18. Basic Data and Criteria. -

a. General. - Basic criteria for the project requires that no interruption or hazard to canal shipping result and that interference with vehicular traffic be kept to an absolute minimum, the latter because of the importance of the bridges to the essential services of the communities in which they are located and their importance to the economy of the region. To meet the above criteria it will be required that no material be allowed to fall from the bridge and that the protrusion of safety netting and other construction material below the

structure be restricted. The basic guidelines established for vehicular traffic are that only one bridge will be under construction at a time, that a minimum of one lane will remain open to traffic at all times on the bridge under construction and that for the period of the year extending from mid-week prior to Memorial Day until mid-week following Labor Day, no work will be allowed which interferes with full operation of four lanes on both bridges. Provisions for detouring traffic during construction and the justification for requiring that one lane remain open are discussed in the Supplementary Environmental Impact Statement prepared for the project.

b. Safety. - Prior to the start of construction safety, construction and traffic control signs will be erected in accordance with the requirements of the Massachusetts Department of Public Works. The contractor will be required to direct and control traffic for the protection of the traveling public and construction personnel at all times except when the bridge is fully opened to traffic. All pedestrians and trucks in excess of 1 ton capacity will be excluded from the bridge under construction except when fully opened. During periods when one lane is open on a bridge, it will be necessary to reverse direction as required to accommodate peak traffic flows and for emergency vehicles on demand. All construction operations will be in accordance with EM 385-1-1, dated 1 June 1977, "General Safety Requirements Manual." That manual requires full protection for workers, such as safety belts, life lines and safety nets. One inch mesh netting is required to protect accessible areas beneath construction from falling debris.

c. Design Criteria. -

(1) General. - Allowable stresses, loading conditions, design assumptions and other criteria were based on applicable parts of the following references:

Working Stresses for Structural Design
EM 1110-1-2101, 1 Nov 1963

Standard Practice for Concrete
EM 1110-2-2000, 1 Nov 1971

Standard Specifications for Highway Bridges
Twelfth Edition, 1977
The American Association of State Highway and
Transportation Officials

Detailed criteria for the major construction materials are given below.

(2) Concrete. - Concrete used for filling the steel grid and in construction of the sidewalk and curbs will contain lightweight aggregate conforming to ASTM Standard C33, "Lightweight Aggregates for Structural Concrete." Materials will be proportioned to produce a high quality air-entrained concrete with a minimum compressive strength of 4,000 pounds per square inch and a unit weight not to exceed 100 pounds per cubic foot. Maximum allowable working stress inflexure is 1,600 pounds per square inch for extreme fiber in compression.

(3) Reinforcing Steel. - All reinforcement is designed for a working stress of 20,000 p.s.i. in tension. The reinforcement will be deformed bars made of new billet steel, intermediate grade (ASTM A-615, Grade 40), conforming to Federal Specification QQ-S-632C, Type II, Class B40.

(4) Steel Grid. - The steel grids will be made of ASTM, A588 designation steel. The metal form pans will be made from 18 gage commercial quality steel. The underside of the steel bearing bars and form pans will be painted.

(5) Structural Steel. - Structural steel used in repairs will be ASTM, A36 designation. Deteriorated rivets will be replaced with ASTM A325 bolts.

19. Comparison with Original Design. - The proposed construction will differ from the original and existing construction in several aspects. A concrete filled steel grid will replace the existing reinforced lightweight concrete slab. The proposed grid will allow more rapid construction than if the decks were replaced in kind, and will require less maintenance in the future. The expansion joints will be replaced with impervious types which will arrest deterioration of supporting steel caused by leakage through the existing joints and will reduce the amount of repair work in the future. New palings on the rails will provide greater resistance to deterioration thereby reducing required painting and will provide a suicide deterrent not provided by the existing railings. Strengthening of the lateral bracing system will correct a deficiency in the original design when compared with present day codes.

F. CONSTRUCTION PROCEDURE

20. General. - Condensed construction schedules were prepared to outline planned traffic restrictions, describe construction procedure and note where a required sequence is necessary for design considerations.

In addition to restrictions noted in the schedules below, it will be required that not more than 132 feet of deck (1/2 width) be removed without replacement with filled grid. This will prevent excessive movement at the truss bearings. Prior to installing new railings, the slab adjacent to them will be completed and on spans 1, 2 and 3, the bottom lateral bracing in bays 9-10 and 10'-9' and the ends of the wind chord at truss strengthened. The schedules assume that the contractor will work 16 hours a day on deck replacement during the spring and fall.

21. Construction Schedule - Bourne Bridge. -

Date	Traffic Restriction	Work to be Accomplished
Friday, 1 Jun 79 to Tues., 4 Sept 79	All lanes open to traffic.	Award contract. Submit shop drawings and work schedule for approval. Install safety nets. Free sliding joints at ends of suspended span. Strengthen top and bottom lateral bracing of approach spans. Strengthen top lateral bracing of spans 2 and 3 at bays 0'-1' & 0-1. Strengthen sway bracing in spans 3 and 2 at panel points 0, 9, 9' and 0'. Perform other steel repairs, sand blasting and painting which will not interfere with flow of traffic.
Wed., 5 Sept 79 to Tues., 20 May 80	One lane (reversible) Open to traffic.	Erect temporary signing and install deck barricade to protect traffic lane adjacent to curb (east side). Start removal of west side of roadway and sidewalk concrete. Continue removal and installation of concrete filled grid, sidewalk and joints in west half of spans 7, 5, 3, and to mid-point of span 1. Relocate barrier to protect traffic lane adjacent to sidewalk (west side) and repeat procedure so that the deck in spans 7, 5, 3 and half of span 1 deck is complete. Install waterproofing and wearing surface before opening of bridge fully on 21 May 1980.

Date	Traffic Restriction	Work to be Accomplished
Wed., 5 Sept 79 (Cont'd.) to Tues., 20 May 80		Before any deck is removed in span 1, the top lateral bracing in bays 9-10, 10-11, 11'-10' and 10'-9' of span 1 will be strengthened. Work on steel repairs, cleaning and painting will continue without interference with one operating lane. Cover or remove temporary signing and remove barricades.
Wed., 21 May 80 to Tues., 2 Sept 80	All lanes open to traffic.	Continue steel repairs and cleaning and painting without interruption to traffic.
Wed., 3 Sept 80 to Tues., 19 May 81	One lane (reversible) open to traffic.	Erect temporary signing and install barricades to protect traffic lane adjacent to curb. Remove and replace deck, sidewalk and joints in west half of spans 2, 4, 6 and north side of span 1. Install new railings on west side of bridge. Relocate barrier to protect a traffic lane adjacent to the sidewalk and repeat procedure on the east half thereby completing deck on spans 2, 4, 6 and 1. Work on steel repairs and painting to continue. Install waterproofing and wearing surface, Remove temporary signing and barricades by 19 May.
Wed., 20 May 81 to Thurs., 28 May 81	All lanes open to traffic.	Complete painting, remove all surplus materials, debris, temporary signing and equipment from site.
Fri., 29 May 81	All lanes open to traffic.	Project complete.

22. Construction Schedule - Sagamore Bridge. -

Date	Traffic Restrictions	Work to be Accomplished.
Monday, 3 Aug 81 to Tues., 8 Sept. 81	All lanes open to traffic.	Award contract. Submit shop drawings and work schedule. Install safety nets. Strengthen top lateral bracing in bays 0-1 and 1'-0'. Strengthen sway bracing at panel points 0, 9, 9' and 0'.

Date	Traffic Restriction	Work to be Accomplished
Wed., 9 Sept 81 to Tues., 25 May 82	One lane (reversible) open to traffic.	Erect temporary signing and install barricades to protect lane adjacent to curb (west side). Start removal of east side of roadway and sidewalk concrete. Continue removal and installation of concrete filled grid, sidewalk and joints in east half of span 3 and part of span 1. Install waterproofing and wearing surface. When half of construction season is over, move traffic lane barricade to east side and repeat procedure on west side so that deck, joints, sidewalk and curb are complete full width of bridge at stopping point when full bridge is reopened to traffic. Before any deck is removed in span 1, the top lateral bracing in bays 9-10, 10-11, 11'-10' and 10'-9' will be strengthened. Steel repairs, cleaning and painting will continue without interference with the operating lane. Cover or remove temporary signing and remove barricades.
Wed., 26 May 82 to Tues., 7 Sept 82	All lanes open to traffic.	Continue steel repairs and cleaning and painting without interruption to traffic.
Wed., 8 Sept 82 to Tues., 24 May 83	One lane (reversible) open to traffic.	Erect temporary signing and install barricades to protect lane adjacent to curb. Repeat procedure for removal and replacement of deck, sidewalk and curbs at span 2 and the portion of span 1 not completed the previous year. Install new railings on completed deck at time when lane adjacent to them are closed. Finish steel repairs, cleaning and painting. Remove surplus materials, debris, temporary signing, barricades and equipment.
Wed., 25 May 83	All lanes open to traffic.	Project complete.

G. CONSTRUCTION COST ESTIMATE

23. Construction Cost Estimate. On pages 30, 31 and 32 is an estimate of the cost of contract construction including contractor's overhead and profit based on price levels as of November 1978.

24. Project Cost Estimate. - The following is an estimate of project costs which include estimated cost of construction, a twenty percent contingency allowance, costs of engineering, design, supervision and administration.

MAJOR REHABILITATION PROJECT
CAPE COD CANAL BRIDGES
PROJECT COST ESTIMATE

	Bourne Bridge	Sagamore Bridge
Construction Cost		
Repairs to Structural Steel	$ 1,160,000	$ 370,000
Remove and Replace Concrete Deck	4,406,800	2,640,000
Cleaning and Painting	400,000	270,000
SUB TOTAL	$ 5,966,800	$ 3,280,000
Contingencies (20%)	1,183,200	650,000
SUB TOTAL - CONSTRUCTION COST	$ 7,150,000	$ 3,930,000
Engineering and Design	350,000	250,000
Supervision and Administration	600,000	320,000
TOTAL	$ 8,100,000	$ 4,500,000
TOTAL PROJECT COST:	$ 12,600,000	

CAPE COD CANAL
HIGHWAY BRIDGES - MAJOR REHABILITATION PROJECT
COST ESTIMATE*

ITEM NO.	DESCRIPTION	BOURNE BRIDGE QUANTITY	BOURNE BRIDGE U.P.	BOURNE BRIDGE AMOUNT	SAGAMORE BRIDGE QUANTITY	SAGAMORE BRIDGE U.P.	SAGAMORE BRIDGE AMOUNT
A	REPLACE BRIDGE DECK						
1	Remove existing deck	10,600 s.y.	$ 45.00	$ 477,000	6,300 s.y.	$ 45.00	$ 283,500
2	5" Steel grid filled with lightweight concrete	95,000 s.f.	16.00	1,520,000	56,000 s.f.	16.00	876,000
3	Epoxy resin bituminous waterproof membrane	10,600 s.y.	30.00	318,000	6,300 s.y.	30.00	189,000
4	2" Bituminous concrete wearing course incl. prime	10,600 s.y.	3.90	41,340	6,300 s.y.	3.90	24,570
5	Traffic lines	1 job	L.S.	5,960	1 job	L.S.	4,130
6	Paint underside of grid	95,000 s.f.	0.30	28,500	56,000 s.f.	0.30	16,800
	SUB TOTAL			($ 2,390,800)			($ 1,414,000)
B	REPLACE SIDEWALK						
1	Remove existing sidewalk	400 c.y.	260.00	104,000	240 c.y.	260.00	62,400
2	Lightweight concrete sidewalk	400 c.y.	220.00	88,000	240 c.y.	220.00	52,800
3	Reinforcing steel	82,000 lb.	0.40	32,800	49,000 lb.	0.40	19,600
4	Adjust anchors for fence post	1 job	L.S.	6,000	1 job	L.S.	3,600
5	2" Bituminous concrete w/prime	185 tons	36.00	6,660	110 tons	36.00	3,960
6	Epoxy resin bituminous waterproof membrane	1,650 s.y.	30.00	49,500	1,000 s.y.	30.00	30,000
7	Remove & reset granite curbing	2,380 l.f.	8.00	19,040	1,410 l.f.	8.00	11,280
	SUB TOTAL			($ 306,000)			($ 195,000)
C	REPLACE CURB						
1	Remove existing concrete curb	390 c.y.	230.00	89,700	230 c.y.	230.00	52,900
2	Lightweight concrete curb	390 c.y.	115.00	44,850	230 c.y.	115.00	26,450
3	Reinforcing steel	27,000 lb.	0.40	10,800	16,000 lb.	0.40	6,400
4	Adjust anchors for fence post	1 job	L.S.	4,390	1 job	L.S.	3,010
5	2" Bituminous concrete w/prime	60 tons	40.00	2,400	35 tons	40.00	1,400
6	Epoxy resin bituminous waterproof membrane	540 s.y.	33.00	17,820	320 s.y.	33.00	10,560
7	Remove & reset granite curbing	2,380 l.f.	8.00	19,040	1,410 l.f.	8.00	11,280
	SUB TOTAL			($ 189,000)			($ 112,000)

CAPE COD CANAL
HIGHWAY BRIDGES - MAJOR REHABILITATION PROJECT
COST ESTIMATE*
(CONT'D)

ITEM NO.	DESCRIPTION	BOURNE BRIDGE QUANTITY	BOURNE BRIDGE U.P.	BOURNE BRIDGE AMOUNT	SAGAMORE BRIDGE QUANTITY	SAGAMORE BRIDGE U.P.	SAGAMORE BRIDGE AMOUNT
D	NEW EXPANSION JOINTS						
1	Bridge Expansion Jt. Type -200	200 l.f.	$ 550.00	$ 110,000	100 l.f.	550.00	$ 55,000
2	Bridge Expansion Jt. Type -300	100 l.f.	1,250.00	125,000	-	-	-
3	Bridge Expansion Jt. Type -650	-	-	-	50 l.f.	2,000.00	100,000
4	Bridge Expansion Jt. Type -900	150 l.f.	2,400.00	360,000	-	-	-
5	Bridge Expansion Jt. Type-1300	-	-	-	50 l.f.	2,900.00	145,000
6	Repair Slotted connections @ FB 10 & PB 10'	2 sets	20,000.00	40,000	-	-	-
	SUB TOTAL			($ 635,000)			($ 300,000)
E	SUICIDE PREVENTION FENCE						
1	Remove existing fence	4,768 l.f.	7.50	35,760	2,820 l.f.	7.50	21,150
2	Erect new fence	4,768 l.f.	62.50	298,000	2,820 l.f.	62.50	176,250
3	Paint new fence	1 job	L.S.	18,240	1 job	L.S.	6,600
	SUB TOTAL			($ 352,000)			($ 204,000)
F	ELECTRICAL WORK						
		1 job	L.S.	115,000	1 job	L.S.	102,000
	SUB TOTAL			($ 115,000			($ 102,000)
G	TRAFFIC CONTROL						
1	Install & remove signs	1 job	L.S.	40,000	1 job	L.S.	35,000
2	Barricades, barrels & cones	1 job	L.S.	115,000	1 job	L.S.	80,000
3	Traffic Officers	24,000 m.h.	11.00	264,000	18,000 m.h.	11.00	198,000
	SUB TOTAL			($ 419,000)			($ 313,000)
	SUB TOTAL DECK WORK			$ 4,406,800			$ 2,640,000

CAPE COD CANAL
HIGHWAY BRIDGES - MAJOR REHABILITATION PROJECT
COST ESTIMATE*
(CONT'D)

ITEM NO.	DESCRIPTION	BOURNE BRIDGE QUANTITY	BOURNE BRIDGE U.P.	BOURNE BRIDGE AMOUNT	SAGAMORE BRIDGE QUANTITY	SAGAMORE BRIDGE U.P.	SAGAMORE BRIDGE AMOUNT
H	STRUCTURAL STEEL REPAIRS						
1	Replace rivets with high strength bolts	2,700 ea	45.00	$ 121,500	1,050 ea	65.00	$ 68,250
2	Replace lacing bars	2,500 ea	50.00	125,000	900 ea	60.00	54,000
3	Strengthen lateral bracing	240,000 lb.	1.90	451,600	60,000 lb.	1.90	114,000
4	Replace & repair bracing angles	112,000 lb.	1.20	212,800	-	-	-
5	Repair gussets	37,000 lb.	2.25	83,250	16,000 lb.	2.25	36,000
6	Repair stay plates	13,000 lb.	2.25	29,250	15,000 lb.	2.25	33,750
7	Repair stiffeners	10,000 lb.	2.25	22,500	1,000 lb.	2.25	2,250
8	Repair webs	6,000 lb.	2.25	13,500	17,000 lb.	2.25	38,250
9	Repair flanges	33,000 lb.	2.25	74,250	3,000 lb.	2.25	6,750
10	Replace grating	-	-	-	500 s.f.	14.00	7,000
11	Miscellaneous repairs	1 job	L.S.	26,950	1 job	L.S.	9,750
	SUB TOTAL			($ 1,160,000)			($ 370,000)
I	PAINTING EXISTING STEEL						
	Superstructure	1 job	L.S.	400,000	1 job	L.S.	270,000
	SUB TOTAL			($ 400,000)			($ 270,000)
	TOTAL			($ 5,966,800)			$ 3,280,000

*November 1978 Price Levels

25. Comparison With Previous Estimate. - The total project cost is now estimated to be $12,600,000 as shown in the previous paragraph. This cost is to be compared with the latest previous estimate of $12,883,000 presented in the Reconnaissance Reports. The difference in the estimates is best shown by comparing the various line items of which they are composed. For the purposes of a meaningful comparison, a cost escalation factor of 7 percent has been applied to the previous estimate to place the estimates on the same cost basis.

Item	Reconnaissance Estimate	Reconnaissance Estimate Escalated	Current Estimate	Difference
Repairs to Structural Steel	$ 1,915,000	$ 2,049,000	$ 1,530,000	$- 519,000
Replace Deck	6,403,000	6,851,200	7,046,800	+ 195,600
Cleaning & Painting	1,132,000	1,211,200	670,000	- 541,200
TOTAL CONST. COST	$ 9,450,000	$10,111,400	$ 9,246,800	- 864,600
Contingencies	2,363,000	2,528,400	1,833,200	- 695,200
Engineering & Design	350,000	374,500	600,000	+ 225,500
Supervision & Inspection	720,000	770,400	920,000	+ 149,600
TOTAL	$12,883,000	$13,784,700	$12,600,000	$-1,184,700

The reduction in estimated cost of repairs to structural steel is a result of the more detailed estimate possible with the development of details during preparation of this memorandum. The net increase in cost of deck replacement is actually the result of a decrease in cost of the deck system and an increase of $550,000 for the proposed suicide deterrent railings which were not contemplated at the time the reconnaissance estimates were prepared. The substantial reduction in estimated costs of cleaning and painting is due to the decision not to completely remove existing paint and apply a new vinyl system as was assumed for the reconnaissance estimate as explained in paragraph 17. The reduction in contingencies reflects the assumption of a 20 percent factor applied to the latest estimated construction cost in place of a 25 percent factor used for the reconnaissance phase estimate. Engineering and Design cost estimates were increased in anticipation that considerable engineering during construction may be required when the need for additional work becomes apparent during the progress of deck removal. Supervision and inspection costs were increased because of the time span of the project and the intermittent nature of certain phases.

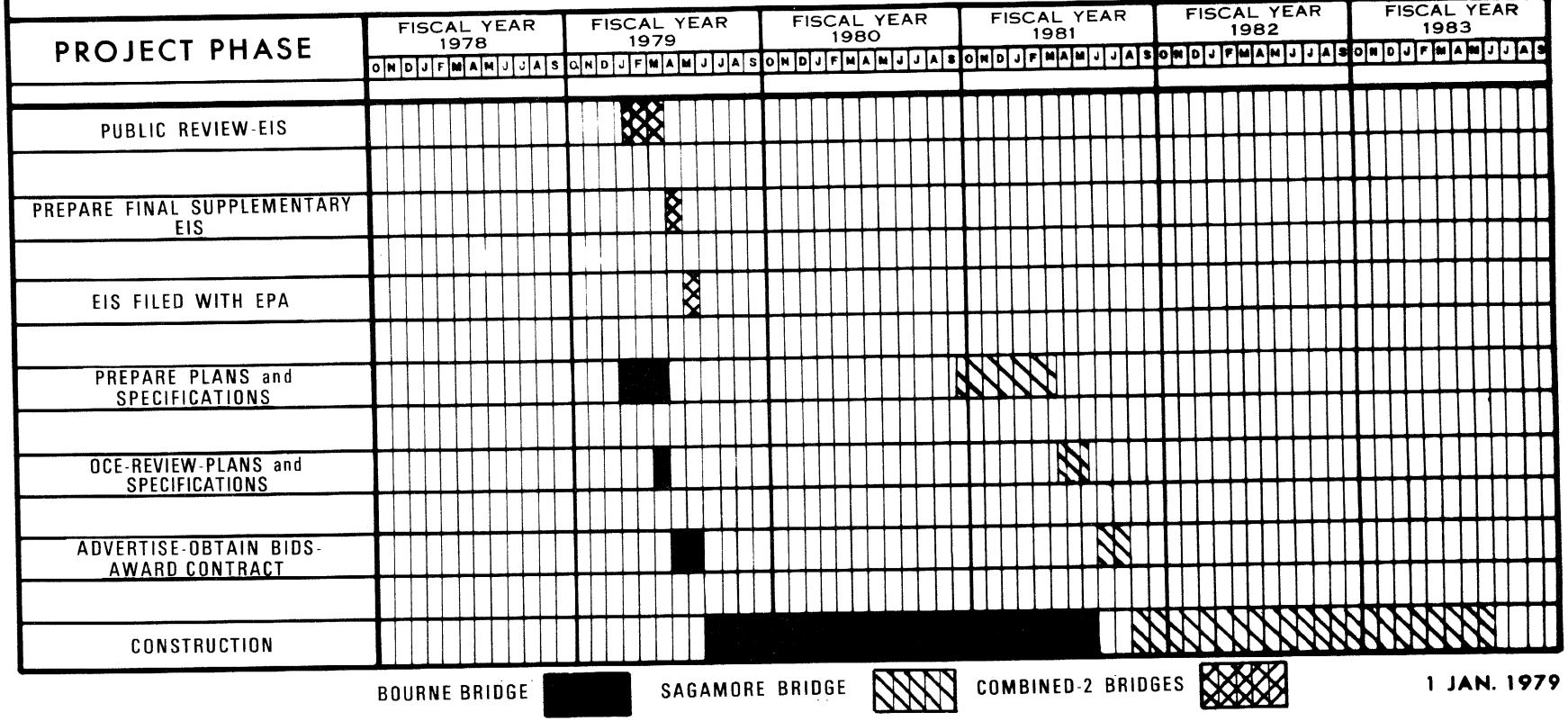
26. Funding Requirements. - The following is an estimate of the funding requirements during the fiscal years of the project. The figures shown are reported in thousands of dollars.

Item	Project Estimate	Current FY 1979	Budget FY 1980	FY 1981	FY 1982	FY 1983
Bourne Bridge Construction	7,150	140	3,700	3,310	-	-
Sagamore Bridge Construction	3,930	-	-	100	2,700	1,130
Engineering & Design	600	280	100	160	30	30
Supervision and Administration	920	80	300	260	190	90
TOTAL	12,600	500	4,100	3,830	2,920	1,250

H. PROJECT SCHEDULE

27. Project Schedule. - The following is a bar graph schedule showing the anticipated progress of the Supplementary E.I.S., preparation of plans and specifications and construction of the project.

CAPE COD CANAL HIGHWAY BRIDGES
MAJOR REHABILITATION PROJECT
PROJECT SCHEDULE



1 JAN. 1979

APPENDIX A

COMPUTATIONS

INDEX TO SHEETS

NED FORM 223
27 Sept 49

CORPS OF ENGINEERS, U.S. ARMY
NEW ENGLAND DIVISION

PAGE A1

SUBJECT Major Rehabilitation Project - Cape Cod Canal Bridges

COMPUTATION Proposed Deck Slab Replacement Alternatives

COMPUTED BY R.L.K. CHECKED BY _____ DATE Oct 78

SYSTEM	WEIGHT	COST/SF ***
I* - 7" L.W. Concrete + Membr. W.P. + 2" Bit Conc. w.s.	90 #/SF	$ 10.38
II - 7" L.W. Conc + Epoxy Coat Top Bars + 2" Bit Conc. w.s.	90 #/SF	7.53
III - 7½" Norm. Wt Conc. + Epoxy Coat Top Bars	97 #/SF	7.24
IV - 7½" Norm. Wt Conc + Cathodic Protection	97 #/SF	12.24
V - 6½" L.W. Conc. + 2" LSOC Overlay	80 #/SF	7.15
VI - 7" L.W. Conc + 1½" PMC. Overlay	83 #/SF	8.73
VII** - 5" L.W. Conc. Filled Steel Grate + Membr. W.P. + 2" Bit Conc	88 #/SF	20.09
VIII - 5" L.W. Conc. Filled Steel Grate + 1½" PMC. Overlay	81 #/SF	18.61

* SAME AS EXISTING DECKS

** SELECTED REPLACEMENT DECK

*** COSTS INCLUDE ONLY THOSE ITEMS WHICH ARE VARIABLE BETWEEN ALT.

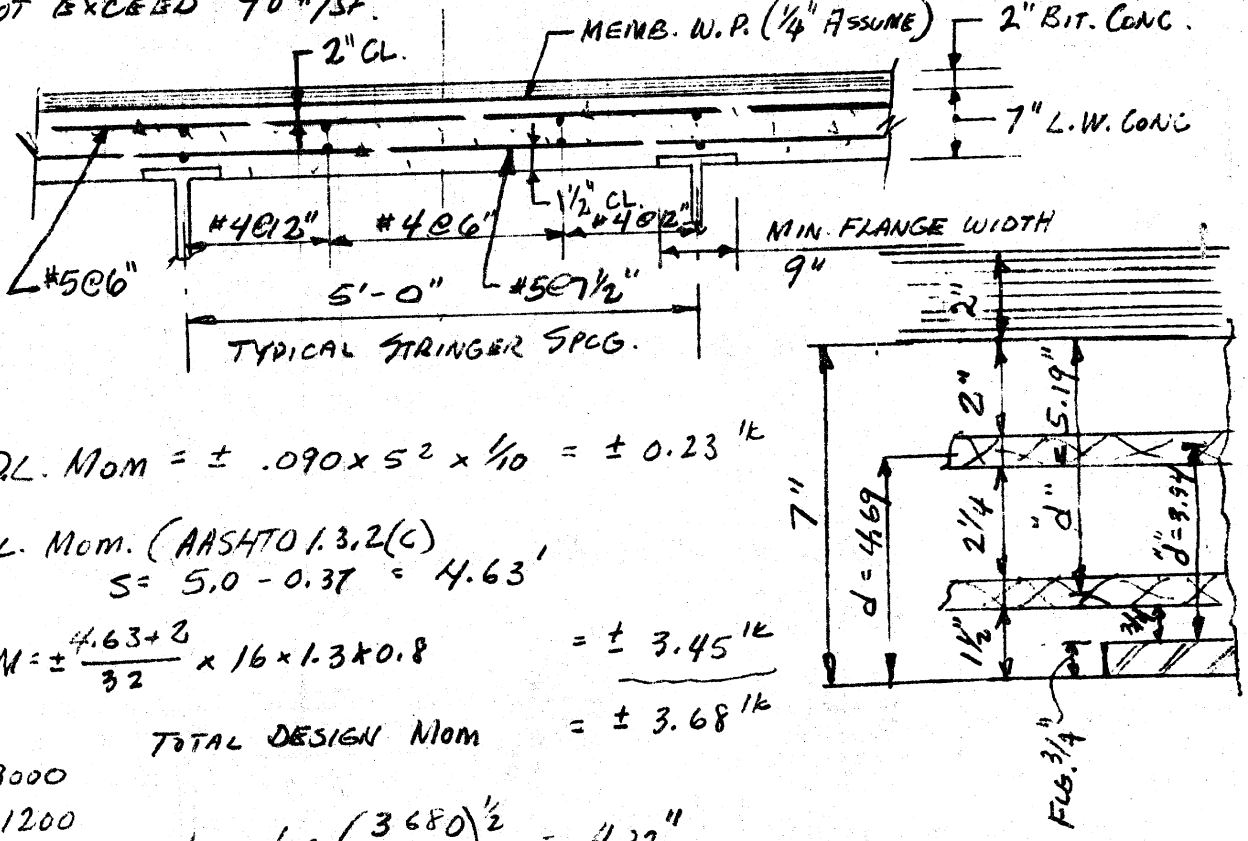
SUBJECT MAJOR REHABILITATION PROJECT - CAPE COD CANAL BRIDGES
COMPUTATION PROPOSED DECK SLAB ALTERNATIVES
COMPUTED BY R.L.H CHECKED BY DATE OCT. 1978

REINFORCED CONCRETE

(1) 7" L.W. CONC. STRUCT. SLAB W/MEMBRANE W.P. & 2" BIT. CONC. WEAR. SURF.
WEIGHT OF ORIGINAL DECK

7" THICK LIGHTWEIGHT CONC. ("HAYDITE") = 7/12 x .110 = 0.064 k/SF
2" " BIT. CONC. WEARING COURSE = 2/12 x .156 = 0.026
TOTAL = 0.090 k/SF

DESIREABLE THAT WEIGHT OF REPLACEMENT DECK NOT EXCEED 90 #/SF.



D.L. Mom = ± .090 x 5² x 1/10 = ± 0.23 ^k

LL. Mom. (AASHTO 1.3.2(c)
S = 5.0 - 0.37 = 4.63'

$M = \pm \frac{4.63+2}{32} \times 16 \times 1.3 \times 0.8$ = ± 3.45 ^k

TOTAL DESIGN Mom = ± 3.68 ^k

f'c = 3000
fc = 1200
fs = 20,000 $d_{reqd} = \left(\frac{3680}{197}\right)^{1/2}$ = 4.32"

TOP COVER - 2½" MIN. ASSUME #5 REINF.
BOT COVER - 1½" MIN.

TOTAL THICKNESS REQD = 4.32" + 0.312" + 2.0" = 6.63" < 7.0 OK

ACTUAL d_{top} = 7.0 - 2 - 0.31 = 4.69" $A_{s\,TOP}$ = 3.68/1.44x4.69 = 0.54 in²/ft
d_{bot} = 7.0 - 1.5 - 0.31 = 5.19 $A_{s\,BOT}$ = /1.44x5.19 = 0.49 in²/ft
IF ¾" FLG THICKNESS IS DEDUCTED d_{top} = 3.94 < 4.32
SAY #5 @ 6" T ; 5@7½" BOT

SUBJECT MAJOR REHABILITATION PROJECT - CAPE COD CANAL BRIDGES

COMPUTATION PROPOSED DECK SLAB ALTERNATIVES

COMPUTED BY R.L.H. CHECKED BY _____ DATE OCT. 1978

REINFORCED CONC. CONT'D

DISTRIBUTION REINF. (LONGITUDINAL)

% OF TRANSVERSE REINF = $\frac{220}{\sqrt{4.63}}$ = 103% USE MAX = 67%

AS REQD = 0.62 × 0.67 = 0.42 "²/LF MID ½

ASSUME #4 BARS 4.63 × ½ × 0.42 = 0.97 "²

$\frac{0.97}{0.20} = \frac{2.31}{x}$ $x = 0.48'$ SAY #4@6" MID ½

AT END QUARTERS USE #4@12"

(II) 7" L.W. CONC. STRUCT SLAB W/EPOXY COATED REBARS (TOP) AND 2" BIT CONC. WEAR SURF.

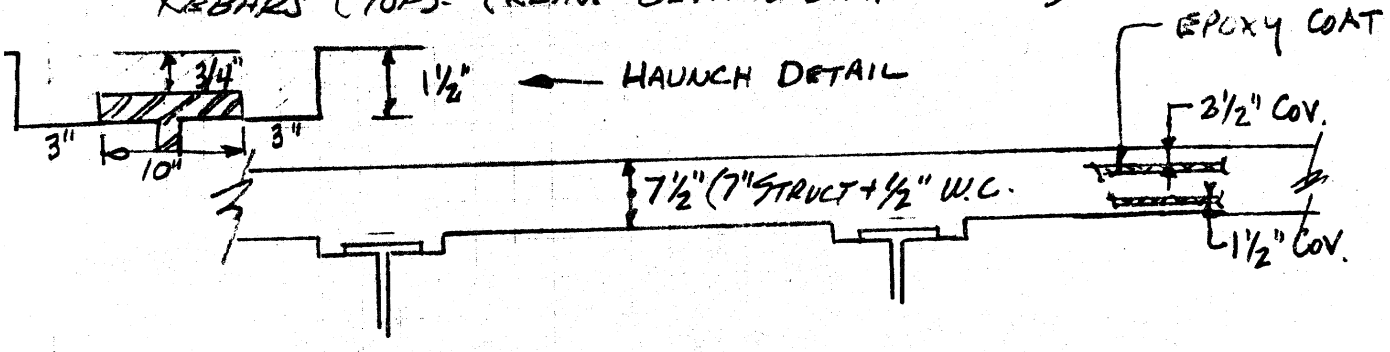
DETAILS OF STRUCT SLAB SAME AS I. W.O./WP.

NOT ADVISEABLE TO HAVE WATER LEAKING THRU BIT CONC. ENTERING LIGHT WGT CONC STRUCT SLAB.

∴ THIS ALTERNATIVE DISCARDED.

SUBJECT MINOR REHABILITATION PROJECT - CAPE COD CANAL BRIDGES
COMPUTATION PROPOSED DECK SLAB ALTERNATIVES
COMPUTED BY RLH CHECKED BY DATE OCT 1978

(III) 7½" (½" W.C) NORMAL WGT. CONC SLAB WITH EPOXY COATED REBARS (TOP). (REINF DETAILS SAME AS I)



WGT. PROP. SLAB
7½" CONC. (NORM. WGT) = 7.5/12 × .150 = .094 K/SF

HAUNCH AREA
3 × 1.5 × 2 = 9"²
.75 × 10 = 7.5
Σ = 16.5"²

16.5/144 × .150 = .0172 K/I
.0172/5 = .0034 K/SF = .003 K/SF

TOTAL DECK WGT = .097 K/SF

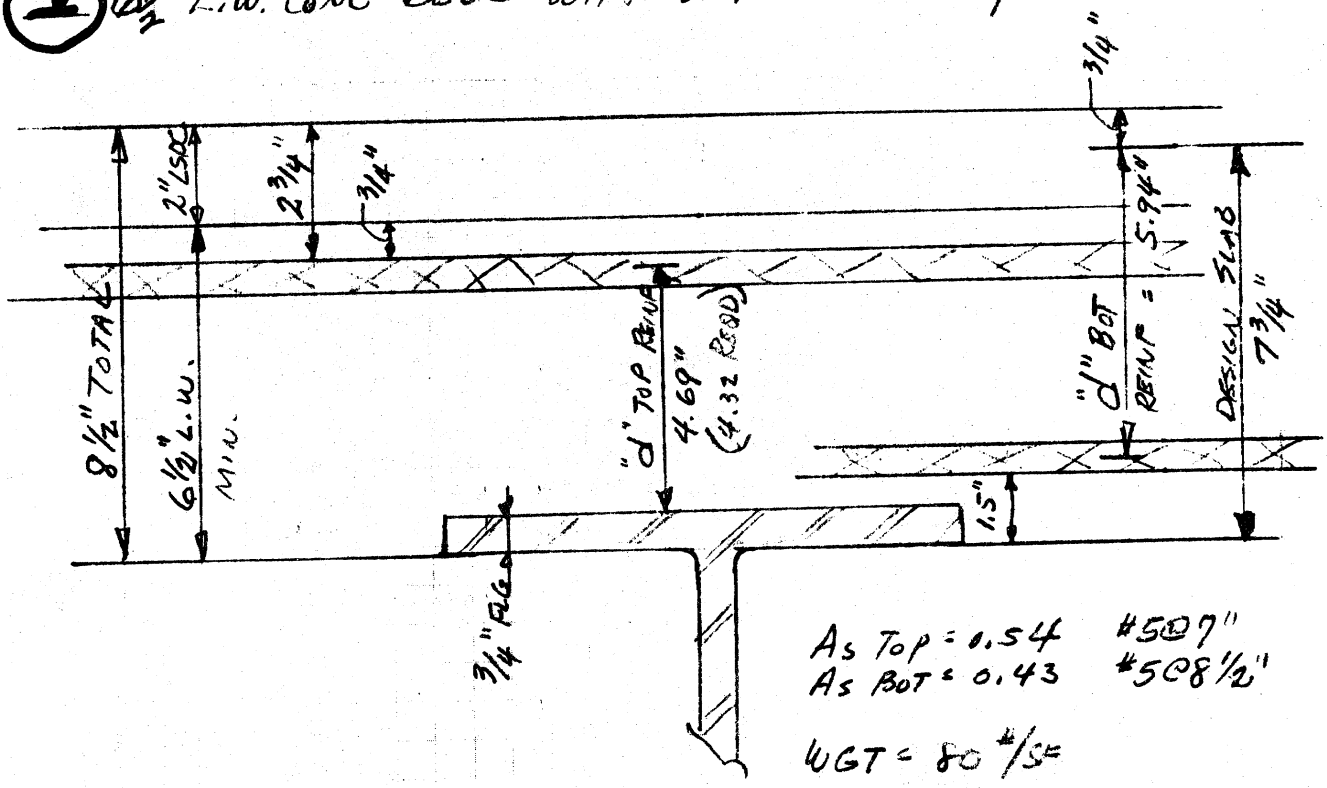
97/90 = 8% INCREASE IN SLAB WGT OVER ORIGINAL

(IV) 7½" NORM. WEIGHT CONC. (INCL. ½" W.C.) + CATHODIC PROTECTION

DETAILS AND WEIGHT SAME AS III.

SUBJECT MAJOR REHABILITATION PROJECT - CAPE COD CANAL BRIDGES
COMPUTATION PROPOSED DECK SLAB ALTERNATIVES
COMPUTED BY R.L.H. CHECKED BY DATE OCT. 1978

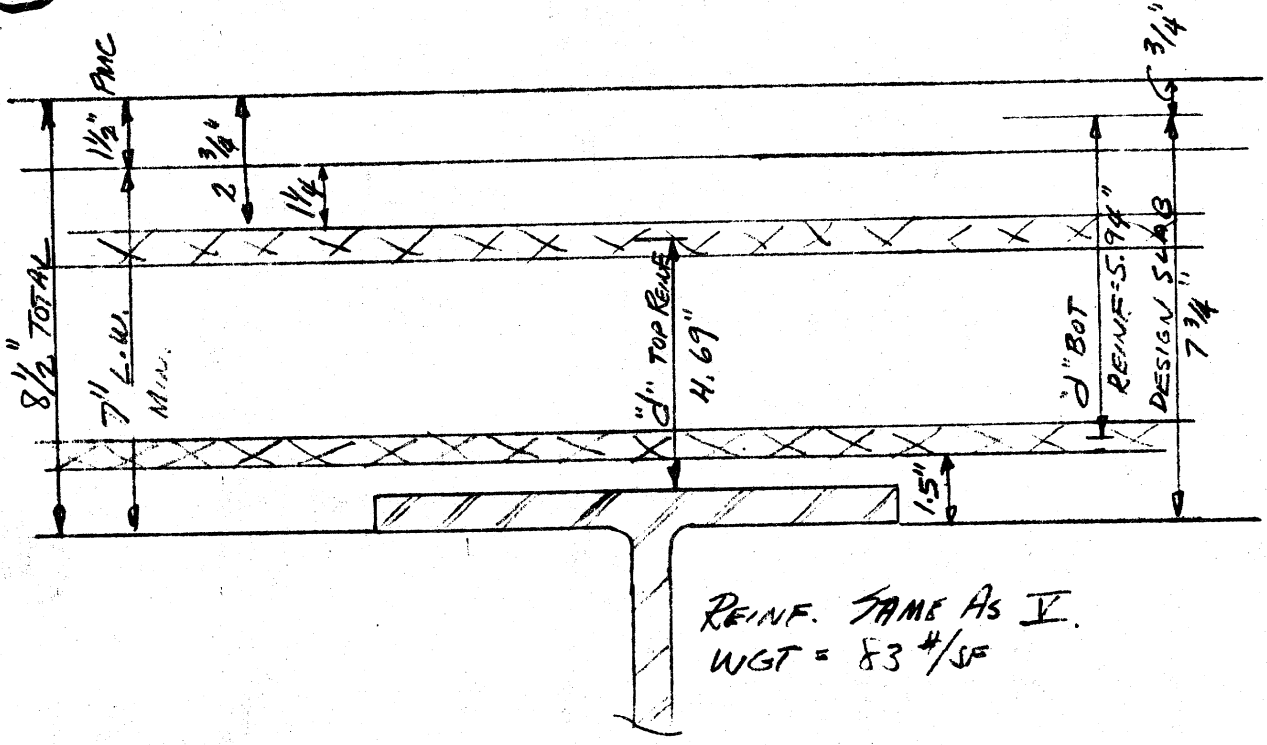
(V) 6½" L.W. CONC DECK WITH 2" LSDC. OVERLAY



As TOP = 0.54 #5@7"
As BOT = 0.43 #5@8½"

WGT = 80 #/SF

(VI) L.W. CONC. DECK WITH 1½" LATEX MODIFIED CONC OVERLAY

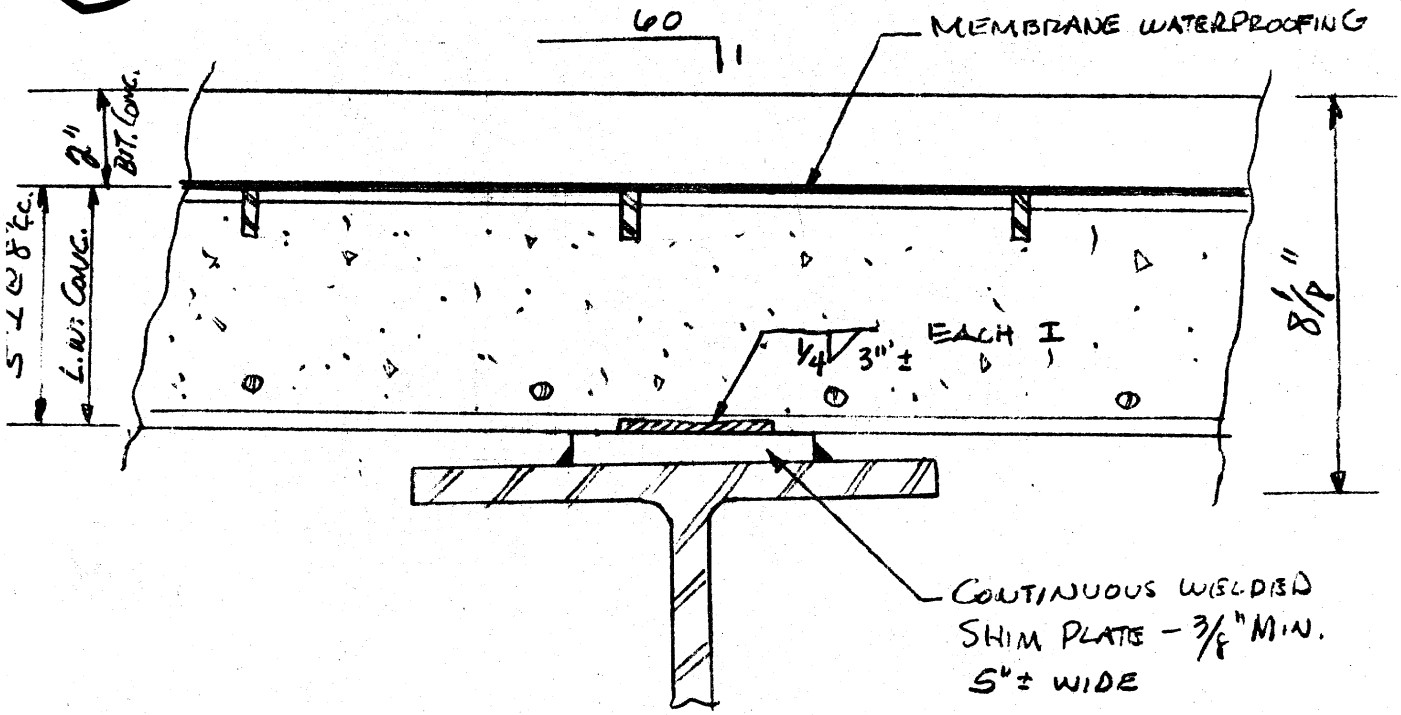


REINF. SAME AS V.
WGT = 83 #/SF

SUBJECT MAJOR REHABILITATION PROJECT - CAPE COD CANAL BRIDGES
COMPUTATION PROPOSED DECK SLAB ALTERNATIVES
COMPUTED BY RICH. CHECKED BY _____ DATE OCT. 1978

CONCRETE FILLED STEEL GRATING

(VII) 5" L.W. CONCRETE FILLED STEEL GRATING + MEMB. W.P. + 2" BIT CONC



WGT/SF

STEEL SHIMS/WELD	1.50 #
STEEL GRATING	16.48
L.W. CONC FILL	43.80
2" BIT CONC.	26.00
	87.78 #/SF

(VIII) 5" L.W. CONCRETE FILLED STEEL GRATING + 1 1/2" LATEX MOD. CONC. OVERLAY

DETAILS SAME AS VII EXCEPT BIT. CONC & MEMBRANE W.P. REPLACED W/ 1 1/2" LATEX MOD. CONC. OVERLAY

TOTAL DEPTH = 7 5/8"

WGT/SF

	1.5 #
	16.48
	43.80
1 1/2"	18.75
	80.53 #/SF

SUBJECT Cape Cod Canal Highway Bridges

COMPUTATION DECK DESIGN - STEEL GRID - CONC. FILLED

COMPUTED BY JBH CHECKED BY _____ DATE Dec 1978

Ref AASHTO art 1.3.2 & 1.3.6

Deck slab shall be 05" deep I. Beam 10" O.C. filled with light weight concrete with a compressive strength of 4000 psi the dead load of the Deck with 1.5" and wearing surface is 88 lb/sf.

steel grid will be A588 F_y = 50 ksi

Live load bend moment H-20 with impact factor of 30%

Continuity factor 0.8

$$DLM = \frac{.088(5)^2}{10} = 0.22\ 'K$$

$$LLM = \left(\frac{5+2}{32}\right) 16 \times 0.8 \times 1.30 = 3.64\ 'K$$

Total moment 3.86 'K

Section properties of Deck

I-Beam alone $I = 6.518\ in^4 \frac{12}{10} = 7.822\ in^4/ft$

Positive $S_t = 2.861\ in^3$ $S_b^* = 3.329\ in^3$

Negative $S_t^* = 2.702\ in^3$ $S_b = 3.451\ in^3$

Composit section N=8

Positive $S_c^* = 53.457\ in^3$ $S_{st}^* = 3.134\ in^3$

Negative $S_c^* = 53.938\ in^3$ $S_{st}^* = 2.752\ in^3$

*estimated value

SUBJECT Cape Cod Canal Highway Bridges

COMPUTATION Deck Design - Steel Grid + Conc. Filled

COMPUTED BY IAM CHECKED BY _____ DATE Dec 1978

Maximum Stresses

Steel $f_{LL+I} = (3.64 \times 12)/3.134$ (Positive) $= 13.94$ ksi

$f_{DL} = (.22 \times 12)/3.329 = .79$ ksi

Total $f_s = 14.73$ ksi

Concrete $f_c = (3.64 \times 12)/53.457 = .82$ ksi

Steel $f_{LL+I} = (3.64 \times 12)/2.752$ (Negative) $= 15.87$ ksi

$f_{DL} = (.22 \times 12)/2.702 = .98$ ksi

Total $f_s = 16.85$ ksi

Concrete $f_c = (3.64 \times 12)/53.938 = .81$ ksi

All stresses meet the allowable

SUBJECT CAPE COD CANAL HIGHWAY BRIDGES
COMPUTATION Top Lateral BRACING — SPAN 7, 6, 5 & 4 BOURNE BRIDGE
COMPUTED BY TKH CHECKED BY DATE 5 SEPT 78

CHECK ℓ/r of lateral bracing

Span length (ℓ) = length between center of the end connections

$\ell/r \leq 240$ AASHTO

TOP LATERALS

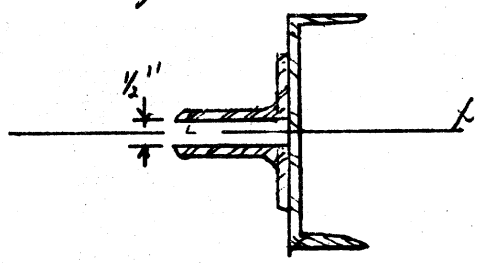
SPAN	Length	½ connections length	ℓ bracing	I_x	I_y	r_{min}	ℓ/r
7	36.63	1.41	35.22	2L5x3½x⅜	12.98	15.6	1.46	289.5
6	33.82	1.50	32.32	2L5x3½x⅜	12.98	15.6	1.46	265.6
5	39.63	1.41	38.22	2L5x3½x7/16	16.29	17.8	1.52	301.7
4	36.65	1.41	35.24	2L5x3½x⅜	13.89	15.6	1.51	280.0

gusset for span 7 & 6 ⅜"
5 & 4 ½"

All $\ell/r > 240$
additional material should be added bracing for span 5
$\ell/r = 301.7$ governs

2-L5x3½x7/16 $A = 7.05$ $I_y = 17.8$ $I_x = 16.29$ r_{min} 1.52

Try MC 10x28.5 for reinforcement
$A = 8.37$ $\bar{x} = 1.12$ $I_x = 127$ in⁴ I_y 11.4 in⁴



$$cg = \frac{(7.05(-1.63) + 8.37(1.12))}{7.05 + 8.37}$$

$$= \frac{-2.12}{15.42} = -0.14"$$

$$I_y = 17.8 + 7.05(1.49)^2 + 11.4 + 8.37(1.26)^2$$

$$= 58.14 \text{ in}^4$$

$$r_y = \left(\frac{58.14}{15.42}\right)^{1/2} = 1.94 \qquad \ell/r_y = \frac{38.22(12)}{1.94} = 236.4 < 240 \text{ OK}$$

$$r_x = \left(\frac{16.29 + 127}{15.42}\right)^{1/2} = 3.05" \qquad \ell/r_x = \frac{38.22(12)}{3.05"} = 150.4 <$$

SUBJECT Cape Cod Canal Highway Bridges
COMPUTATION Top Lateral Bracing - Connection Design
COMPUTED BY TKH CHECKED BY DATE SEPT 78

Design connection for new channel

use 7/8 H.S. Bolts ASTM A-325

use 1/2 gusset plates

Max Design Force = 75.6 K (A&W computer output)

M10x28.5 A_{gross} = 8.37 $\square$

A_{net} = 8.37 − (1 x 2 x .575) − (2 x .425)

= 6.370 $\square$

Member strength = 6.370 (18 K/$\square$) = 114.66 K

@75% = 85.995 K

Avg of design force + member strength

(75.6 + 114.66) 0.5 = <u>95.13 K</u>

<u>Channel bolts</u>

allow shear 9.02 K (55 ksi)

$\frac{95.13}{9.02}$ = 10.55

SAY 12

6 Top

6 Bottom

P_V = 95.13 x 60/78.7

= 72.53 K

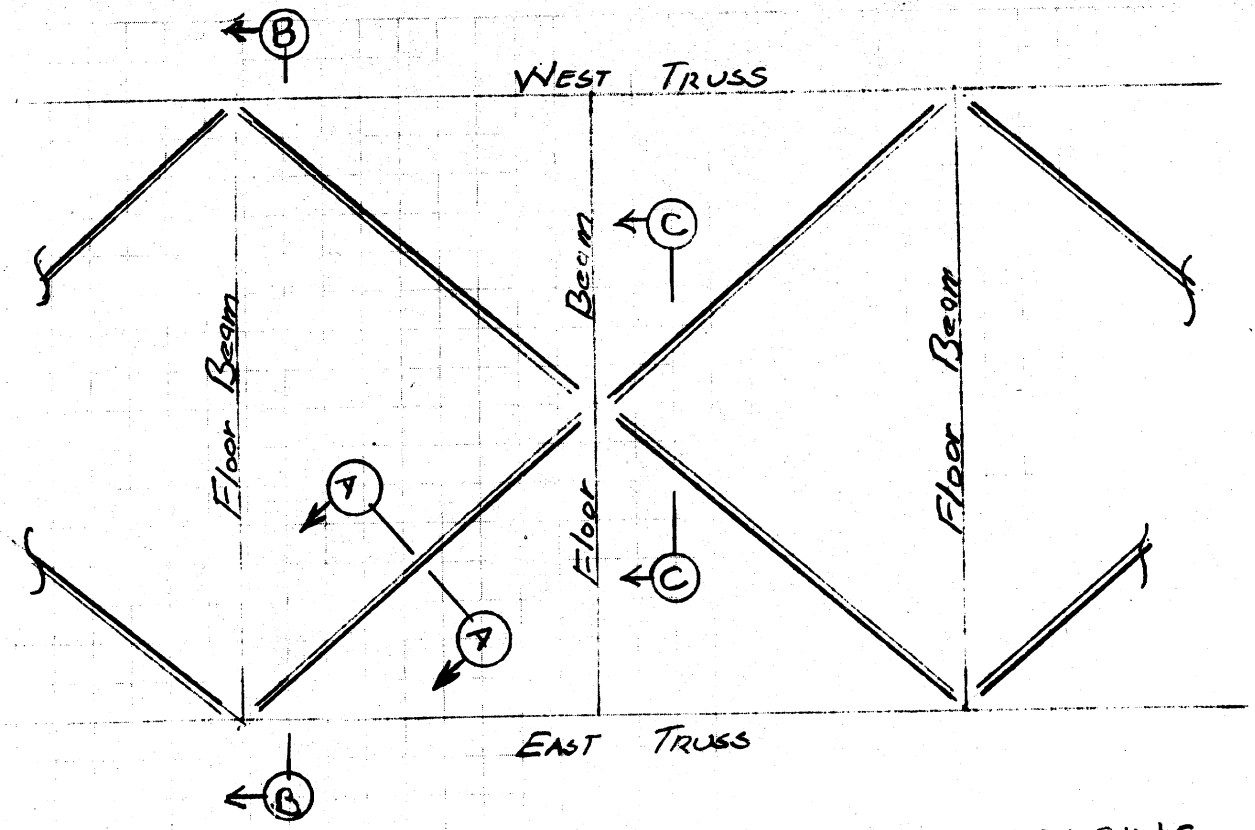
P_H = 95.13 x 51/78.7

= 61.65 K

SUBJECT Cape Cod Canal Highway Bridges

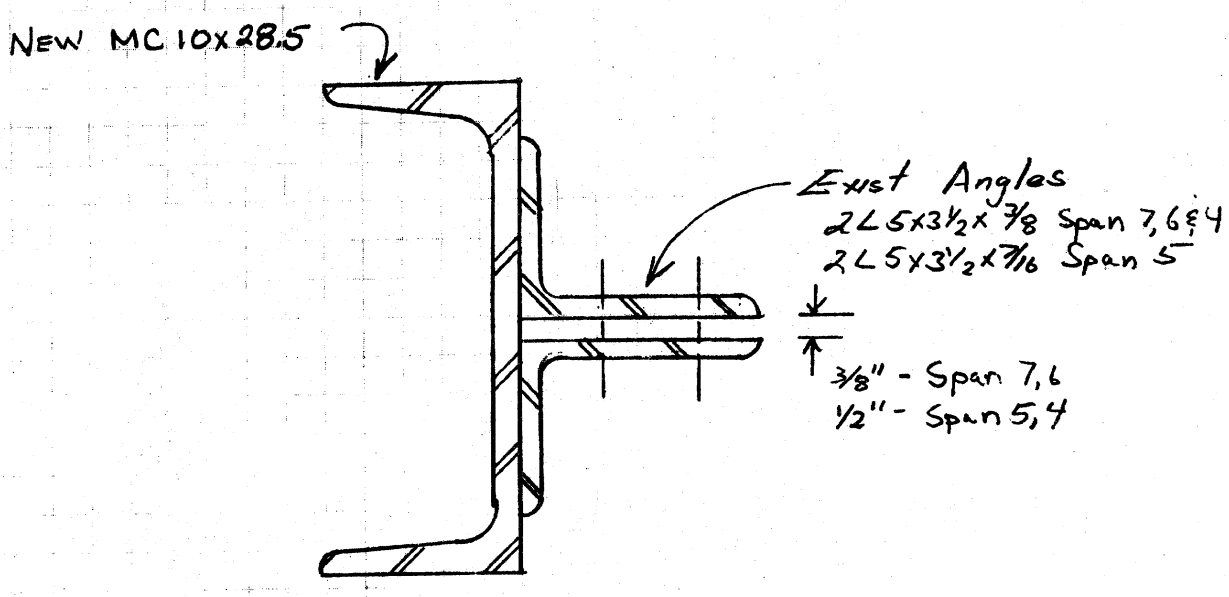
COMPUTATION Top Lateral Bracing - Repair Details

COMPUTED BY TKH CHECKED BY DATE SEPT 78



TYPICAL PLAN OF TOP LATERAL BRACING.

SCALE 1/16" = 1'-0"



SECTION A-A

Scale 3" = 1'-0"

SUBJECT Cape Cod Canal Highway Bridge

COMPUTATION Bottom Lateral Bracing – Spans 7, 6, 5 & 4 Bourne

COMPUTED BY JHH CHECKED BY _____ DATE Sept 78

Bottom Laterals

Span	Length	½ connection length	ℓ bracing	I_x	I_y	r_{min}	ℓ/r
7	36.94	1.69	35.25	2L5x3½x⅞	12.98	15.6	1.46	289.7
6	33.88	1.69	32.19	2L5x3½x⅞	12.58	15.6	1.46	264.6
5	39.72	1.69	38.12	2L5x3½x⅞	13.89	15.6	1.51	302.9 ←
4	36.91	1.69	35.22	2L5x3½x⅞	13.89	15.6	1.51	279.9

gusset ⅞" Span 7 & 6
½" Span 5 & 4

All ℓ/r > 240
additional material should be added, bracing for Span 5 ℓ/r = 302.9 governs.

2L5x3½x⅞ A = 6.09 I_y = 15.6 I_x = 13.89

Try 2L5x5x⅜" gusset ½" A = 7.22 I_y = 17.5 r_y = 1.56

r = 2.26 $I_x = 7.22(2.26)^2 = 36.88$

$cg = (7.22(1.39) - (6.09 \times 1.61))/7.22 + 6.09 = .017"$

$I_y = (15.6 + 6.09 \times 1.627^2) + (17.5 + 7.22 \times 1.373^2) = 62.83 \text{ in}^4$

$I_x = 13.89 + 36.88 = 50.77 \text{ in}^4$

$r_y = \left(\frac{50.77}{13.31}\right)^{1/2} = 1.95$ $\quad \ell/r = 38.12/1.95 \times 12 = 234.58 < 240$ ok

$r_y = \left(\frac{62.83}{13.31}\right)^{1/2} = 2.17$ $\quad \ell/r = \frac{38.12 \times 12}{2.17} = 210.80 < 240$ ok

SUBJECT Cape Cod Canal Highway Bridges

COMPUTATION Bottom Lateral Bracing — Connection Design

COMPUTED BY TKH CHECKED BY DATE Sept 79

DESIGN CONNECTION FOR NEW ANGLES

MAX DESIGN FORCE 77.3 K (A&W computer output)

$2 \angle 5 \times 5 \times 3/8$ $A_{gross} = 7.22$ in

$$A_{net} = \left[7.22 - \left(2 - \frac{2^2}{4 \times 2}\right) \times 2 \times 0.375\right]$$

$$= 7.1075$$

Member strength $= 7.1075 \times 18 = 127.94$ K

@ 75% 95.95 K

Avg (design force + Memb strength) $= \frac{77.3 + 127.94}{2} = 102.62$ K

Angle bolts use 7/8 H.S. Bolts.
allow shear 9.05 K (15 ksi)

$\frac{102.62}{9.05} = 11.34$ say 12 bolts

check 1/2 gusset assume new gusset will carry weight of both old & new angles.

wt $2 \angle 5 \times 5 \times 3/8$ = 24.6 lb/FT
$2 \angle 5 \times 3\frac{1}{2} \times 3/8$ = 20.8 lb/FT

$\ell = 38.12$ $w = 45.4$ lb/FT

$$M_{max} = \frac{w\ell^2}{12} = \frac{45.4 (38.12)^2}{12} = 5497.69 \text{ FT-lb}$$

$$R = \frac{w\ell}{2} = \frac{45.4 (38.12)}{2} = 865.32 \text{ lb}$$

deflection of gusset $\ell = 12''$ $b = 24''$

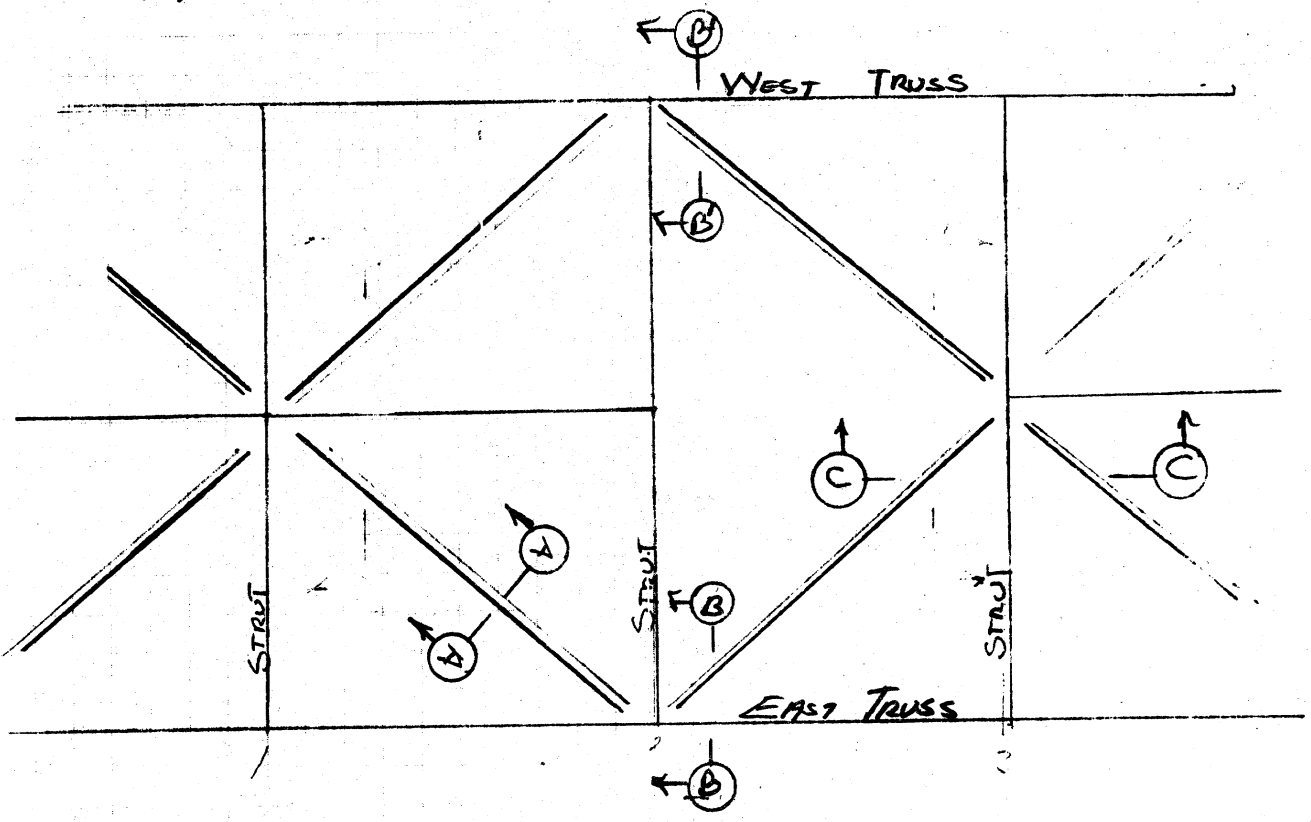
$$I = \frac{24 (.5)^3}{12} = .25$$

$$\Delta x = \frac{2P\ell^3}{6EI} = \frac{2(865.32)(12)^3}{6(29{,}000{,}000)(.25)} = .069 \text{ in}$$

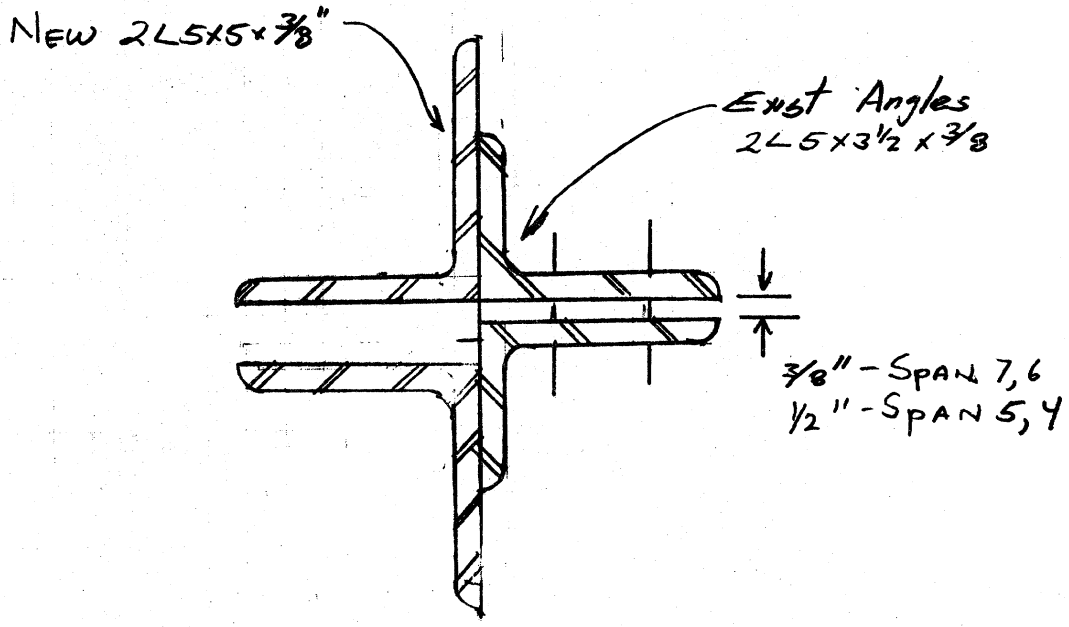
SUBJECT Cape Cod Canal Highway Bridge

COMPUTATION Bottom Lateral Bracing Detail of Repair

COMPUTED BY TKH CHECKED BY _____ DATE SEPT 78



TYPICAL PLAN OF TOP LATERAL BRACING
Scale 1/16 = 1'-0"



SECTION A-A

SCALE 3" = 1'-0"

SUBJECT Cape Cod Canal Bridges
COMPUTATION Suicide Fence and Slab Removal - Strengthening of Bracing
COMPUTED BY DKH CHECKED BY DATE Sept 78

Sway Bracing @ PP 9 & 9'

All members 485, 486, 491, 492

Design for full wind on fence K = .75

Axial Force 161 Kips Carbon steel F_y = 33 Ksi

L	A_G	A_N	r_z	r_y	Kl_z	Kl_y	F_a	C	T
72.42'	14.44	11.63	3.0	5.2		167.1	8.53	128	211

$C_c = (2\pi^2 \times 29000/33)^{1/2} = 131.7$

$Kl_r = .75(167.1) = 125.3 < C_c$

$$F_a = \frac{33000}{2.12}\left[1 - \frac{0.75^2 (Kl/r)^2 \, 33000}{4\pi^2 29000000}\right]$$

$F_a = 15566 - 0.252 (Kl/r)^2$

$F_a = 8.53$

Required Area = 161/8.53
= 18.87 in²

area exist = 14.44
add area = 4.43 in²

use 3/8 PL each side

3/8 x 10.75 x 2 = 8.06 in²

or 4 L 2x2x3/8

4 x 1.36 = 5.44 in²

Connection using 3/8 PL for strengthing

Allowable tension 0.55(33000) = 18.150 Ksi

A_N = 11.63 + 8.06 - 2.81 = 16.88

Capacity = 306.37
75% = 229.78 Kips

Avg stress Capacity = 1/2 (306.37 + 161)
= 233.69 Kips governs

No. of bolts required $\frac{233.69}{9.0}\left(\frac{1}{2}\right) = 12.95$
Say 13

SUBJECT Cape Cod Canal Bridges

COMPUTATION Suicide Fence & Slab Removal - Strengthening of Bracing

COMPUTED BY TKH CHECKED BY _____ DATE Sept 79

Check f_a and new F_a

existing

A_g	ℓ	r_x	r_y	I_x	I_y
14.44	72.42	3.0	6.2	129.96	330.4
2-3/8 PL					
6.06		3.1	6.2	77.64	309.82
Total					
22.5		2.98	5.58	200.6	700.28

$\frac{\ell}{r_2} = \frac{1}{2}\frac{(72.42)12}{2.98}$ $\frac{\ell}{r_y} = 72.42(12)/5.58$

145.81 156.74 <

$F_a = 15566 - 0.252(156.74)^2$

$= 9.45$ ksi > 8.53 ksi

OK

SUBJECT Cape Cod Canal Bridges

COMPUTATION Suicide Fence & Slag Removal - Strengthening of Bracing

COMPUTED BY JHH CHECKED BY _____ DATE Sept 78

Sway Bracing @ PP 9.0'

A.W. Members 475, 476, 501, 502

K = .75

Axial Force = 133.67 Kips Carbon steel / F_y = 33 Ksi

L	As	Am	r_z	r_y	L/r_z	L/r_y	F_a	C	T
67.88	12.2	9.39	2.5	5.2	162.9	156.6	8.88	108	170

C_c = 131.7

$K L/r$ = .75 (162.9) = 122.18 < Cc

$F_a = 15566 - 0.252 \left(\frac{L}{r}\right)^2$

F_a = 8.88 Required Area = $\frac{133.67}{8.88}$

= 15.05

area exist = 12.20

add'l area = 2.85 in²

Use 3/8 ℄ each side

3/8 × 10.75 × 2 = 8.06 in²

Connection

Allowable Tension 18,150 Ksi

A_N = 9.39 + 8.06 − 2.81 = 14.64

Capacity = 265.72 Kips

75% = 199.29 Kips

Avg stress Capacity ½ (133.67 + 265.72)

= 199.69 Kips < govern

No. of bolts required.

$\frac{199.69}{9.02}\left(\frac{1}{2}\right)$ = 11.06

Say 12

SUBJECT Cape Cod Canal Bridge

COMPUTATION Suicide Fence & Slab Removal - Strengthening of Bracing

COMPUTED BY JKH CHECKED BY DATE Sept 78

Check k/r and calc new Fa

exist

Ag	ℓ	r2	ry	I2	Iy
12.2	67.88	2.5	5.2	76.25	329.89

2 3/8 ℄

8.06		3.1	6.2	77.64	309.32

Total

20.26		2.76	5.62	153.89	639.71

$\frac{\ell}{r_2} = \frac{\frac{1}{2}(67.88)12}{2.76}$ $\frac{\ell}{r_y} = \frac{67.88(12)}{5.62}$

$= 147.56 <$ 144.94

$F_a = 15566 - .252(147.56)^2$

$= 10.08$ ksi > 8.88

OK

SUBJECT CAPE COD CANAL BRIDGES

COMPUTATION SUICIDE FENCE & SLAB REMOVAL - STRENGTHENING OF BRACING

COMPUTED BY JAH CHECKED BY _____ DATE Sept 78

Bottom Lateral Bracing @ Bay 9-10 & 8-9'

All members 342, 343, 372, 373

Design for full wind on fence

Axial Force - 318 kips Carbon Steel $F_y = 33$ ksi

L	A_g	A_N	r_z	r_y	L/r_z	L/r_y	F_a	C	T
78.85	27.76	22.14	80	3.1		152.6	9.70	269	402

C = 131.7

Required Area $318/9.70$

$= 32.78$

area exist $= 22.76$

add'l area $= 5.02\ in^2$

use 7/8 PL each side

$\frac{7}{8} \times 12.05 \times 2 = 9.56\ in^2$

CONNECTION

$A_N = 22.14 + 9.56 - 5.62 = 26.08\ in^2$

$F_T = 18.150$ Kips

Capacity = 473.35 Kips

75% = 355.01 Kips

Avg stress Capacity = $\frac{1}{2}(473.35 + 318)$

$= 395.68$ Kips < given

No of bolts required

$\frac{395.68}{9.02} \times \frac{1}{2} = 21.9$

Say 22

SUBJECT Cape Cod Canal Bridges

COMPUTATION Suicide Fence & Slab Removal - Strengthening of Bracing

COMPUTED BY JKH CHECKED BY DATE Sept 78

check ℓ/r and c of c near F_a

existing

	A_g	ℓ	r_z	r_y	I_z	I_y
	27.76	78.85	8.0	3.1	1776.64	266.77
2-3/8 ℄	9.56		9.19	3.68	806.96	129.46
Total	37.32		8.32	3.26	2583.6	396.23

$\ell/r_z = \frac{78.85(12)}{8.32} = 113.72$

$\ell/r_y = \frac{78.85(12)(1/2)}{3.26} = 145.12$

$F_a = 15366 - 0.252(145.12)^2$

$= 10.26 \text{ ksi} > 9.70$ OK

SUBJECT Cape Cod Canal Bridges

COMPUTATION Suicide Fence & Sand Removal - Strengthening of Bracing

COMPUTED BY JAT CHECKED BY _____ DATE Sept 78

Top Lateral Bracing @ Bays 9-10, 10-11, 11-10, 10-9

Full wind on face K=.75

All members 433, 437, 440, 439
462, 461, 464, 463

Axial force 108 Kips Bay 9-10
112 Kips Bay 10-11

L	Ag	An	le	ry	L/r	Fa	C	T
7.02	12.2	9.39	8.2	2.6	163.7	8.8	107	170

$C_c = 131.7$

$KL/r = 122.9$

Required area = 112/8.8

= 12.73 in

area exist = 12.20 in

add'l area = 0.52 in

Use 3/8 PL each side

$3/8 \times 10.75 \times 2 = 8.06\ in^2$

Connection

Allow Ten. = 18.15

$An = 7.39 + 8.06 - 2.81 = 14.64$

Capacity = 265.72 Ksi

75% = 199.29 Ksi < governs

Avg stress Capacity = 188.86 Ksi

No of bolts required.

$199.29 / 9.02 \left(\frac{1}{2}\right) = 11.05$

Say 12

SUBJECT Cape Cod Canal Bridges

COMPUTATION Suicide Fence & Slab Removal - Strengthening of Bracing

COMPUTED BY JBK CHECKED BY _____ DATE Sept 78

Check f_a and calc new F_a

	A_g	ℓ	r_z	r_y	I_z	I_y
Existing	12.2	71.02	8.2	2.6	820.33	82.47
2-3/8 PL	8.06		9.2	3.1	682.20	71.64
Total	20.26		8.61	2.81	1502.53	160.11

$\ell/r_z = \frac{71.02(12)}{8.61}$ $\ell/r_y = \frac{71.02(12)}{2.81}$

98.98 151.64

$F_a = 15.66 - 0.252(151.64)^2$

$= 9.77$ ksi > 8.3 ksi

OK

NED FORM 223
27 Sept 49

NEW ENGLAND DIVISION
CORPS OF ENGINEERS, U. S. ARMY

SUBJECT Cape Cod Canal Bridges

COMPUTATION Suicide Fence & Slab Removal - Strengthening of Bracing

COMPUTED BY IKH CHECKED BY _____ DATE Sept 28

Top Lateral Bracing @ Bay 0-1, 0-1'

Design full wind K=.25 Au members 427, 428, 473, 474

Axial Force = 109 Kips Carbon Steel F_y = 33 ksi

L	A_g	A_n	r_z	r_y	L/r_z	L/r_y	K_u	C	T
67.41	12.2	9.39	8.2	2.6		155.6	9.46	115	170

$L/r = 155.6 < L/r = 163.9$ for members in Bays 9-10 & 10-11

∴ some strengthing used for Bays 9-10 & 10-11 will be more than adequate for Bay 0-1

SUBJECT Cape Cod Bridges

COMPUTATION Suicide Fence & Slab Removal - Strengthening of Bracing

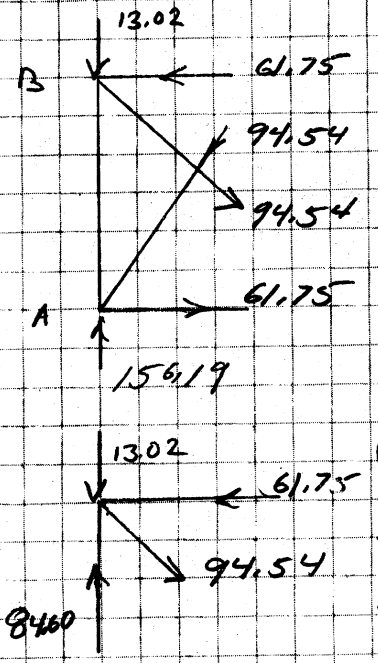
COMPUTED BY TKH CHECKED BY DATE Sept 78

Connection @ PP-10 from wind chord

AW - Suicide Fence P-11E

AW - Sagamore Comp! P 72-104

Wind Chord



		original wind load Fa	1.23% (Fence) Fa	allowable Fa
Diagonal		7.75	9.5	10.63
Vert Strut		2.49	3.06	12.61
Connection (Sect A-A)	$\frac{D_1 L_0}{1.25}$		21.75	18.0 (Nb)
Sect 1-1		17.29	21.27	18.0
Sec 2-2		4.89	6.01	18.0
Strut rivets		11	14	28
Diagonal		17	21	28

NED FORM 223
27 Sept 49

NEW ENGLAND DIVISION
CORPS OF ENGINEERS, U. S. ARMY

PAGE A25

SUBJECT CAPE COD CANAL - Highway Bridges
COMPUTATION SLAB REMOVAL - Joint Displacements
COMPUTED BY IAH CHECKED BY DATE Oct 79

Shop drawing dimensions	Roller Dia	Nest length c to c	Total length o to o	℄	Δ
Sagamore Bridge					
Pier 1	9"	7'-1½"	7'-10½"	9'-1"	14½"
Abutments	6"	2'-8½	3'-2½	3-10½	8"
Bourne Bridge					
Pier 2	9"	7'-1½"	7'-10½"	9'-1"	14½"
Pier 3 & 4	6"	2'-8½	3'-2½"	3'-10½	8"

Roller Bearing Locations

	1969			1976			Δ+℄
Sagamore Bridge	S	N	Δ	S	N	Δ	Shop dr.
West Truss							
Pier 1	11"	4 5/8"	14 5/8"	11 1/16"	3 1/16"	14 1/4"	15"
South Abutment	2"	5 1/2"	7 1/2"	3 1/4"	5 1/2"	8 3/4"	8"
North Abutment	2 1/16	5 3/4"	8 5/16"	2 1/2"	6"	8 1/2"	8"
East Truss							
Pier 1	11"	5"	16"	11 1/2"	3 1/4"	14 3/4"	15"
South Abutment	1 7/8"	5 5/8"	7 1/2"	2 1/2"	5 5/8	8 1/8"	8"
North Abutment	2 15/16"	4 15/16	7 7/8"	3 1/2"	4 5/8	8 1/8"	8"
Bourne Bridge							
West Truss							
Pier 2	5	11 3/8	16 3/8	—	12 1/8	—	15 1/4"
Pier 3	4 1/4	3 1/2	7 3/4	5 3/16	3 5/16	8 1/2"	8"
Pier 4	5 1/4	2 1/4	7 1/2	4 5/16	3 3/4	7 13/16	8"
East Truss							
Pier 2	4 15/16	11 1/2	16 7/8	—	12 3/10	—	15 1/4"
Pier 3	—	2 3/4	—	5 3/16	3 5/16	8 1/2"	8"
Pier 4	4"	3 5/8	7 5/8	3 1/2	5 1/16	8 9/16"	8"

NEW ENGLAND DIVISION
CORPS OF ENGINEERS, U. S. ARMY

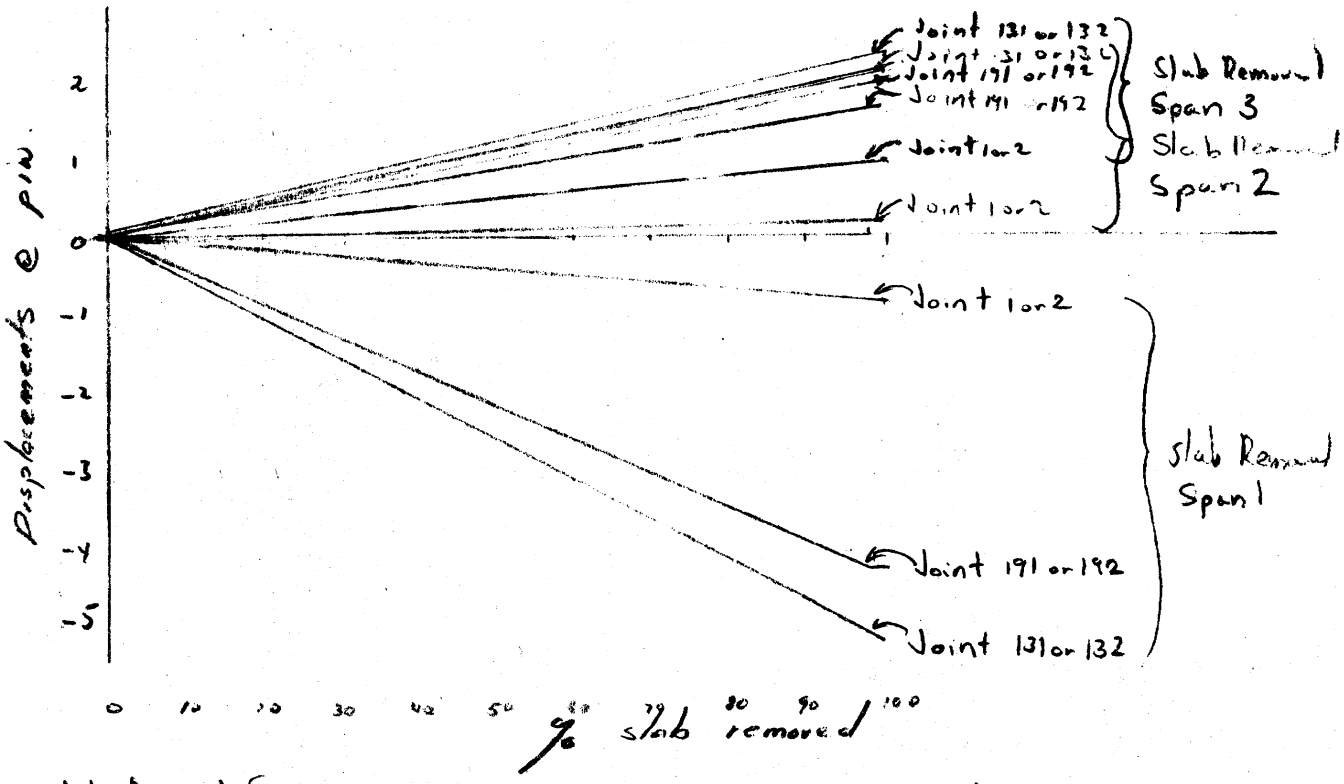
SUBJECT Cape Cod Canal Highway Bridges

COMPUTATION Span Removal - Joint Displacements

COMPUTED BY TAM CHECKED BY DATE 19 Aug 78

Joints	1 or 2		131 or 132		191 or 192	
	+X	-X	+X	-X	+X	-X
Loadings (Slab Removal only)						
Slab Removal, Span 3	0.91		1.78		1.62	
Slab Removal, Span 1		-0.79		-5.17		-4.28
1 Lane Live Load, Span 3		-0.20		-0.38		-0.34
1 Lane Live Load, Span 1	0.17		1.10		0.92	
1 Lane Live Load, Span 2		-0.03		-0.36		-0.24
Live Load Combo	0.17	-0.23	1.10	-0.74	0.92	-0.58

assume straight line relation between % Slab Removed and displacement



Slab Removal, Span 2	0.14	1.69	1.14

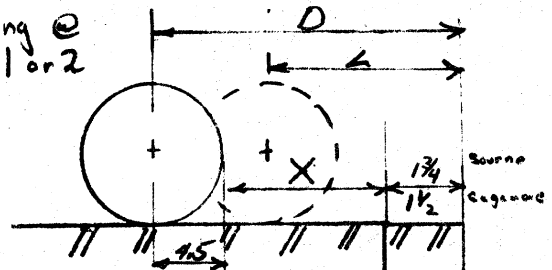
SUBJECT Cape Cod Canal Bridges

COMPUTATION Slab Removal - Joint Displacements

COMPUTED BY TKH CHECKED BY DATE Oct 78

Span 1 Slab Removal
Check displacements for
-30°F, 0°F, 60°F & 120°F

Bearing @ Pier 1 or 2

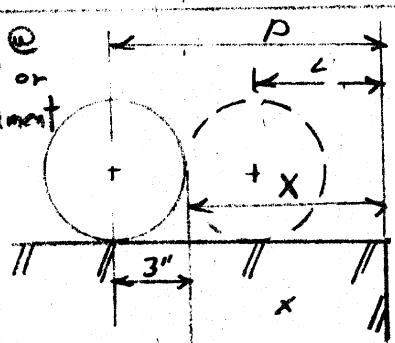


max pin movement = 5.91"
roller movement = 2.96"

@ 32° x = 2.31" Bourne
@ 60° x = 1.75" Sagamore

		X	D	L	
Bourne Pier #2	-30°F	0.82	7.07	4.11	roller projected out by 0.39"
	0°F	1.54	7.79	4.83	
	60°F	2.98	9.23	6.27	
	120°F	4.42	10.67	7.71	
Sagamore Pier #1	-30°F	-0.41	5.59	2.63	roller projected out by 1.87"
	0°F	0.31	6.31	3.35	roller projected out by 1.15"
	60°F	1.75	7.75	4.79	
	120°F	3.19	9.19	6.23	

Bearing @ Pier 4 or South Abutment



max pin movement = 4.86"
roller movement = 2.43"

@ 28° x = 3.5" Bourne
@ 71° x = 5.5" Sagamore

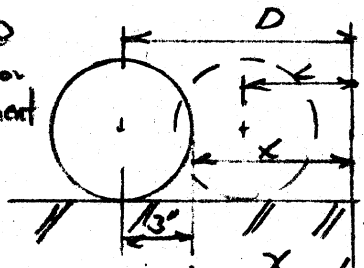
		X	D	L	
Bourne Pier #4	-30°F	1.21	4.21	1.78	roller projected out by 1.22"
	0°F	2.39	5.39	2.96	roller projected out by 0.04"
	60°F	4.76	7.76	5.33	
	120°F	7.13	10.13	7.70	
Sagamore South Abutment	-30°F	1.51	4.51	2.08	roller projected out by 0.92"
	0°F	2.70	5.70	3.27	
	60°F	5.06	8.06	5.63	
	120°F	7.43	10.43	8.00	

SUBJECT Cape Cod Canal Bridges

COMPUTATION Slab Removal – Joint Displacements

COMPUTED BY TKH CHECKED BY DATE Oct 78

Bearing @ Pier #3 or North Abutment



max pin movement = 1.02
roller movement = 0.51"

@ 35° x = 3.3125" Bourne
@ 76° x = 2.50" Sagamore

		x	D	L
Bourne Pier #3	-30°F	2.35	5.35	4.84
	0°F	2.77	5.77	5.26
	60°F	3.74	6.74	6.23
	120°F	4.62	7.62	7.11
Sagamore North Abutment	-30°F	1.50	4.50	3.99
	0°F	1.96	4.96	4.45
	60F	2.89	5.89	5.38
	120°F	3.81	6.81	6.30

Span 3 or 2 Slab Removal

Check displacements for

60°F & 120°F

Bearing @ Pier 1 or 2

Δ = allowable total movement on ℄ = 14.6"
max pin movement = 2.88 roller movement = 1.44

		x	Δ - x	D	L
Bourne Pier #2	60°F	2.98	11.52	16.02	14.58
	120°F	4.42	10.08	14.58	13.14
Sagamore Pier #1	60°F	1.75	12.75	17.25	15.81
	120°F	3.19	11.31	15.81	14.37

Bearing @ Pier 4 or South Abutment

Δ = allowable total movement on ℄ = 8"
max pin movement = 2.54 roller movement = 1.27

Bourne Pier 4	60°F	4.76	3.24	6.24	4.97
	120°F	7.13	0.87	3.87	2.60 roller projected out by 0.40"
Sagamore South Abutment	60°F	5.06	2.94	5.94	4.67
	120°F	7.43	0.57	3.57	2.30 roller projected out by 0.30"

SUBJECT Cape Cod Canal Bridges

COMPUTATION Slab Removal - Joint Displacement

COMPUTED BY TKH CHECKED BY DATE Oct 1978

Bearing @ Pier #3 or North Abutment

Δ allowable total movement or ℄ = 8"
max pin movement = 1.08
roller movement = 0.54

		X	Δ-X	D	L
Bourne Pier #3	60°F	3.74	4.26	7.26	6.72
	120°F	4.62	3.38	6.38	5.84
Sagamore North Abutment	60°F	2.89	5.11	8.11	7.57
	120°F	3.81	4.19	7.19	6.65

Restrictions on deck removal due to movement at roller bearings. — Even ~~at~~ the min. Temp −30°F the maximum movement is such that the rollers will remain on the bearing plates. The only restrictions would then be:

1/ Removal of the closure plates so to avoid any damage to the plates or roller nest if this extreme movement occures

2/ Monitoring of the roller movements during construction

SUBJECT Cape Cod Canal Bridges
COMPUTATION Slab Removal - Joint Displacements
COMPUTED BY IKH CHECKED BY DATE Oct 28

Maximum movement of pin at joints

@ Pier 1 or 2

Movement due to	
Temp change -30°F to 120°F	7.2"
Removal of Span 1	5.91
Removal of Span 3	2.88"
	15.99"

@ Pier 4 or South Abutment

Temp change -30°F to 120°F	11.84"
Removal of Span 1	4.86"
Removal of Span 3	2.54"
	19.24"

@ Pier #3 or North Abutment

Temp change -30°F to 120°F	4.54
Removal of Span 1	1.02
Removal of Span 3	1.08
	6.64"

Max allowable movement in slotted holes @ Pier #4 or Pier #3 or South or North Abutment 15 INCHES

Restrictions on deck removal due to movement of bolts in slotted holes. The maximum allowable movement is 15 inches movement of Pier 4 or South Abutment could be as much as 19.24" with deck removal. Since the exact location of the bolts are not known in the slotted holes at this time the following restrictions are recommended.

1) Restriction of removal of deck to a max of 3 bays on any one span.

2) Monitoring of the movement of the bolts durning construction.

APPENDIX B

CERL PAINT REPORT

DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORY
P. O. BOX 4005
CHAMPAIGN, ILLINOIS 61820

OCT 31 1978

CERL-EM

SUBJECT: Coatings on the Sagamore and Bourne Highway Bridges

Division Engineer
U.S. Army Engineer Division, New England
424 Trapelo Road
Waltham, MA 68102

1. On 19 Oct 78 Mr. Beitelman of this laboratory accompanied Mr. Harrington and other persons from New England Division on an inspection of the Sagamore and Bourne Highway Bridges. The attached Memorandum for Record reflects the observations made.

2. If there are further questions, please contact Mr. Beitelman, FTS 958-7421 or Commercial (217) 352-6511.

FOR THE COMMANDER AND DIRECTOR:

John A. Brown, MAJ CE, Dep CDR & DIR
for R. R. WILLIAMSON, Chief
Engineering & Materials Division

1 Incl
as

CF:
Robert Harrington

DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORY
P. O. BOX 4005
CHAMPAIGN, ILLINOIS 61820

CERL-EM

MEMORANDUM FOR RECORD

SUBJECT: Coatings on the Sagamore and Bourne Highway Bridges

1. On 19 Oct 78 at the request of Carter Laing of New England Division, I visited the Cape Cod canal area to observe the coating system on two of the bridges over the canal. Other persons at the site included Robert Harrington, Structural Engineer, Robert Maki, Specifications Section, and Frank Hocam, Construction Section. It was requested that I offer comments on a coating system suggested by an engineering firm along with my recommendations on a coating system for the structures.

2. The coatings were observed on both the Sagamore and Bourne Highway Bridges. Although the coating on the Bourne is newer than that on the Sagamore, it is in somewhat poorer condition. The cause of this difference in performance is unknown; however, inadequate surface preparation often leads to early coating failure. The major coating failures on the bridges are in the areas that are subjected to heavy concentrations of deicing salts. Much of this problem could be eliminated by installing waterproof expansion joints in the roadbed. Extensive corrosion is also taking place in some of the lattice structure. The difficulty of preparing the surfaces and painting these lattice structures has probably led to poor paint systems and premature failures.

3. The engineer's report suggests sandblasting to either a commercial or near-white grade and applying a paint system consisting of three coatings; i.e., an organic zinc primer, a vinyl butyral wash coat, and a vinyl finish coat. The report suggests that this system should have a 20-year life span, thereby compensating for its higher costs over the current system. To this system, I would offer the following comments:

a. This would constitute a major change in the paint system. The proposed coatings would probably lift any of the current system which might remain on the structure. It would, therefore, be of utmost importance that the proposed surface preparation remove all traces of the existing coating from the entire structure.

b. In order for a zinc-rich coating to be truly effective, the zinc must be in intimate contact with the steel. Thus, sandblasting to near-white metal would be more appropriate than the commercial grade.

c. Although I have had no experience with this particular system, it sounds quite effective and should meet the 20-year life span if it could be properly applied. I would, however, question the statement that it is cost-effective.

4. The engineer's report states that the coal tar epoxy (SSPC-Paint No. 16) should be removed and indicates that, as such, it should not have been applied over a zinc-rich primer. The following comments are offered:

a. If the proposed system is applied, it is appropriate that all existing coatings be removed, including the coal tar epoxy.

b. At the time the SSPC-16 specification was written, its performance over zinc-rich primers was unknown. Current technology has proven the effectiveness of such primers. SSPC is in the process of rewriting the specification, and the new version will suggest the use of inhibitive primers such as organic zincs.

5. It is my opinion that the system proposed in the engineer's report is impractical for use on the structures. An oil base system similar to the one in existence would be much more practical.

a. The proposed system would require sandblasting of the entire structures to the near-white grade (see paragraphs 3.a. and 3.b.). This would be very costly and time-consuming. With an oil base system, surface preparation could consist of spot blasting only the corroded areas to a brush-off or commercial grade.

b. The proposed system would be considerably more expensive in terms of material costs and application costs. The proposed paints are more expensive on a per-gallon basis. Because more area and greater thicknesses are required, more gallons would be required. The intermediate coat and perhaps also the primer are multi-component materials with limited pot lifes, thus resulting in additional time for mixing and additional material loss due to the limited pot life. In addition, contractors often charge a premium for applying what they might consider "exotic" systems.

c. The majority of the coating failure taking place is occurring not on the massive surfaces, but rather in the crevices and joints (especially on the lattice). The cause is poor -- or perhaps impossible -- surface preparation. The proposed system is less tolerant of poor surface preparation than is the oil base system. Given equal surface preparation in these areas, it is possible that an oil base system would be equal, if not superior, to the proposed system.

6. I suggest the bridges be maintained in the following fashion:

a. An effort should be made to keep deicing salts from coming in contact with the coating. The installation of waterproof expansion joints would greatly extend the life of any coating system in the areas below the joints.

b. All areas where corrosion is evident should be sandblasted to at least the brush-off grade. Blasting to the commercial grade in areas where extensive corrosion is taking place would be of additional benefit. Power tool cleaning of these structures is impractical. Water jet cleaning forces moisture into crevices which often does not evaporate prior to painting, thus accelerating early paint failure.

c. All areas where bare metal is exposed should be spot primed with a coat of TT-P-86, Type 1, followed with a topcoat of TT-P-38. Because of the complex structure, it would be beneficial if the primer were applied by brush. The topcoat may be spray applied.

d. An overall topcoat of TT-P-38 should be spray applied to the entire structure.

e. If given areas cannot be isolated from the deicing salts, the members in these areas should be encapsulated with a system consisting of E-303 epoxy zinc and C-200 coal tar epoxy. TT-P-38 may be used as an additional topcoat for aesthetic purposes.

f. The ultimate success or failure of the above outlined paint system would be determined to a great extent by the amount and competency of the inspection of the work. An inspector should be on the job evaluating each days sandblasting operation as well as the application of each coat of the new paint system.

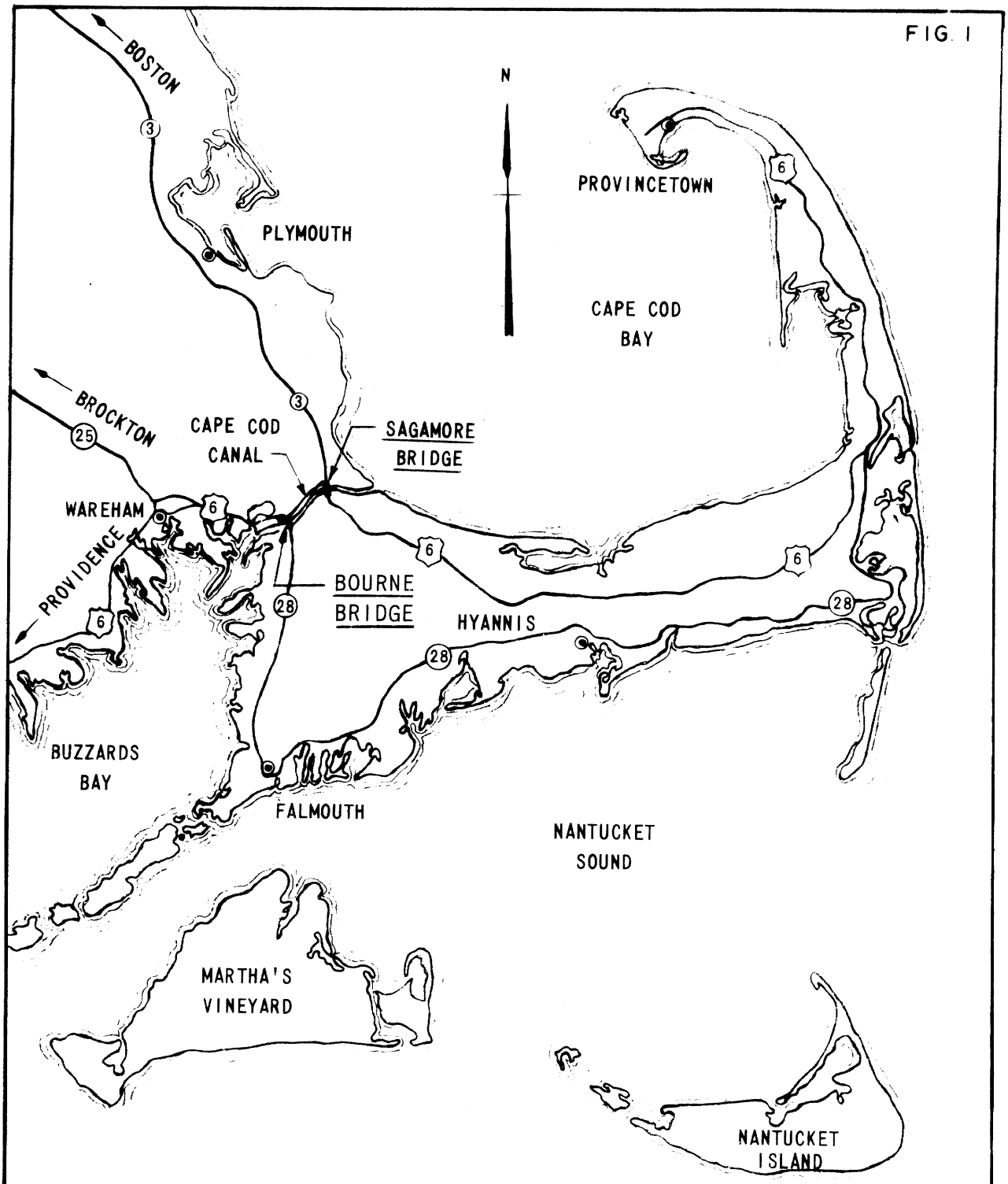
7. A question was raised concerning the use of inorganic zinc primers, perhaps as a shop coat on replacement members. Industry is often able to offer a considerable savings by shop blasting and shop priming with inorganic zincs. Members so primed have added protection in areas which would be otherwise inaccessible to sandblasting and painting after fabrication. Caution must be exercised, however, to avoid allowing the oil base aluminum topcoat to come in direct contact with the zinc primer as a chemical reaction could take place. The use of an intermediate coat, such as the wash primer, DOD-P-15328 or C-200 coal tar epoxy, would be necessary to isolate the topcoat from the zinc primer.

8. A question was raised concerning the procurement of galvanized railings for the structures. It is not felt that galvanizing will provide significant benefit over the current oil base paint system. If alternative materials are desired, it is suggested that 316 stainless steel be considered. If the galvanizing is to be painted, it should be pretreated with the wash primer, DOD-P-15328. Many coatings will adhere to this material, including TT-P-38.

Alfred Beitelman

ALFRED BEITELMAN
Chemist

FIG. 1



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS
CAPE COD CANAL
BOURNE, MASS.

CAPE COD CANAL BRIDGES
MAJOR REHABILITATION PROJECT

LOCATION PLAN

FIG. 2

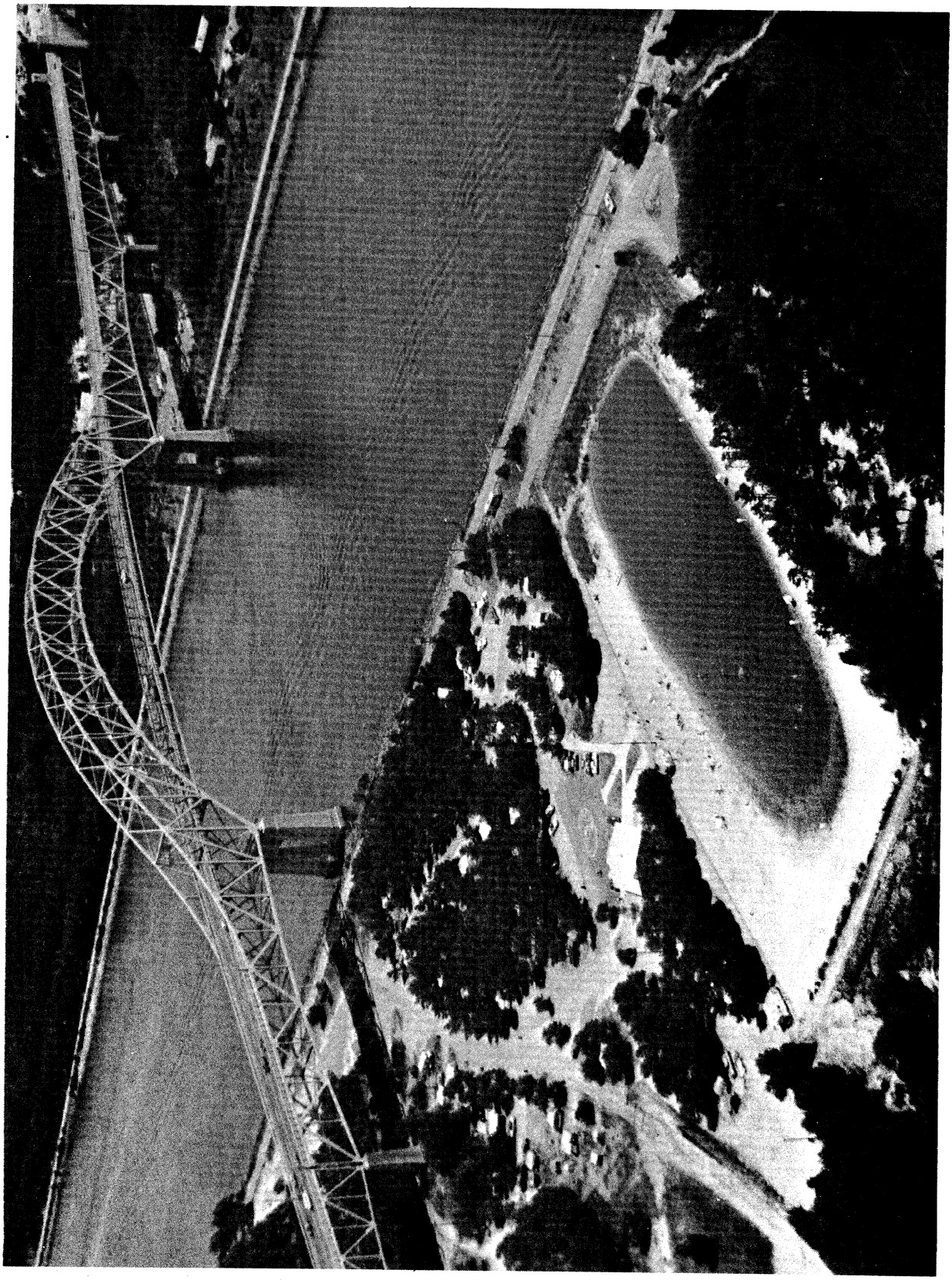
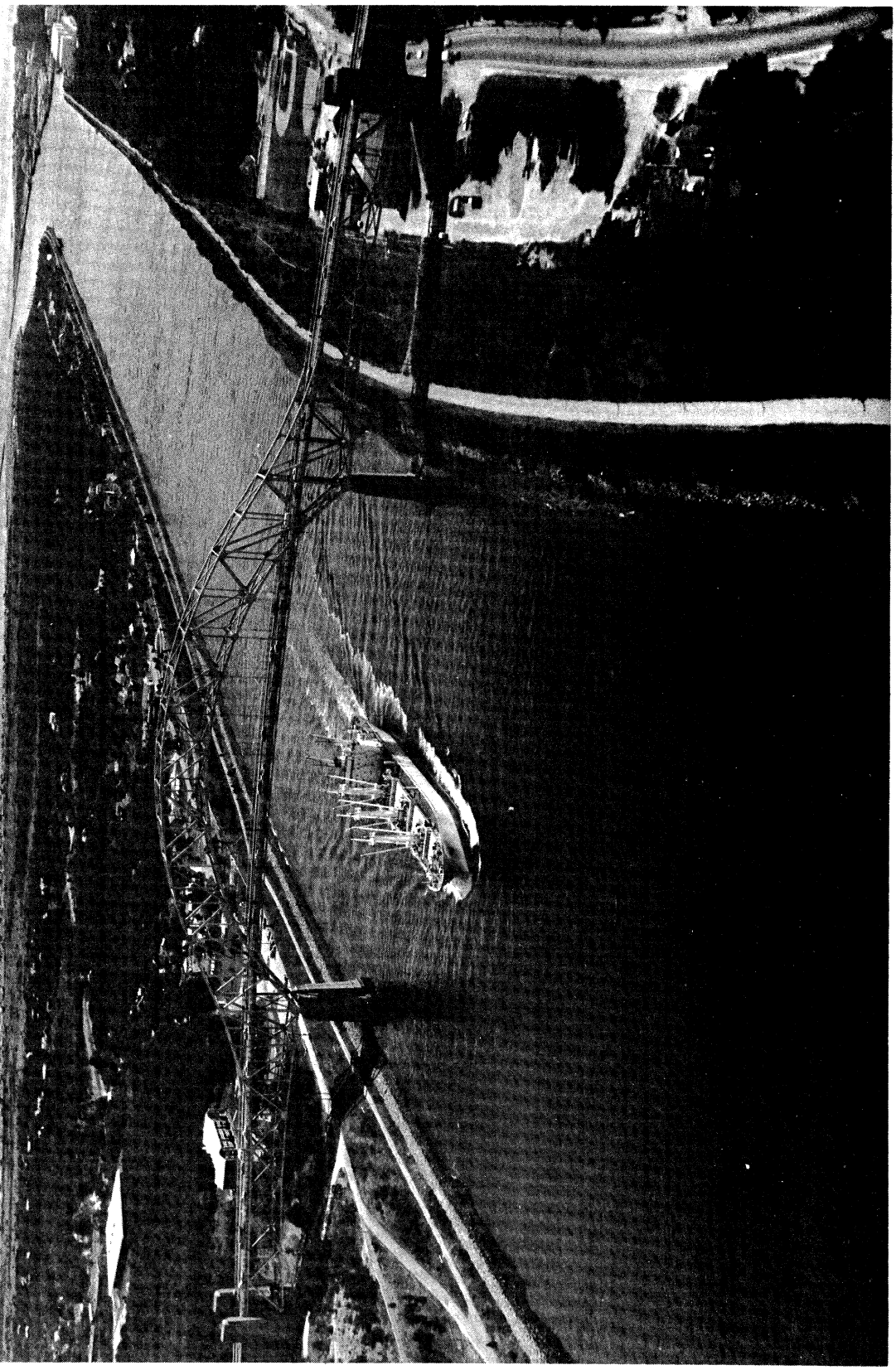
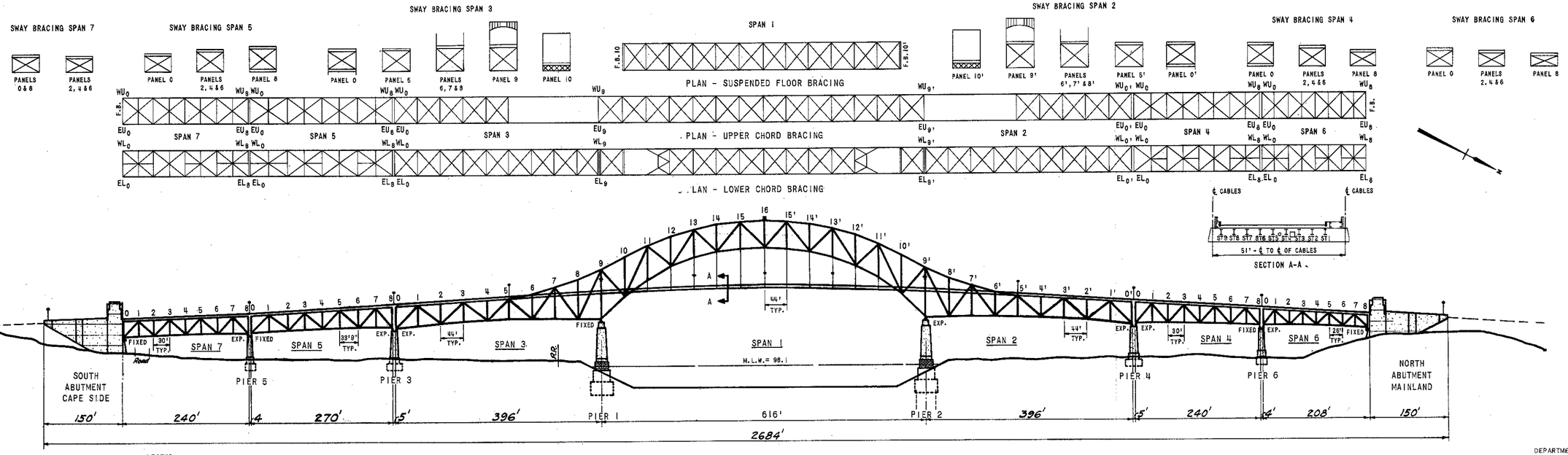


FIG. 3





LEGEND

N = NORTH
S = SOUTH
E = EAST
W = WEST
F.B.= FLOOR BEAM
L = LOWER CHORD PANEL POINT
U = UPPER CHORD PANEL POINT
MLW = MEAN LOW WATER BASED ON MSL= 100

ST = STRINGER
SW = SIDEWALK
W.C. = WIND CHORD
M.H. = MAN HOLE

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

CAPE COD CANAL
BOURNE, MASS.

BOURNE HIGHWAY BRIDGE
MAJOR REHABILITATION PROJECT

KEY PLAN

FIG 5

SWAY BRACING SOUTH END

PANEL 0 | PANEL 5 | PANELS 6, 7 & 8 | PANEL 9 | PANEL 10

SWAY BRACING NORTH END

PANEL 10' | PANEL 9' | PANELS 6', 7' & 8' | PANEL 5' | PANEL 0'

F.B.10 — F.B.10'

PLAN - SUSPENDED FLOOR BRACING

F.B. — WU_0 — WU_9 — $WU_{9'}$ — $WU_{0'}$ — F.B.

EU_0 — EU_9 — $EU_{9'}$ — $EU_{0'}$

PLAN - TOP CHORD BRACING

N

WL_0 — WL_9 — $WL_{9'}$ — $WL_{0'}$

EL_0 — EL_9 — $EL_{9'}$ — $EL_{0'}$

PLAN - LOWER CHORD BRACING

¢ CABLES ¢ CABLES

ST1 ST2 ST3 ST4 ST5 ST6 ST7 ST8 ST9 ST9 ST8 ST7 ST6 ST5 ST4 ST3 ST2 ST1

51' - ¢ TO ¢ OF HANGERS

SECTION A-A

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 15' 14' 13' 12' 11' 10' 9' 8' 7' 6' 5' 4' 3' 2' 1' 0'

A — A

44' TYP.

EXP. — SPAN 3 — EXP. — SPAN 1 — FIXED — SPAN 2 — EXP.

Roadway — RR — Roadway — Roadway

M.L.W.= ELEV. 96.3

SOUTH ABUTMENT
CAPE SIDE

PIER 1 — PIER 2

NORTH ABUTMENT
MAINLAND

225' | 396' | 616' | 396' | 200'

1408'

1833'

ELEVATION

LEGEND

E = EAST
W = WEST
F.B.= FLOOR BEAM
L = LOWER CHORD PANEL POINT
U = UPPER CHORD PANEL POINT
MLW = MEAN LOW WATER BASED ON MSL=100

50 0 100 200

SCALE IN FEET

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS
CAPE COD CANAL
BOURNE, MASS.
SAGAMORE HIGHWAY BRIDGE
MAJOR REHABILITATION PROJECT

KEY PLAN

FIG. 6

REINFORCING TRUSSES

Spaced 6'-6" c. to c. Depth 5'-0" out to out of truss and cambered as shown. Top and bottom chord-area each chord = 0.44 sq. in. web area to average ½" per lin. ft. of truss

SECTION A-A

Continuous flat steel supports at all stringers.

CROSS SECTION OF ROADWAY - SPAN 1

(Except as noted)

CROSS SECTION OF ROADWAY - SPANS 4 & 7 AS SHOWN - SPANS 1,2,3,5 & 6 AS NOTED

DETAIL OF PULL BOX

Furnish & install 36 Pull Boxes as directed by Engineer.

DETAIL OF WALKWAY

(included for payment with structural steel)

FENCE DETAILS

SCALE 0 1 FT

DETAIL AT INTERMEDIATE FENCE POST

ELEVATION INTERMEDIATE FENCE POST

TYPICAL DETAIL AT HANGER

SPACING SCHEDULE FENCE POSTS

Span	No. of Spaces per Panel	Distance between Posts c. to c.
7	4	7'-6"
5	5	6'-9"
3	6	7'-4"
1	6	7'-4"
2	6	7'-4"
4	4	7'-6"
6	4	6'-6"

DETAIL OF TRAFFIC MARKER

SCALE 1 0 1 2 FT

SECTION SPANS 2 & 3

SECTION SPAN 6

SECTION B-B

SECTION C-C

SECTION E-E

DETAIL OF CHANNEL CONNECTION TO FLOOR BEAM

Legend:
Concrete in Section shown thus:
Reinforcing steel in section shown thus:
Reinforcing Truss web shown thus:

Notes:
For Spans 1, 2 and 3 see Sheets No. 6-11 inclusive.
For Spans 4, 5, 6 and 7 see Sheets No. 12-15 inclusive.
For details of expansion joints see Sheet No. 5
Bottom of concrete slab to be flush with bottom of top flange of stringers.
All steel to be Carbon unless otherwise noted.
For detail of scuppers see Sheet No. 5
For detail of Lamp post see Sheet No. 10
Rivets to be ⅞" ϕ - Open holes to be 15/16" ϕ (Holes 1⅛" in ℓ. Brs.)
For Section D-D see Sheet No. 5
End Conn. ∠s
All fence posts to be vertical.

NOTE:
ONLY SPANS 1, 2, AND 3 ARE APPLICABLE TO SAGAMORE BRIDGE. PLAN REVISED TO SHOW CONDITION AT TIME OF INSPECTION. AUG., 1969

FAY, SPOFFORD & THORNDIKE, ENGINEERS
BY Edward M. Spofford

CRAM & FERGUSON, CONSULTING ARCHITECTS
BY

WAR DEPARTMENT
CORPS OF ENGINEERS U.S. ARMY
OFFICE OF DISTRICT ENGINEER, BOSTON, MASS.

HIGHWAY BRIDGES

OVER CAPE COD CANAL
AT BOURNE, MASSACHUSETTS

SAGAMORE AND BOURNE BRIDGES
DEPUTY SECTIONS

SCALE EXCEPT AS SHOWN
2 1 0 2 4 6 8 FT.

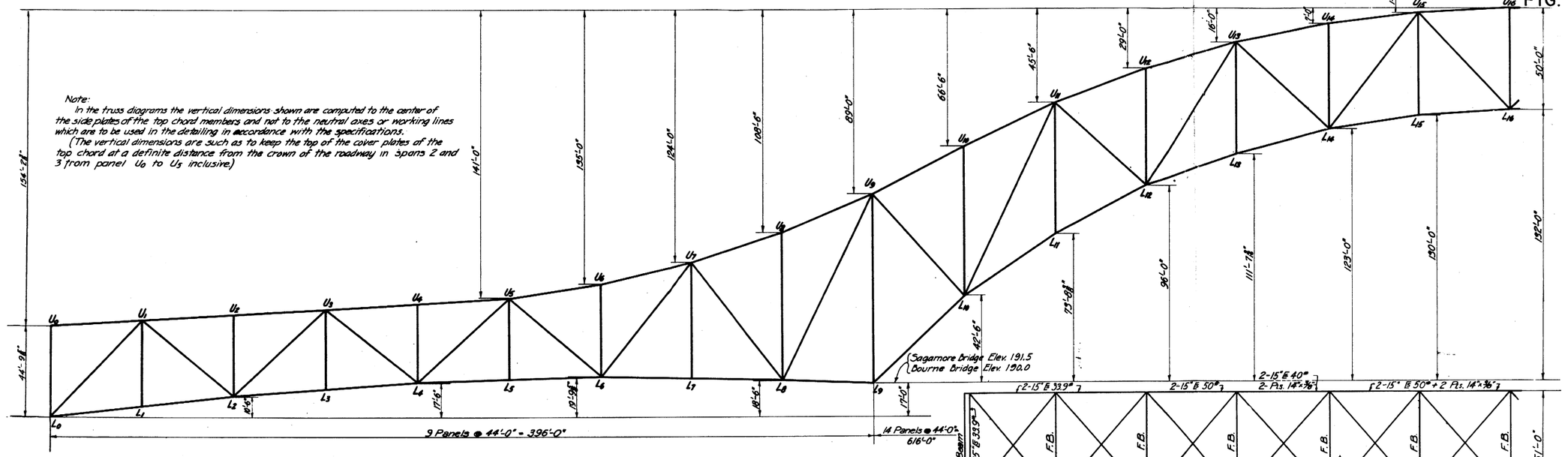
APPROVED
LT. COL. CORPS OF ENGINEERS
DECEMBER 1933

SUPERSTRUCTURE CONTRACT PLANS SHEET No. 4 OF (17)

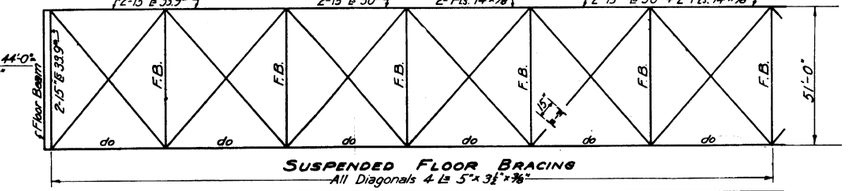
FAY, SPOFFORD & THORNDIKE
BOSTON, MASSACHUSETTS
DESIGNED BY M.B.S.
DRAWN BY M.B.S.
TRACED BY J.T.
CHECKED BY W.L.C.
SCALE 1"=5' EXCEPT AS SHOWN

FIG. 7

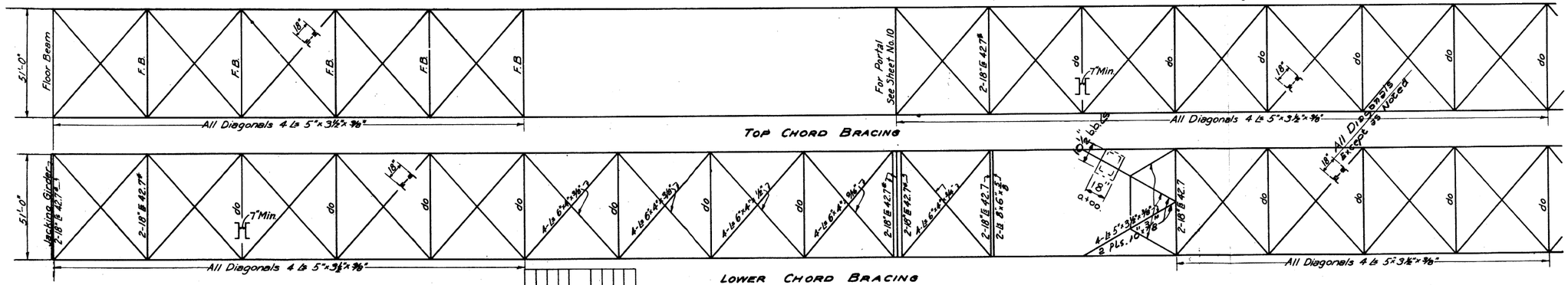
Note:
In the truss diagrams the vertical dimensions shown are computed to the center of the side plates of the top chord members and not to the neutral axes or working lines which are to be used in the detailing in accordance with the specifications.
(The vertical dimensions are such as to keep the top of the cover plates of the top chord at a definite distance from the crown of the roadway in spans 2 and 3 from panel U_0 to U_5 inclusive)



HALF ELEVATION SPANS 1, 2 & 3.

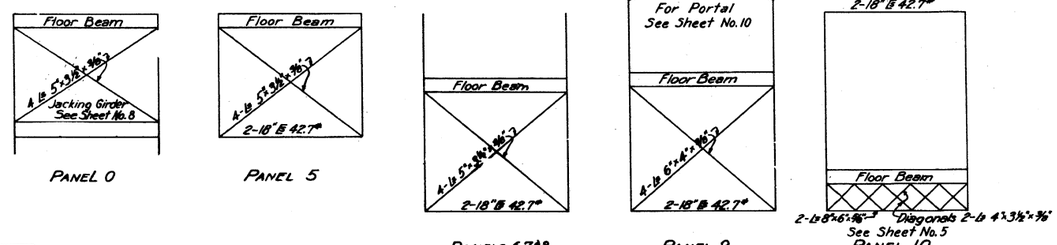


SUSPENDED FLOOR BRACING
All Diagonals 4 L's 5"×3½"×⅜"



TOP CHORD BRACING

LOWER CHORD BRACING



PANEL 0 — PANEL 5 — PANELS 6,7&8. — PANEL 9 — PANEL 10

SWAY BRACING

Notes:
For General Elevations - see Sheets No. 2 and 3
For Deck Sections and Details see Sheets No. 4 and 5
For Stress Sheet see Sheet No. 7
For Truss Details (Spans 1, 2 and 3) see Sheets No. 8 to 11 inclusive.
For Truss Bearings (Spans 1, 2 and 3) see Sheet No. 16
For Detail of Jacking Girder - see Sheet No. 8
All elevation are referred to a datum 100 feet below Mean Sea Level

FAY, SPOFFORD & THORNDIKE, ENGINEERS
BOSTON, MASSACHUSETTS
DESIGNED BY R.E.C. W.L.C.
DRAWN BY W.L.C.
TRACED BY E.T.M.
CHECKED BY J.B.W.
SCALE - 1" = 50'

FAY, SPOFFORD & THORNDIKE, ENGINEERS
BY [signature]

WAR DEPARTMENT
CORPS OF ENGINEERS U. S. ARMY
OFFICE OF DISTRICT ENGINEER, BOSTON, MASS.

HIGHWAY BRIDGES
OVER CAPE COD CANAL
AT BOURNE, MASSACHUSETTS

SAGAMORE AND BOURNE BRIDGES
TRUSSES AND BRACING - SPANS 1, 2 AND 3

20 10 0 20 40 60 80 FT.
SCALE

APPROVED [signature]
LT. COL. CORPS OF ENGINEERS
DECEMBER 1933

SUPERSTRUCTURE CONTRACT PLANS SHEET No. 6 OF (17)

FIG. 8

MEMBERS IN SPANS 2 AND 3

BAR	DEAD STRESS	LIVE STRESS UNIF.	LIVE STRESS CONC.	LIVE STRESS TOTAL	%I	IMP.	LIVE & IMP.	ERECTION DEAD + TRAV. A	ERECTION DEAD + TRAV. B	WIND COMP. STRUCT.	WIND ERECTION A	WIND ERECTION B	D+L+I.	D+2[(L+I)+W	TOTAL ERECT. A	TOTAL ERECT. B	DESIGN STRESS BASIS OF 32,400	LENGTH	MAKE-UP OF SECTIONS	ASSEMBLY	RADIUS OF GYRATION	AREA
L_0L_1	+411	+193 -69	+30 -5	+223 -74	6 7	+19 -5	+236 -79	+1	+688	+80 -152	+156 -232	+120 -216	+647	+963	+157 -231	+808	+963 -210	44.31	4 Ls 6"×4"×⅜" 2 Webs 30"×½"	Si		G. 444 N. 361
L_1L_2	+411	+193 -69	+30 -5	+223 -74	6 7	+13 -5	+236 -79	+1	+688	+139 -217	+233 -301	+216 -301	+647	+1022	+234 -300	+904	+1022 -273	44.31	Same as L_0L_1	Si	do	G. 444 N. 361
L_2L_3	+646	+442 -226	+64 -17	+505 -242	6 7	+28 -16	+534 -258	-312	+1512	+375 -451	+631 -699	+551 -626	+1180	+2120 -547	+319 -1011	+2069	+2120 -920	44.14	4 Ls 6"×4"×⅝" 4 Webs 30"×½"	Si		G. 812 N. 66.
L_3L_4	+646	+442 -226	+64 -17	+505 -242	6 7	+28 -16	+534 -258	-312	+1512	+430 -500	+691 -750	+625 -688	+1180	+2175 -596	+379 -1062	+2137	+2175 -967	44.14	Same as L_2L_3	Si	do	G. 812 N. 66.
L_4L_5	-129	+417 -369	+56 -27	+473 -396	6 7	+26 -26	+499 -422	-1074	+1240	+620 -670	+1028 -1077	+892 -942	+614 -756	+1982 -2104	-2151	+2132	+1982 -2104	44.02	4 Ls 6"×4"×½" 4 Webs 30"×⅝	Si	r_x= 9.7 r_y=11.3	G. 94. N. 76.6
L_5L_6	-129	+417 -369	+56 -27	+473 -396	6 7	+26 -26	+499 -422	-1074	+1240	+624 -676	+974 -1077	+873 -942	+614 -756	+1986 -2104	-2151	+2113	+1986 -2104	44.02	Same as L_4L_5	Si	do	G. 94 N. 76.6
L_6L_7	-1340	+132 -387	+22 -27	+154 -414	7 5	+11 -22	+165 -436	-1660	-37	+405 -493	+531 -660	+506 -615	-1776	-2705	-2320	+469 -652	+427 -2705	44.00	4 Ls 6"×4"×⅝" 4 Webs 30"×¾"	Si	r_x= 9.6 r_y= 11.1	G. 111.2 N. 90.6
L_7L_8	-1340	+132 -387	+22 -27	+154 -414	7 5	+11 -22	+165 -436	-1660	-37	+327 -423	+374 -538	+352 -512	-1776	-2635	-2198	+315 -549	+286 -2635	44.00	4 Ls 6"×4"×⅝" 4 Webs 30" 11/16 3/4"	Si	r_x= 9.6 r_y= 11.1	G. 1038 N. 84.5
L_8L_9	-2070	+51 -481	+6 -22	+56 -503	10 4	+5 -22	+62 -525	-1781	-1033	+305 -355	+55 -127	+28 -144	-2595	-3475	-1908	-1177	-3475	44.03	4 Ls 8"×6"×⅜" 4 Webs 30"×¾	Si	r_x=10.2 r_y=10.8	G. 1328 N.
U_9U_{10}	0	0 0	0 0	0 0	0 0	0 0	0 0	0		-45	-69	-49	0 0	-45	-69	-49	-63	44.08	1-C.P. 24# 9/16" 23" 4-Ls 6"×4"×⅝" 2-Webs 30"×⅜"		r_x=11.4 r_y=10.7	G. 459
$U_{10}U_{11}$	-651	+147 -349	+11 -53	+158 -401	7 6	+10 -23	+168 -424	+96	-1225	+111 -115	+335 -426	+210 -272	-1075	-1614	+431 -930	-1497	+992 -1614	44.08	1-C.P. 24# 9/16" 23" 4-Ls 6"×4"×⅝" 2-Webs 30"×¾	Si	r_x=10.8 r_y=11.	G. 714 N. 385
$U_{11}U_{12}$	-651	+147 -349	+11 -53	+158 -401	7 6	+10 -23	+168 -424	+96	-1225	+110 -94	+404 -475	+245 -281	-1075	-1593	+500 -979	-1506	+455 -1593	44.08	Same as $U_{10}U_{11}$	Si	do	G. 714 N. 385
$U_{12}U_{13}$	-391	+308 -474	+23 -66	+331 -540	7 6	+22 -30	+352 -570	+654	-1550	+286 -284	+893 -898	+557 -591	+117 -1000	+933 -2031	+1487 -244	-2141	+1352 -2031	44.08	1-C.P. 24# 9/16" 23" 4-Ls 6"×4"×½" 2-Webs 30"×⅜"	Si	r_x=10.9 r_y=10.9	G. 716 N. 629
$U_{13}U_{14}$	-391	+308 -474	+23 -66	+331 -540	7 6	+22 -30	+352 -570	+654	-1550	+309 -325	+942 -1007	+640 -674	+117 -1000	+956 -2072	+1596 -353	-2224	+1452 -2072	44.08	Same as $U_{12}U_{13}$	Si	do	G. 716 N. 629
$U_{14}U_{15}$	+794	+398 -284	+29 -40	+427 -324	7 6	+28 -18	+455 -342	+1479	-655	+359 -936	+1009 -1000	+655 -653	+1249	+2127 -528	+2488	-1308	+2265 -1190	44.41	1-C.P. 24# 9/16" 22" 4-Ls 6"×4"×⅝" 4 Webs 30"×⅝	Si	r_x=10.6 r_y=11.1	G. 985 N. 814
$U_{15}U_{16}$	+811	+407 -290	+30 -41	+437 -331	7 6	+28 -19	+464 -349	+1511	-668	+366 -340	+1026 -1017	+666 -664	+1275	+2171 -534	+2537	-1332	+2300 -1210	45.35	Same as $U_{14}U_{15}$	Si	do	G. 985 N. 814
$U_{16}U_{17}$	+1842	+456 -75	+25 -9	+481 -84	5 9	+22 -7	+503 -91	+1856	+639	+179 -170	+663 -651	+375 21" -368	+2345	+3028	+2519	+1014	+3130	46.65	1-C.P. 24# 9/16" 4-Ls 6"×4"×9/16" 4 Webs 30"×⅝"	Si		G. 1232 N. 101.6
$U_{17}U_{18}$	+1901	+471 -78	+26 -9	+497 -86	5 9	+23 -8	+520 -94	+1915	+659	+184 -175	+683 -670	+387 -377	+2421	+3125	+2598	+1046	+3240	48.13	Same as $U_{17}U_{18}$	Si	do	G. 1232 N. 101.6
L_0U_1	-601	+101 -280	+11 -64	+112 -344	7 6	+7 -19	+119 -363	-2	-1003	+119 -117	+225 -226	+173 -174	-964	-1443	+223 -228	-1177	+203 -1443	64.70	4-Ls 6"×4"×⅜" 2-Webs 30"×½" 2-Webs 30"×⅜"	Si	r_x= 9.9 r_y=11.6	G. 666.9 N. 54.5
U_1L_2	+314	+212 -110	+53 -11	+264 -121	6 6	+16 -7	+280 -128	-127	+704	+117 -121	+226 -222	+174 -166	+594	+1009 -175	+99 -349	+878	+1009 -317	57.45	4-Ls 6"×4"×⅜" 2-Webs 30"×½"	Si		G. 44.4 N. 36.1
L_2U_3	+8	+144 -164	+22 -44	+166 -208	6 6	+10 -13	+176 -221	+298	-381	+119 -113	+231 -223	+167 -164	+276 -307	+658 -730	+529	-545	+658 -730	60.98	4-Ls 6"×4"×⅜" 2-Webs 24"×½"	Si	r_x= 8.5 r_y=11.5	G. 384 N. 30.1
U_3L_4	-326	+111 -174	+32 -31	+143 -204	7 6	+10 -11	+153 -215	-438	+53	+108 -115	+221 -219	+162 -161	-541	+225 -911	-657	+215 -108	+225 -911	56.36	4-Ls 6"×4"×½" 2-Webs 24"×½"	Si	r_x= 8.5 r_y=11.4	G. 43. N. 33.6
L_4U_5	+705	+223 -61	+49 -19	+272 -79	5 7	+14 -6	+286 -85	+572	+418	+69 -79	+159 -150	+104 -102	+991	+1346	+731	+522	+1346	59.80	4-Ls 6"×4"×½" 2-Webs 27"×⅜	Si		G. 328 N. 42.1
U_5L_6	-872	+16 -228	+5 -58	+21 -286	8 5	+2 -14	+22 -300	-519	-785	+66 -79	+170 -171	+134 -137	-1172	-1551	-690	-922	-1562	58.27	4-Ls 6"×4"×⅜" 4 Webs 30"×⅜"	Si	r_x= 9.7 r_y= 11.5	G. 669
L_6U_7	+887	+276 -69	+70 -5	+346 -54	6 7	+19 -4	+365 -57	+312	+1138	+154 -164	+313 -313	+226 -241	+1252	+1771	+625 -1	+1364	+1771 -1	70.59	4 Ls 6"×4"×⅜" 4 Webs 30"×½"	Si		G. 744 N. 60.7
U_7L_8	-648	+67 -298	+7 -55	+74 -293	7 6	+5 -16	+79 -310	-147	-919	+163 -156	+289 -289	+224 -224	-958	-1423	+142 -436	-1143	+129 -1423	71.61	4 Ls 6"×4"×½" 4 Webs 30"×½"	Si	r_x= 9.9 r_y= 11.4	G. 79. N. 64.2
L_8U_9	+619	+258 -96	+58 -10	+315 -106	6 7	+18 -7	+333 -113	+69	+991	+186 -194	+398 -399	+260 -257	+952	+1470	+407 -270	+1251	+1470 -245	101.53	4 Ls 6"×4"×⅜" 2 Webs 30"×¾"	Si		G. 594 N. 48.4
L_0U_0	-85	0 -55	0 -50	10 -104	0 30	0 -32	0 -136	-190	-90	-56	-70	-61	-221	-412	-200	-151	-412	44.80	2-15" @ 40#	Si	r_x= 5.4 r_y=11.5	G. 234 N.
L_1U_1	+16	0 0	0 0	0 0	0 0	0 0	0 0	+16	+17	+2	-1	-1	+16	+18	+16	+17	+21	42.19	2-15" @ 33.9#			G. 198 N. 155
L_2U_2	-171	0 -55	0 -50	0 -104	0 24	0 -25	0 -129	-160	-176	0	-1	-1	-300	-428	-161	-177	-428	39.58	2-15" @ 40#	Si	r_x= 5.4 r_y=11.5	G. 234 N. 185
L_3U_3	+30	0 0	0 0	0 0	0 0	0 0	0 0	+30	+32	-2	-5	-3	+30	+30	+30	+32	+40	38.72	2-15" @ 33.9#			G. 198 N. 155
L_4U_4	-175	0 -55	0 -50	0 -104	0 24	0 -25	0 -129	-164	-181	+2	-1	-1	-304	-432	-165	-182	-432	37.86	2-15" @ 40#	Si	r_x= 5.4 r_y=11.5	G. 234 N.
L_5U_5	+32	0 0	0 0	0 0	0 0	0 0	0 0	+32	+32	-61	-113	-60	+32	+32 -29	+32 -81	+32 -28	+43 -74	39.35	2-15" @ 40#		r_x= 5.4 r_y=11.5	G. 234 N. 185
L_6U_6	-63 -83	+45 -87	+5 -56	+50 -142	7 6	+9 -8	+53 -150	+138 -161	-248	+41 -49	+85 -97	+58 -72	+169 -233	+295 -457	+223 -258	-320		44.20	2 Webs 24"×½" 4 Ls 6"×4"×½"	Si	r_x= 8.6 r_y=11.5	G. 43. N. 34.2
L_7U_7	+180 +34	+55 0	+50 0	+104 0	24 0	+25 0	+129 0	+66	+184	-35	+2 -21	+2 -25	+309	+437	+68	+186		55.85	4 Webs 24"×½" 4 Ls 6"×4"×½"	Si	r_x= 8.0 r_y=11.3	G. 67. N. 53.8
L_8U_8	+124 -22	+39 -61	+3 -51	+42 -112	5 9	+2 -10	+44 -121	+122 -169	+22 -128	+16 -45	+58 -82	+29 -62	+185 -158	+312 -430	+180 -251	+51 -190		72.00	4 Ls 6"×4"×⅜" 2 Webs 24"×½"	Si	r_x= 8.4 r_y=11.4	G. 384 N. 30.1
L_9U_9	+1305 -1451	+1 -301	+1 -49	+2 -350	18 4	0 -12	+2 -363	-288	-1180	+374 -366	+286 -420	+219 -285	-1814	-2542	-708	-1465	-2542	93.00	4 Ls 6"×6"×⅝" Webs 36" 3/4"	Si	r_x= 11.4 r_y= 10.7	G. 195.8

MEMBERS IN SPAN 1

BAR	DEAD STRESS	LIVE STRESS UNIF.	LIVE STRESS CONC.	LIVE STRESS TOTAL	%I.	IMP.	LIVE & IMP.	ERECTION DEAD + TRAV. A	ERECTION DEAD + TRAV. B	WIND COMP. STRUCT.	WIND ERECTION A	WIND ERECTION B	D+L+I	D+2[(L+I)+W	TOTAL ERECT. A	TOTAL ERECT. B	DESIGN STRESS BASIS OF 32,400	LENGTH	MAKE-UP OF SECTIONS	ASSEMBLY	RADIUS OF GYRATION	AREA
L_0L_{10}	-2800	+71 -670	+8 -33	+78 -702	10 4	+8 -31	+86 -734	-2475		+180 -487	+19 -177		-3534	-4755	-2652		-4755	61.17	4 Pls. @ 8"×6"×⅜" 4 @ 8"×6"×⅝" 6 Webs 36"×⅝" 1 Diamagram 18"×⅜"	Si		G. 261.8
$L_{10}L_{11}$	-814	+124 -341	+25 -33	+149 -374	7 5	+10 -20	+159 -394	-1652		+103 -119	+123 -136		-1208	-1721	-1788		-1721	53.94	4 Ls 6"×6"×⅝" 4 Webs 36"×⅝"	Si	r_x=12.0 r_y=11.0	G. 118.4
$L_{11}L_{12}$	-744	+114 -312	+23 -31	+137 -343	7 5	+10 -19	+146 -362	-1512		+152 -160	+35 -47		-1106	-1628	-1559		-1628	49.33	4 Ls 6"×6"×½" 4 Webs 36"×½"	Si	r_x=12.2 r_y=11.2	G. 95.0
$L_{12}L_{13}$	+1002	+428 -270	+52 -26	+480 -296	7 5	+35 -16	+514 -311	-646		+367 -410	+30 -45		+1516	+2397	-691		+2397 -628	46.68	4 Ls 6"×4"×⅜" 4 Webs 36"×½"	Si	r_x=12.1 r_y=11.6	G. 95.4 N. 77.4
$L_{13}L_{14}$	+976	+417 -263	+50 -25	+467 -288	7 5	+34 -15	+501 -303	-630		+388 -424	+4 -43		+1477	+2366	-673		+2366 -612	45.45	Same as $L_{12}L_{13}$	Si	do	do	G. 95.4 N. 77.4
$L_{14}L_{15}$	+1970	+632 -277	+70 -19	+702 -296	7 5	+51 -16	+752 -312	-54		+544 -573	+0 -32		+2722	+4018	-86		+4018 -78	44.55	4 Ls 8"×6"×⅝" 4 Webs 36"×½" 2 Webs 36"×⅝"	Si		G. 154.9 N. 127.9
$L_{15}L_{16}$	+1946	+625 -274	+69 -19	+694 -293	7 5	+50 -16	+744 -309	-53		+549 -572	-2		+2690	+3983	-55		+3983 -50	44.05	Same as $L_{14}L_{15}$ 22"	Si	do		G. 154.9 N. 127.9
U_9U_{10}	+1646	+437 -63	+29 -10	+466 -73	5 9	+21 -7	+487 -80	+1851		+63 -127	+401 -482		+2133	+2683	+2252		+2844	49.42	1 C.P. 24# 9/16" 3/4" 4 Ls 6"×4"×⅝" 2 Webs 30"×⅝" 2 Webs 30"×½"	Si		G. 107.4 N. 88.9
$U_{10}U_{11}$	+1627	+430 -62	+28 -10	+458 -72	5 9	+21 -7	+479 -79	+1826		+132 -187	+315 -381		+2100	+2711	+2141		+2800 -	48.75	Same as U_9U_{10} 9/16"	Si	do		G. 107.4 N. 88.9
$U_{11}U_{12}$	-199	+260 -255	+28 -39	+288 -294	5 8	+14 -24	+302 -318	+1054		+53 -44	+166 -218		+245 -399	+751 -1112	+1220		+1110 -1112	46.99	1 C.P. 24# ½" 23" 4 Ls 6"×4"×⅜" 2 Webs 30"×⅜"	Si	r_x=10.8 r_y=11.0	G. 714 N. 59.4
$U_{12}U_{13}$	-194	+254 -249	+27 -37	+281 -286	5 8	+14 -24	+295 -310	+1030		+52 -60	+108 -148		+239 -384	+733 -1101	+1138		+1032 -1101	45.88	Same as $U_{11}U_{12}$	Si	do	do	G. 714 N. 59.4
$U_{13}U_{14}$	-1577	+271 -549	+22 -62	+293 -611	5 7	+15 -44	+308 -655	+304		+142 -151	+54 -82		-2232	-3039	+358		+326 -3039	44.91	1 C.P. 24# ½" 22" 4 Ls 8"×6"×½" 6 Webs 30"×⅜"	Si	r_x=10.7 r_y=10.7	G. 117.6 N. 98.7
$U_{14}U_{15}$	-1556	+268 -543	+22 -63	+290 -606	5 7	+15 -44	+305 -650	+300		+123 -127	+21 -40		-2206	-2983	+321		+291 -2983	44.34	Same as $U_{13}U_{14}$	Si	do	do	G. 117.6 N. 98.7
$U_{15}U_{16}$	-2081	+277 -656	+16 -72	+293 -728	5 7	+15 -53	+308 -781	0		+194 -182	+0 -8		-2862	-3825	-8		-3825	44.03	1 C.P. 24# ½" 21" 4 Ls 8"×6"×½" 8 Webs 30"×⅜"	Si	r_y=10.8	G. 144.
U_9L_{10}	+826	+209 -62	+38 -8	+247 -70	7 5	+18 -4	+265 -74	+201		+133 -129	+66 -71		+1091	+1489	+267		+1489	66.98	4 Ls 6"×4"×⅞" 2 Webs 30"×11/16"	Si		G. 71.4 N. 47.1
$L_{10}U_{11}$	-1890	+72 -441	+7 -73	+80 -514	5 7	+4 -37	+84 -551	-708		+238 -235	+104 -103		-2441	-3227	-811		-3256	103.79	4 Ls 8"×6"×1" 8 Webs 36"×⅝"	Si	r_x=1.5 r_y=10.5	C. 232.
$U_{11}L_{12}$	+1154	+271 -38	+46 -6	+317 -44	5 8	+16 -3	+333 -47	+491		+158 -160	+31 -35		+1487	+1978	+522		+1984	59.80	4 Ls 6"×4"×⅝" 2 Webs 30"×⅜" 2 Webs 30"×½"	Si		G. 82.8 N. 67.3
$L_{12}U_{13}$	-1426	+74 -364	+9 -61	+83 -425	7 5	+6 -22	+89 -447	-708		+185 -182	+19 -18		-1873	-2502	-726		-2502	82.68	4 Ls 8"×6"×⅝" 4 Webs 30"×⅝" 2 Webs 30"×9/16"	Si	r_x= 9.9 r_y=10.8	G. 142.2
$U_{13}L_{14}$	+839	+242 -71	+43 -10	+285 -81	5 7	+15 -6	+301 -87	+435		+120 -121	+0 -2		+1140	+1561	+435		+1561	61.52	4 Ls 6"×4"×½" 2 Webs 30"×¾"	Si		G. 64. N. 51.9
$L_{14}U_{15}$	-658	+115 -244	+19 -46	+132 -290	7 6	+9 -16	+141 -306	-403		+94 -87	+6 -4		-964	-1357	-407		-1357	72.40	4 Ls 6"×4"×⅝" 2 Webs 30"×¾"	Si	r_x=10.5 r_y= 11.4	G. 68.4
$U_{15}L_{16}$	+202	+178 -138	+34 -25	+212 -163	6 6	+12 -10	+224 -173	+79		+29 -27	+0 -0		+442 -98	+782 -335	+79		+782 -335	65.48	4 Ls 6"×4"×⅜" 2 Webs 21"×½" 6"	Si	r_x= 7.8 r_y= 7.7	G. 35.4 N. 27.
$U_{16}L_{17}$	-85 -231	+2 -67	+04 -49	+2 -117	10 4	+08 -5	+3 -122	-160		+6 -40	+21 -17		-353	-515	-177		-515	73.00	4 Ls 5" 7/16" 4" 2 Webs 21"×½"	Si	r_x= 7.7 r_y= 6.6	G. 37.7
$U_{17}L_{18}$	+54	+75 -56	+55 -8	+130 -64	7 6	+9 -4	+139 -68	-214		+17 -14	+18 -19		+209 -47	+398 -161	-233		+398 -212	62.80	2-18" @ 45.8#		r_x= 6.6	G. 26.8 N. 22.
$U_{18}L_{19}$	-14	+19 -19	+4 -3	+23 -22	8 5	+2 -1	+25 -23	-132		+3 -16	+13 -12		+24 -45	+63 -96	-144		+63 -130	57.00	2-18" @ 45.8#		r_x= 6.6	G. 26.8 N. 22.
$U_{19}L_{20}$	+281	+99 -24	+56 -3	+149 -27	7 5	+10 -1	+159 -28	-13		+33 -33	+0 -7		+440	+632	-20		+632 -18	54.40	2-18" @ 45.8#	Si		G. 26.8 N. 22.
$U_{20}L_{21}$	+78	+43 -21	+7 -3	+50 -24	7 5	+3 -1	+53 -25	-148		+10 -10	+3 -4		+131	+194	-152		+194 -138	52.00	2-15" @ 33.9#		r_x= 5.6	G. 19.8 N. 15.7
$U_{21}L_{22}$	+424	+126 -31	+61 -3	+186 -34	7 5	+13 -2	+199 -36	+51		+52 -64	0 0		+623	+874	+51		+874	50.50	2-15" @ 50.0# 2 Pls 12"×⅜"	Si		G. 30.3 N. 30.7
$U_{22}L_{23}$	+91	+45 -19	+7 -2	+52 -21	7 5	+4 -1	+56 -22	-27		+12 -13	0 0		+147	+215 -	-27		+215 -25	50.00	2-15" @ 33.9#			G. 19.8 N. 15.7
No Gusset		+503	+238	+50	+288	5	+16	+303	+57	+775	+133			+806	+1242							
No Gusset		+3572	+779	+50	+829	4	+36	+865	+2183	+2510	+714			+4437	+6016							

BAR	MOM. IN FT. KIPS DUE TO WIND COMP. STRUCT.	WIND ERECTION	RESISTANCE TO BUCKLING
U_6L_6	19	19	325
U_7L_7	121	121	472
U_8L_8	146	146	
U_9L_9	578	632	
L_9L_{10}	862	960	
$L_{10}L_{11}$	815	895	
$L_{11}L_{12}$	705	775	

Does not control design of these members

Erection 'B' does not control design of these members

Erection 'B' does not control design of these members

NOTES:

The stress in the column marked 'Design Stress' equals for each member, the largest of the following three values: ⅓(D+L+I); D+2(L+I)+W; ⅔ (total erection stress). See specifications.

The stresses in the columns marked "Erection A" are based on the assumption that the trusses extend from panel points 0 to 16, inclusive; the floor steel (no concrete) is in place from panel points 0 to 11, inclusive; the traveler load is at U_{15}.

The stresses in the columns marked "Erection B" are based on the assumption that the trusses extend from panel points 0 to 14, inclusive; the floor steel is in place from panel points 0 to 11, inclusive; the traveler load is at U_{13}.

Material listed under make-up of sections and marked (Si) to be of silicon steel.

FAY, SPOFFORD & THORNDIKE, ENGINEERS
BY Charles W. Spofford

WAR DEPARTMENT
CORPS OF ENGINEERS U. S. ARMY
OFFICE OF DISTRICT ENGINEER, BOSTON, MASS.

HIGHWAY BRIDGES

OVER CAPE COD CANAL
AT BOURNE, MASSACHUSETTS

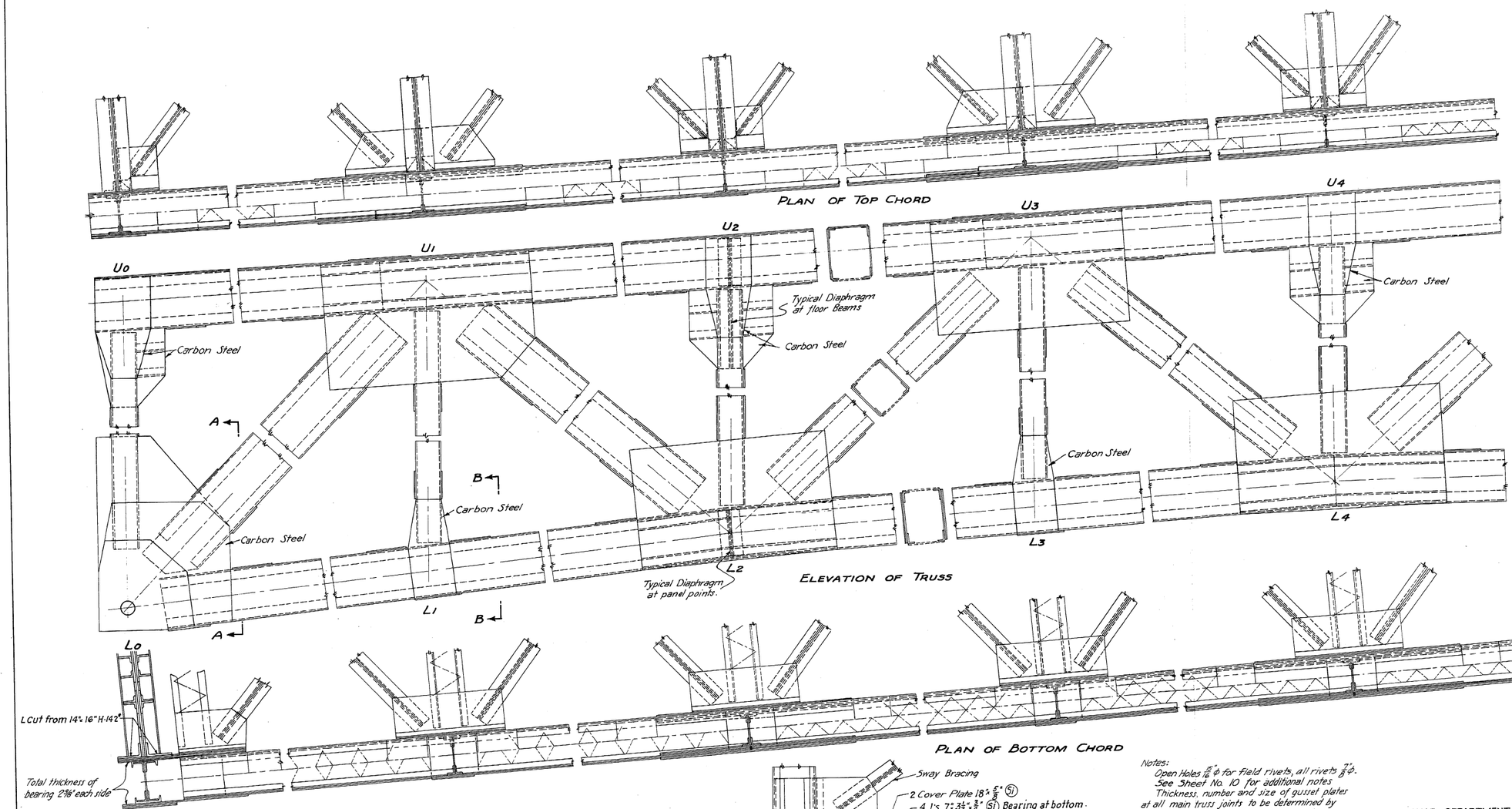
SAGAMORE AND BOURNE BRIDGES
STRESS SHEET - SPANS 1, 2 AND 3.

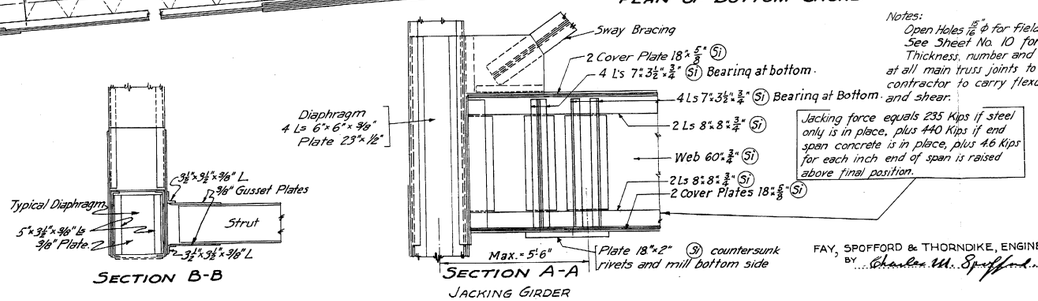
APPROVED R. Park
LT. COL. CORPS OF ENGINEERS
DECEMBER 1933

SUPERSTRUCTURE CONTRACT PLANS SHEET No. 7 OF (17)

FAY, SPOFFORD & THORNDIKE
BOSTON, MASSACHUSETTS
DESIGNED BY J. B. W.
DRAWN BY W. L. E.
TRACED BY B. T. M.
CHECKED BY I. K. B.

FIG. 9





Notes:
Open Holes 15/16" ϕ for Field rivets, all rivets 7/8" ϕ.
See Sheet No. 10 for additional notes
Thickness, number and size of gusset plates at all main truss joints to be determined by contractor to carry flexure, direct stress and shear.

Jacking force equals 235 Kips if steel only is in place, plus 440 Kips if end span concrete is in place, plus 46 Kips for each inch end of span is raised above final position.

FAY, SPOFFORD & THORNDIKE, ENGINEERS
BY Charles M. Spofford

FAY, SPOFFORD & THORNDIKE
BOSTON, MASSACHUSETTS
DESIGNED BY F.M.
DRAWN BY F.M.
TRACED BY H.L.K.
CHECKED BY REC - L.B.T.
SCALE: 1" = 2'

WAR DEPARTMENT
CORPS OF ENGINEERS U. S. ARMY
OFFICE OF DISTRICT ENGINEER, BOSTON, MASS.

HIGHWAY BRIDGES
OVER CAPE COD CANAL
AT BOURNE, MASSACHUSETTS

SAGAMORE AND BOURNE BRIDGES
TRUSS DETAILS - SPANS 2 AND 3

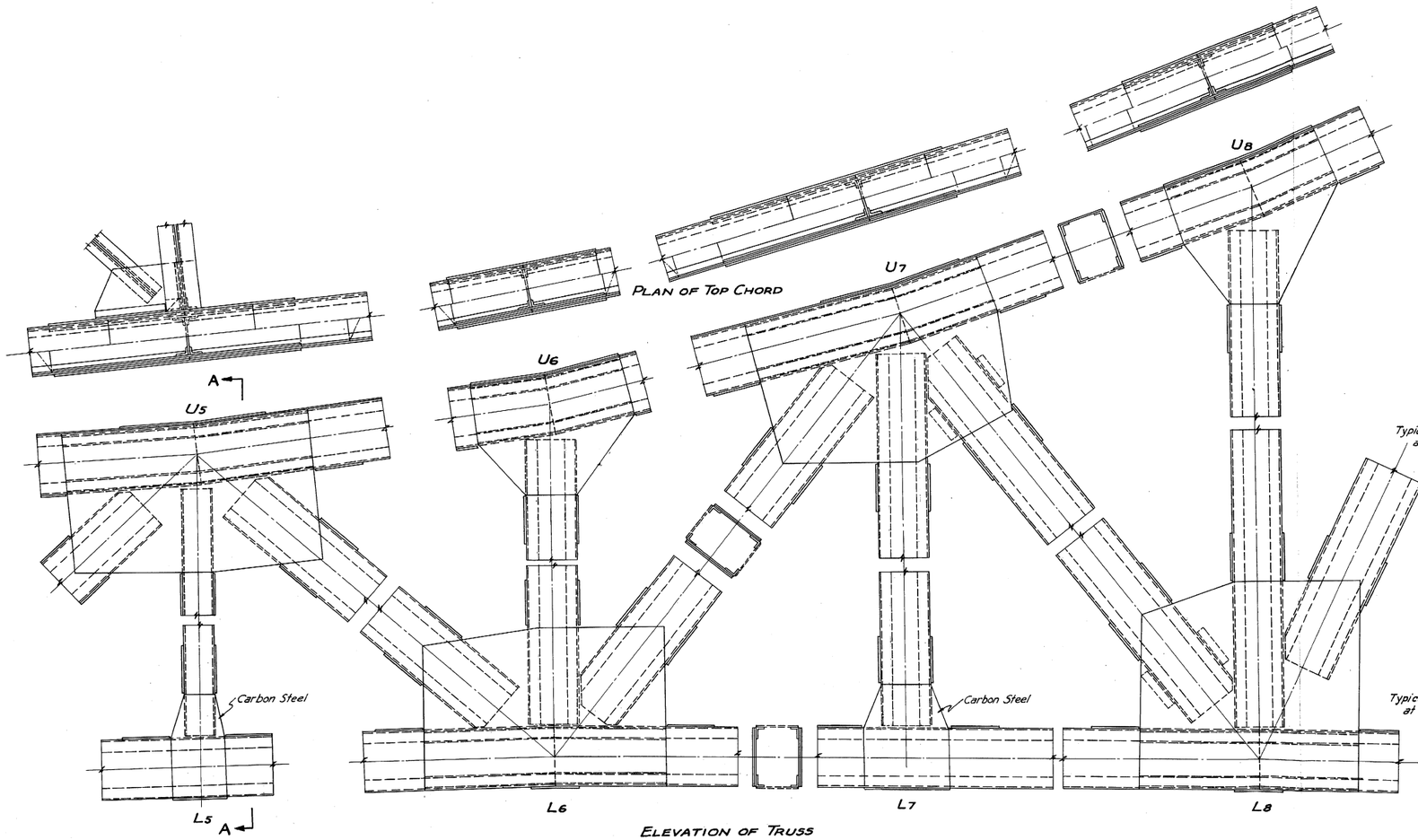
2 1 0 2 4 6 8 FT.
SCALE

APPROVED
LT. COL. CORPS OF ENGINEERS
DECEMBER 1933

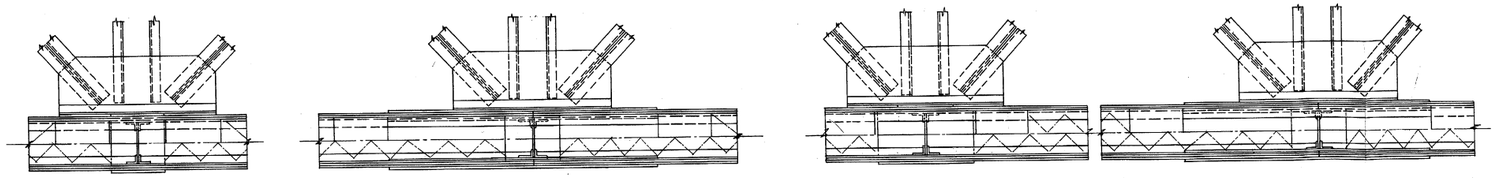
SUPERSTRUCTURE CONTRACT PLANS SHEET No. 8 OF (17) VT 15 78

DWG. NO. CCC-1 FILE 402 E-12-1 SB-201

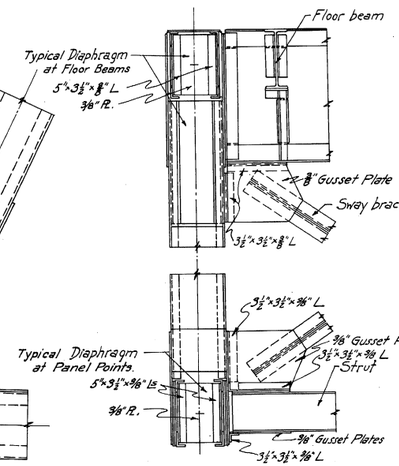
FIG. 10



ELEVATION OF TRUSS



PLAN OF BOTTOM CHORD



SECTION A-A

Notes:

All rivets to be ⅞" ϕ

See Sheet No. 10 for additional notes.

Rivets in top chord to be countersunk and chipped at Fence Posts in Panel U_5-U_6 and U_6-U_7.

Open Holes for field Rivets ⅞" ϕ

Thickness, number and size of gusset plates at all main truss joints to be determined by contractor to carry flexure, direct stress and shear.

FAY, SPOFFORD & THORNDIKE, ENGINEERS
BY Charles M. Spofford

FAY, SPOFFORD & THORNDIKE
BOSTON, MASSACHUSETTS
DESIGNED BY F.M.
DRAWN BY F.M.
TRACED BY W.H.F.
CHECKED BY R.E.F. L.B.T.
SCALE: 1", 2'

WAR DEPARTMENT
CORPS OF ENGINEERS U. S. ARMY
OFFICE OF DISTRICT ENGINEER, BOSTON, MASS.

HIGHWAY BRIDGES

OVER CAPE COD CANAL
AT BOURNE, MASSACHUSETTS

SAGAMORE AND BOURNE BRIDGES
TRUSS DETAILS SPANS 2 AND 3

2 1 0 2 4 6 8 FT.
SCALE

APPROVED R.P. Paul
LT. COL. CORPS OF ENGINEERS.

DECEMBER 1933

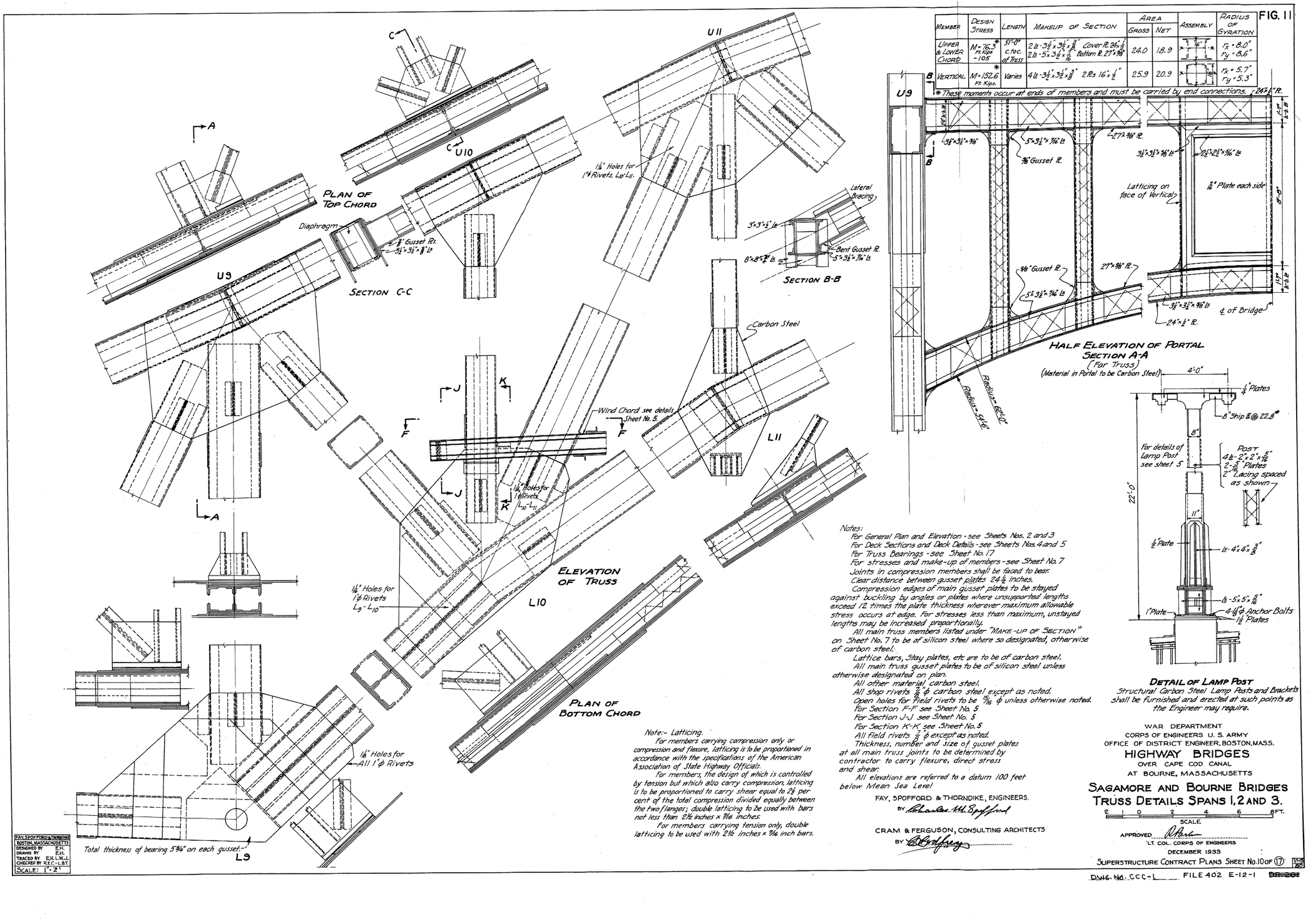
SUPERSTRUCTURE CONTRACT PLANS SHEET No. 9 OF (17)

DWG. NO. CCC-1 FILE 402 E-12-1

FIG. 11

Member	Design Stress	Length	Makeup of Section	Area Gross	Area Net	Assembly	Radius of Gyration
Upper & Lower Chord	M=76.3 Ft. Kips -105 *	31'-0" c.to.c. of Truss	2 Lls - 3½" x 3½" x ⅝" Cover Pl. 24" x ⅝" 2 Lls - 5" x 3½" x 7/16" Bottom Pl. 27" x ⅜"	24.0	18.9		r_x = 8.0" r_y = 8.6"
Vertical	M=152.6 Ft. Kips. *	Varies	4 Lls - 3½" x 3½" x ⅝" 2 Pls 16" x ½"	25.9	20.9		r_x = 5.7" r_y = 5.3"

* These moments occur at ends of members and must be carried by end connections.



Half Elevation of Portal
Section A-A
(Far Truss)

(Material in Portal to be Carbon Steel)

Detail of Lamp Post

Structural Carbon Steel Lamp Posts and Brackets shall be furnished and erected at such points as the Engineer may require.

Notes:

For General Plan and Elevation - see Sheets Nos. 2 and 3
For Deck Sections and Deck Details - see Sheets Nos. 4 and 5
For Truss Bearings - see Sheet No. 17
For stresses and make-up of members - see Sheet No. 7
Joints in compression members shall be faced to bear.
Clear distance between gusset plates 24½ inches.
Compression edges of main gusset plates to be stayed against buckling by angles or plates where unsupported lengths exceed 12 times the plate thickness wherever maximum allowable stress occurs at edge. For stresses less than maximum, unstayed lengths may be increased proportionally.
All main truss members listed under "Make-up of Section" on Sheet No. 7 to be of silicon steel where so designated, otherwise of carbon steel.
Lattice bars, Stay plates, etc. are to be of carbon steel.
All main truss gusset plates to be of silicon steel unless otherwise designated on plan.
All other material carbon steel.
All shop rivets ⅞ ϕ carbon steel except as noted.
Open holes for field rivets to be 15/16 ϕ unless otherwise noted.
For Section F-F see Sheet No. 5
For Section J-J see Sheet No. 5
For Section K-K see Sheet No. 5
All field rivets ⅞ ϕ except as noted.
Thickness, number and size of gusset plates at all main truss joints to be determined by contractor to carry flexure, direct stress and shear.
All elevations are referred to a datum 100 feet below Mean Sea Level

FAY, SPOFFORD & THORNDIKE, ENGINEERS.
BY Edward M. Spofford

CRAM & FERGUSON, CONSULTING ARCHITECTS
BY O. H. Ferguson

Note:- Latticing.
For members carrying compression only or compression and flexure, latticing is to be proportioned in accordance with the specifications of the American Association of State Highway Officials.
For members, the design of which is controlled by tension but which also carry compression, latticing is to be proportioned to carry shear equal to 2½ per cent of the total compression divided equally between the two flanges; double latticing to be used with bars not less than 2½ inches x 5/16 inches.
For members carrying tension only, double latticing to be used with 2½ inches x 5/16 inch bars.

FAY, SPOFFORD & THORNDIKE
BOSTON, MASSACHUSETTS
DESIGNED BY E.H.
DRAWN BY E.H.
TRACED BY E.H. L.W.L.
CHECKED BY K.E.C. - L.B.T.
SCALE: 1" = 2'

WAR DEPARTMENT
CORPS OF ENGINEERS U. S. ARMY
OFFICE OF DISTRICT ENGINEER, BOSTON, MASS.

HIGHWAY BRIDGES
OVER CAPE COD CANAL
AT BOURNE, MASSACHUSETTS

SAGAMORE AND BOURNE BRIDGES
TRUSS DETAILS SPANS 1, 2 AND 3.

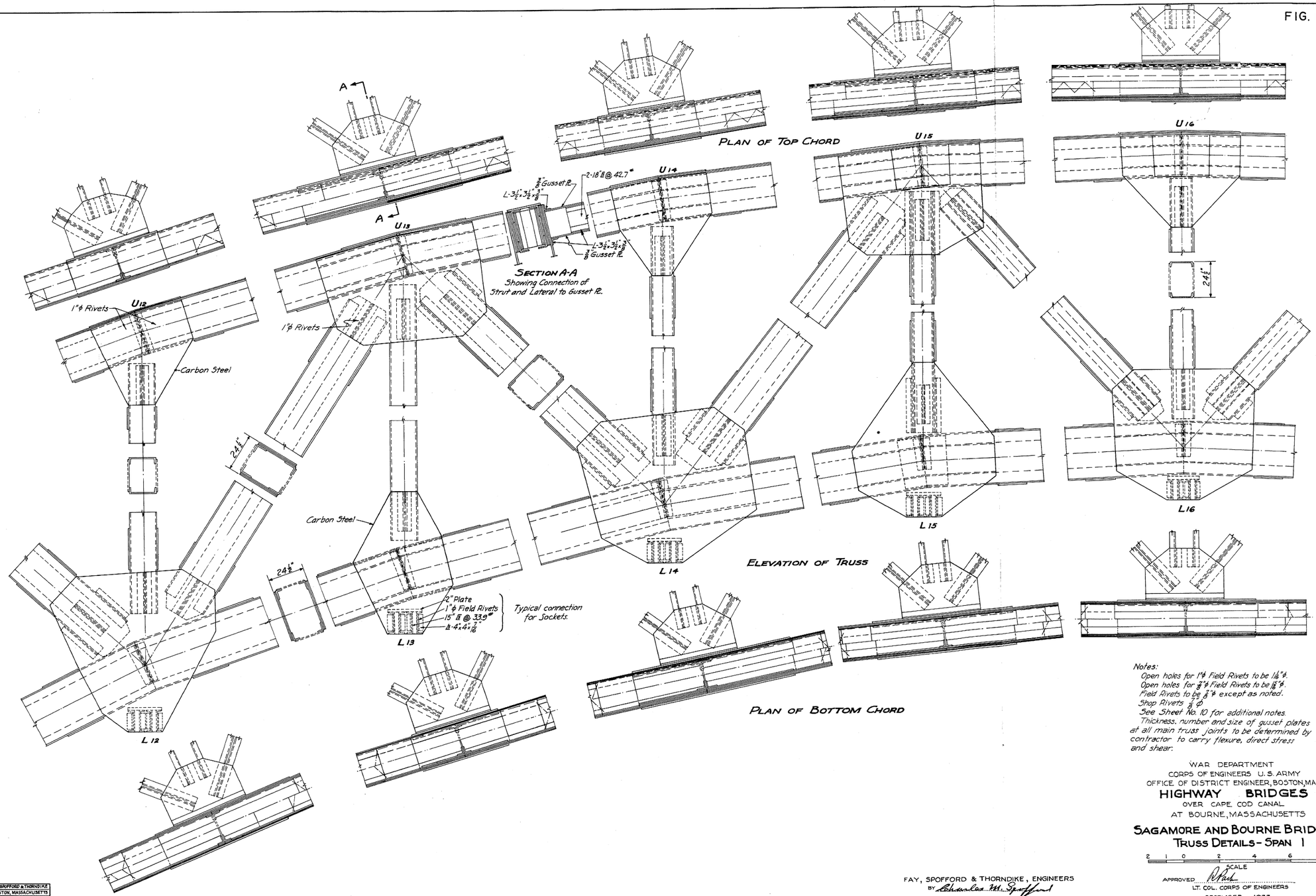
2 1 0 2 4 6 8 FT.
SCALE.

APPROVED
LT. COL. CORPS OF ENGINEERS
DECEMBER 1933

SUPERSTRUCTURE CONTRACT PLANS SHEET No. 10 OF 17

DWG. No. CCC-L FILE 402 E-12-1 ~~DR-201~~

FIG. 12



Notes:

Open holes for 1"ϕ Field Rivets to be 1⅛"ϕ.
Open holes for ⅞"ϕ Field Rivets to be 1/16"ϕ.
Field Rivets to be ⅞"ϕ except as noted.
Shop Rivets ⅞"ϕ
See Sheet No. 10 for additional notes.
Thickness, number and size of gusset plates at all main truss joints to be determined by contractor to carry flexure, direct stress and shear.

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CORPS OF ENGINEERS U.S. ARMY
OFFICE OF DISTRICT ENGINEER, BOSTON, MASS.

HIGHWAY BRIDGES

OVER CAPE COD CANAL
AT BOURNE, MASSACHUSETTS

SAGAMORE AND BOURNE BRIDGES
TRUSS DETAILS - SPAN 1

2 1 0 2 4 6 8
SCALE

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LT. COL. CORPS OF ENGINEERS
DECEMBER 1933

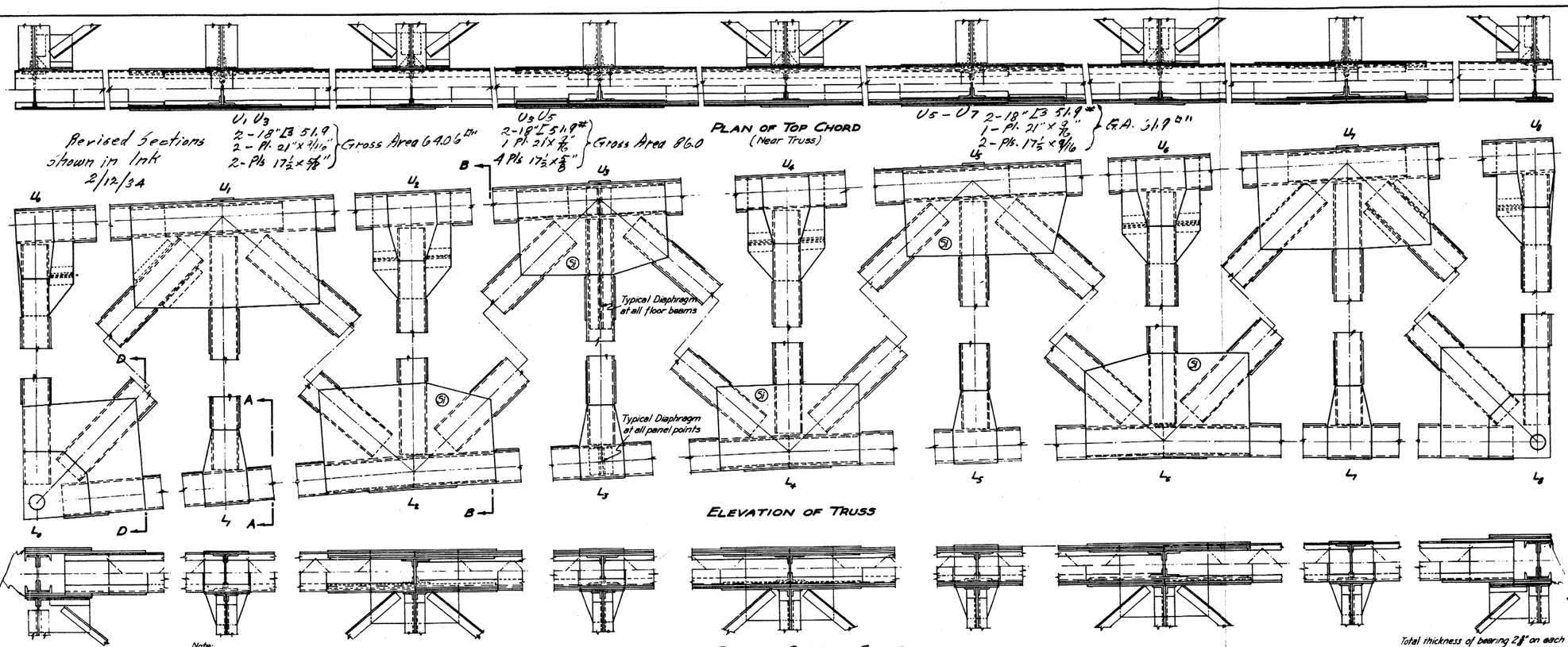
FAY, SPOFFORD & THORNDIKE, ENGINEERS
BY Charles M. Spofford

FAY, SPOFFORD & THORNDIKE
BOSTON, MASSACHUSETTS
DESIGNED BY S.J.G.
DRAWN BY S.J.G.
TRACED BY L.W.J.
CHECKED BY R.E.C.-L.B.T.
SCALE: 1" = 2'

SUPERSTRUCTURE CONTRACT PLANS SHEET No. 11 OF (17)

DWG. NO. C.C.C.-1 FILE 402 E-12-1

FIG. 13

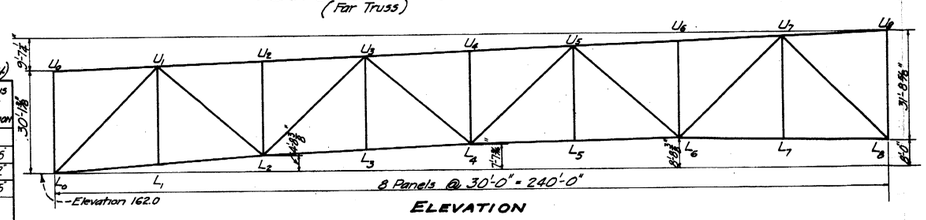


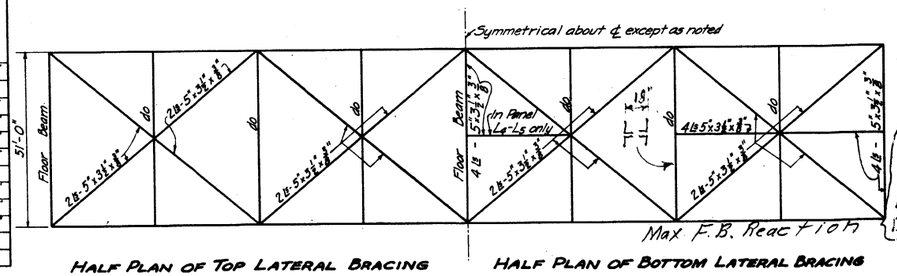
Note:
In the truss diagrams the vertical dimensions shown are computed to the center of the channels of the top chord members and not to the neutral axes or working lines which are to be used in the detailing in accordance with the specifications.
(The vertical dimensions are such as to keep the top of the cover plates of the top chord at a definite distance from the crown of the roadway)

Member	Stresses in Kips: Dead	Live + Impact	Wind	Design Stress	Make-up of Section	Area: Gross	Area: Net	Assembly	Radius of Gyration
U_0-U_1			-56	-56	2-18" [@ 42.7# Cover PL 21"x 9/16" 17½"	36.8			
U_1-U_3	-885	-337	-74	-1633	2-18" [@ 58# (51) Cover PL 21"x 9/16" 2 PL 18"x 7/16"	63.8			r_z=6.5
U_3-U_5	-1205	-461	-74	-2220	2-18" [@ 58# (51) Cover PL 21"x 9/16" 4 PL 18"x 7/16"	86.3			r_z=6.2
U_5-U_7	-863	-329	-74	-1595	2-18" [@ 58# (51) Cover PL 21"x 9/16" 2 PL 18"x 7/16"	61.5			r_z=6.5
U_7-U_8			-56	-56	2-18" [@ 42.7# Cover PL 21"x 9/16" 17½"	36.8			
L_0-L_2	+500	+191		+ 922	2-18" [@ 58# (51)	34.0	29.8		
L_2-L_4	+1120	+428	+16	+2064	2-18" [@ 58# 4 PL 18"x 5/8" (51)	79.0	68.7		
L_4-L_6	+1105	+425	+16	+2040	2-18" [@ 58# 2 PL 18"x 5/8" 2 PL 18"x 9/16" (51)	76.8	66.7		
L_6-L_8	+478	+182		+ 880	2-18" [@ 58# (51)	34.0	29.8		
L_0-U_1	-722	-299		-1362	2-18" [@ 58# 2 PL 18"x ½" 2 PL 18"x 7/16" (51)	67.7			r_z=5.8
U_1-L_2	+518	+235		+1004	2-18" [@ 45.8# 2 PL 15"x ⅜" (51)	38.0	32.0		
L_2-U_3	-328	-186		- 700	2-18" [@ 58# (51)	34.0			r_z=6.3
U_3-L_4	+115	+130 −123		+416 − 81	2-15" [@ 33.9# (51)	19.8	17.4		r_z=5.6
L_4-U_5	+141	+141 −77		+437 − 84	2-15" [@ 33.9# (51)	19.8	17.4		r_z=5.6
U_5-L_6	-329	-185		- 698	2-18" [@ 58# (51)	34.0			r_z=6.3
L_6-U_7	+540	+ 236		+1035	2-18" [@ 51.9# 2 PL 15"x ⅜" (51)	41.6	35.7		
U_7-L_8	-682	- 282		-1286	2-18" [@ 58# 2 PL 18"x ⅜" 2 PL 18"x 7/16" (51)	63.2			r_z=5.8
U_0-L_2 & U_6-L_8	-69	- 112	-43	- 336	2-15" [@ 33.9# (51)	19.8			r_z=5.6
U_8-L_2	-137	- 112	-10	- 371	2-15" [@ 33.9# (51) U_0-L_2, U_6-L_8	19.8			r_z=5.6
No Gross	470	227	41		2-15" [@ 33.9 (51) U_1-L_2, U_3-L_3, U_5-L_5, U_7-L_7				
No Gross	470	227	43						

Notes:
The stress in the column marked "Design Stress" equals for each member, the largest of the following two values: ½(D+L+I) ; D+2(L+I)+W. See specifications.
Material listed under "Make-up of Section" and marked (51) to be of silicon steel. Main truss gusset plates to be of carbon steel unless otherwise designated on the plans. All other material including rivets to be of carbon steel.

FAY, SPOFFORD & THORNDIKE
BOSTON, MASSACHUSETTS
DESIGNED BY W.L.C.
DRAWN BY L.W.J.
TRACED BY L.W.J.
CHECKED BY A.T.W.
SCALE: 1"=5' EXCEPT AS SHOWN





SCALE
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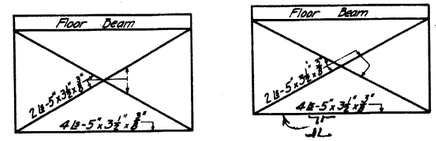


SWAY BRACING

Note: See Sheet No. 14 for additional notes.

Thickness, number and size of gusset plates at all main truss joints to be determined by contractor to carry flexure, direct stress and shear.

30' Panel
D.L. = 100.7
L.L. = 66.2
Imp = 21.5
D+L = 188.4
D+2L = 216.1

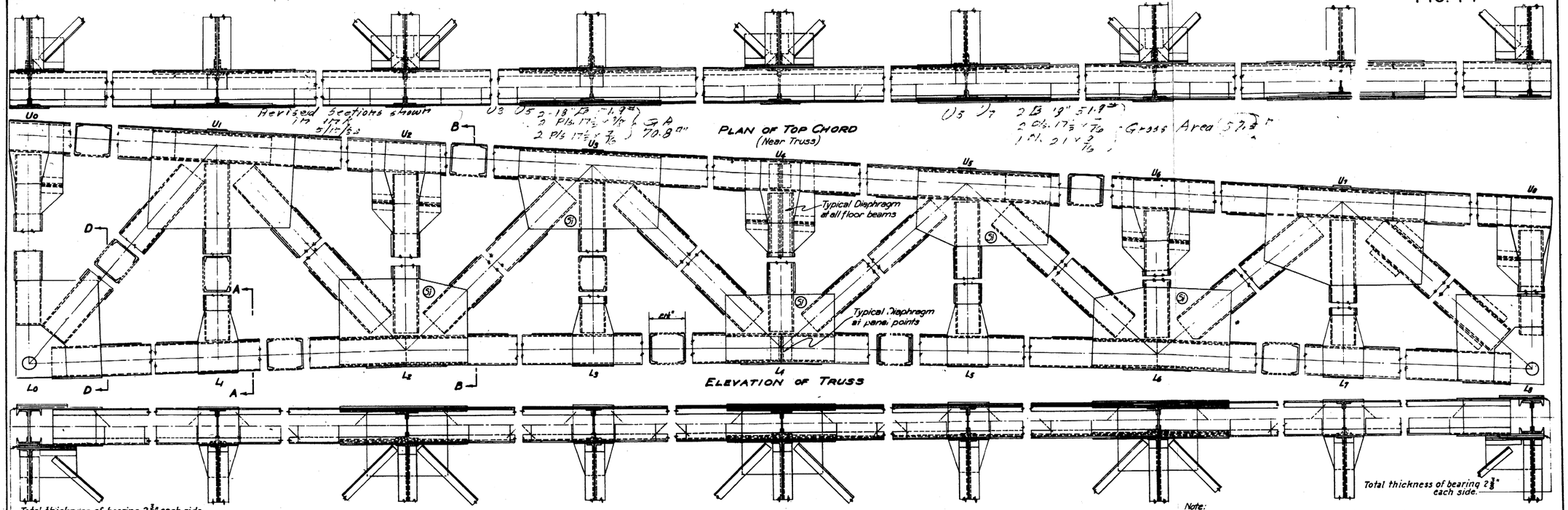
FAY, SPOFFORD & THORNDIKE, ENGINEERS
BY Palmer Dan Ill. Spofford

WAR DEPARTMENT
CORPS OF ENGINEERS U.S. ARMY
OFFICE OF DISTRICT ENGINEER, BOSTON, MASS.
HIGHWAY BRIDGES
OVER CAPE COD CANAL
AT BOURNE, MASSACHUSETTS

BOURNE BRIDGE
TRUSSES AND BRACING-SPAN 7
SCALE EXCEPT AS SHOWN
2 1 0 2 4 6 8 FT

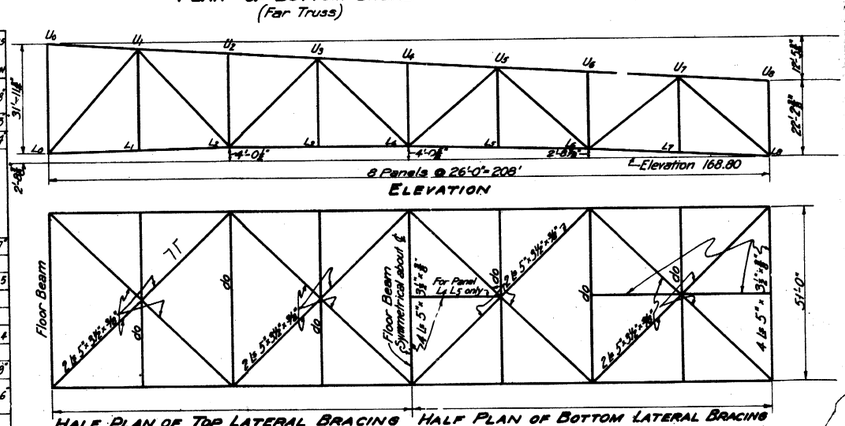
APPROVED R. Park
LT. COL. CORPS OF ENGINEERS
DECEMBER 1933
SUPERSTRUCTURE CONTRACT PLANS SHEET NO. 12 OF (17)

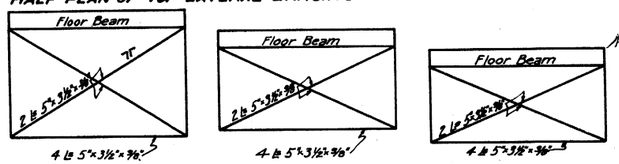
FIG. 14



Member	Stresses in Kips: Dead	Live + Impact	Wind	Design Stress	Make-up of Section	Area: Gross	Net	Assembly	Radius of Gyration
U0-U1			-48	-48	2-18" I @ 42.7# Cover Pl 21"x 3/8"	36.8			rx=6.8
U1-U2	-651	-269	-63	-1252	2-18" I @ 58# Cover Pl 21"x 3/8" 17½"x 7/16" (51)	45.8			rx=6.3
U2-U3	-981	-401	-63	-1846	2-18" I @ 58# Cover Pl 21"x 3/8" 2 Pl (18"x 1/2" & 2 Pl 17½"x 1/2") (51)	70.5			ry=6.4
U3-U4	-791	-326	-63	-1506	2-18" I @ 58# Cover Pl 21"x 3/8" 2 Pl (15"x 3/8") (51)	57.0			ry=6.4
U4-U5			-48	-48	2-18" I @ 42.7# Cover Pl 21"x 3/8" 17½"x 7/16"	36.8			
L0-L2	+348	+144		+657	2-18" I @ 42.7# (51)	25.0	20.5		
L2-L4	+859	+355	+13	+1620	2-18" I @ 58# 2 Pl 18"x 1/2" (51)	58.7	50.4		
L4-L6	+951	+393	+13	+1793	2-18" I @ 58# 4 Pl 18"x 3/8" 7/16" [redacted] (51)	64.3	55.0		
L6-L8	+462	+192		+873	2-18" I @ 58# (51)	34.0	27.0		
L0-U1	-536	-242		-1038	2-18" I @ 58# 2 Pl 15"x 9/16" (51)	50.8			rx=5.7
U1-L2	+455	+220		+901	2-18" I @ 42.7# 2 Pl 15"x 3/8" (51)	36.2	31.1		
L2-U3	-294	-174		-642	2-18" I @ 45.8# (51)	26.8			rx=6.5
U3-L4	+175	+139		+453	2-15" I @ 33.9# (51)	19.8	16.6		
L4-U5	+43	+ 98 / - 85		+ 317 / - 220	2-15" I @ 33.9#	19.8	16.6		
U5-L6	-219	-154		- 527	2-18" I @ 51.9#	30.4			rx=6.6
L6-U7	+424	+209		+845	2-18" I @ 58# (51)	34.0	27.0		
U7-L8	-626	-282		-1210	2-18" I @ 58# 2 Pl 18"x 7/16" (51)	52.0			ry=5.9
L2-U4	-49	- 84	-37	- 254	2-15" I @ 33.9# L2-U4	19.8			
L4-U4	-101	- 84	- 9	- 278	2-15" I @ 33.9# L4-U4, L5-U4, L6-U4, L6-U6, L7-U4	19.8			ry=5.6
Rx Gross	448	205	37						
Ry Gross	448	205	37						

Notes:
The stress in the column marked "Design Stress" equals for each member, the largest of the following two values: ⅔(D+L+I); D+½(L+I)+W; See Specifications.
Material listed under "Make-up of Section" and marked (51) to be of silicon steel. Main Truss gusset plates to be of carbon steel unless otherwise designated on the plans. All other material including rivets to be of carbon steel.





Note:
In the truss diagrams the vertical dimensions shown are computed to the center of the channels of the top chord members and not to the neutral axes or working lines which are to be used in the detailing in accordance with the specifications. (The vertical dimensions are such as to keep the top of the cover plates of the top chord at a definite distance from the crown of the roadway.)

Note:-
See Sheet No. 14 for additional notes.
For Sections A-A, B-B etc see Sheet No. 15
Thickness, number and size of gusset plates at all main truss joints to be determined by contractor to carry flexure, direct stress and shear.

26' Panel
D.L. = 88.6
L.L. = 65.5
Imp = 21.7
D+L = 175.8
D+2L = 263.
Max. F.B. Reaction

FAY, SPOFFORD & THORNDIKE, ENGINEERS
BY Charles M. Spofford

FAY, SPOFFORD & THORNDIKE ENGINEERS BOSTON, MASSACHUSETTS
DESIGNED BY F.M.
DRAWN BY F.M. H.L.R.
TRACED BY H.L.R.
CHECKED BY C.H.N.
SCALE: ½" EXCEPT AS NOTED

WAR DEPARTMENT
CORPS OF ENGINEERS U. S. ARMY
OFFICE OF DISTRICT ENGINEER, BOSTON, MASS.
HIGHWAY BRIDGES
OVER CAPE COD CANAL
AT BOURNE, MASSACHUSETTS

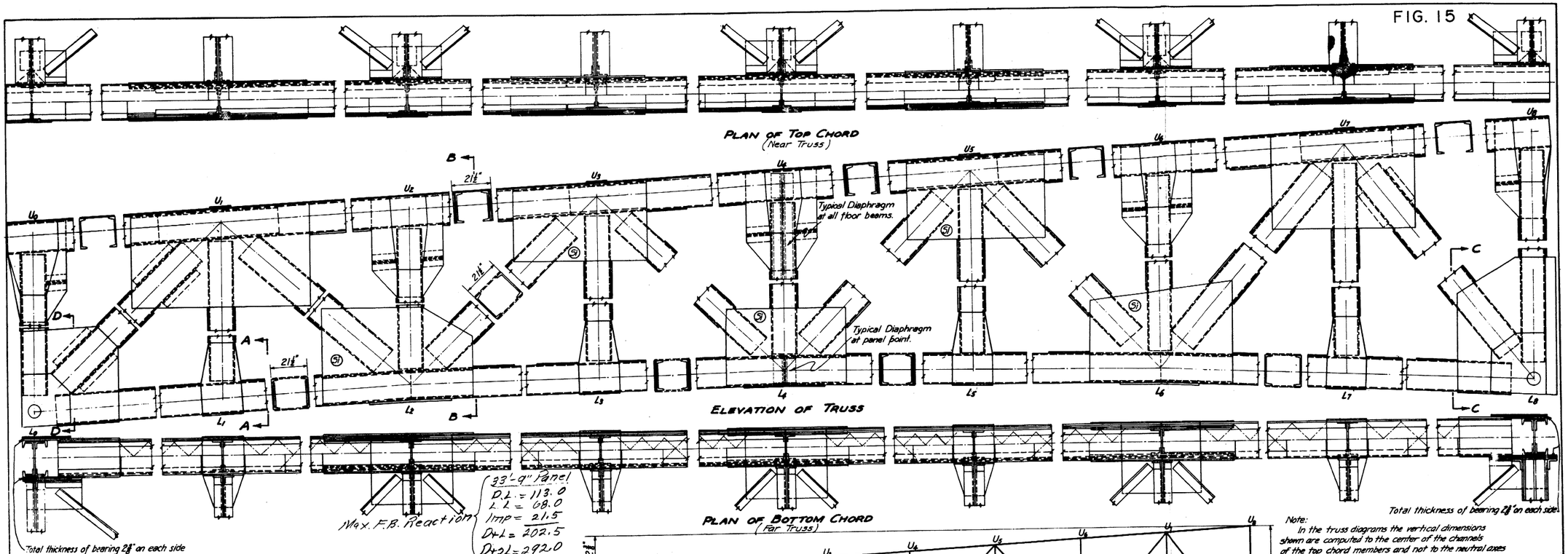
BOURNE BRIDGE
TRUSSES AND BRACING - SPAN 6

SCALE EXCEPT AS SHOWN
2 1 0 2 4 6 8 FT.

APPROVED
LT. COL. CORPS OF ENGINEERS
DECEMBER 1933

SUPERSTRUCTURE CONTRACT PLANS SHEET No. 13 OF (17)

FIG. 15



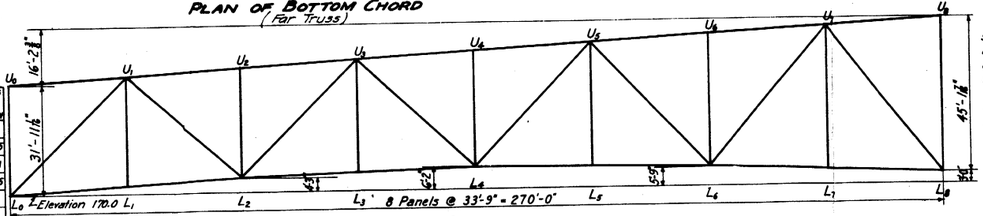
Max. F.B. Reaction

33'-9" Panel
D.L. = 113.0
L.L. = 68.0
Imp. = 21.5
D+L = 202.5
D+L = 292.0

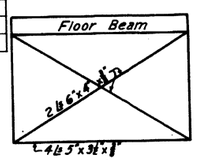
4 Pls 17½ × 4 11/16"

Member	Stress in Kips: Dead	Live +Impact	Wind	Design Stress	Make-up of Section 17½ × ½	Area: Gross	Area: Net	Assembly	Radius of Gyration
U_0-U_1			-82	-82	Cover PL 21" × ⅜" 2-Ls-18"@42.7#	36.76		[]	
U_1-U_2	-1000	-363	-117	-1843	Cover PL 21" × ⅜" 4 PL(16" × ½) 2-Ls-18"@58# (58) 51.9## (51)	77.3		⊏ ⊐	r_x= 6.5
U_2-U_3	-1245	-454	-117	-2270	Cover PL 21" × ⅜" 2 PL(18" × ⅞) 2 PL(18" × ⅞) 2-Ls-18"@58# (51)	93.01		⊏ ⊐	r_x= 6.1
U_3-U_5	-828	-302	-117	-1549	Cover PL 21" × ⅜" 2 PL(16" × ½) 2-Ls-18"@58# (58) 51.9## (51)	61.51		[]	r_x= 6.5
U_5-U_6			-82	-82	Cover PL 21" × ⅜" 2-Ls-18"@42.7# 17½ × 9/16	36.76		[]	
L_0-L_2	+579	+212		+1054	45# 2-Ls-18"@51.9# 2 PL(15" × ⅞) 18 × 9/16 (51)	41.61	35.21	⊏ ⊐	
L_2-L_4	+1200	+439	+20	+2186	2-Ls-18"@58# 4 PL 18" × ⅞ (51)	83.46	68.5	⊏ ⊐	
L_4-L_6	+1090	+397	+20	+1982	2-Ls-18"@58# 4 PL 18" × ⅞ (51)	74.46	60.98	⊏ ⊐	
L_6-L_8	+440	+161		+802	2-Ls-18"@51.9# (51)	30.36	24.26	⊏ ⊐	
L_0-U_1	-825	-308		-1511	2-Ls-18"@58# 4 PL 18" × ⅞ (51)	83.46		[]	r_x= 5.7
U_1-L_2	+564	+245		+1078	2-Ls-18"@51.9# 2 PL 15" × ⅞ (51)	41.61	35.21	⊏ ⊐	
L_2-U_3	-296	-163		-622	2-Ls-18"@58# (51)	33.96		⊏ ⊐	r_x= 6.3
U_3-L_4	+ 55	+114 −97		+360 −332	2-Ls-15"@53.3# 45## charged by A.B. Co. for Erection Stresses	19.8	15.7	⊏ ⊐	r_x= 5.6
L_4-U_5	+218	+159		+536	2-Ls-18"@58.3# 58##	26.76	22.26		
U_5-L_6	-398	-198		-795	2-Ls-18"@51.9# 2 PL 18" × ⅞ (51)	43.86		[]	r_x= 6.1
L_6-U_7	+600	+254		+1138	2-Ls-18"@58# 2 PL 15" × ⅞ (51)	45.21	38.41	⊏ ⊐	
U_7-L_8	-717	-267		-1312	2-Ls-18"@58# 2 PL 18" × ⅞ 2 PL 18" × ⅞ (51)	81.21		[]	r_x= 5.7
L_8-U_8	- 78	- 94	- 67	-333	2-Ls-15"@33.9# L_0-U_0 (51)	19.8			r_x= 5.6
L_8-U_8	- 156	- 94	- 14	-358	2-Ls-15"@33.9# L_4-U_8 L_6-U_8 (51)	19.8		[]	r_x= 5.6
					2-Ls-15"@33.9# L_1-U_1 L_2-U_2 L_2-U_3 L_4-U_7				
R_0 Gross	536	247	48						
R_6 Gross	538	247	67						

* Chan



HALF PLAN OF TOP LATERAL BRACING



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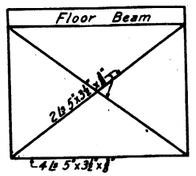

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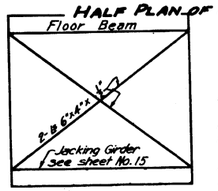
HALF PLAN OF BOTTOM LATERAL BRACING



U_8-L_8

SWAY BRACING

16 8 0 16 32 48 64 FT
SCALE

Notes:
The stress in the column marked "Design Stress" equals for each member, the largest of the following two values: ¾(D+L+I); D+2(L+I)+W. See specifications.
Material listed under "Make-up of Section" and marked (51) to be of silicon steel. Main Truss gusset plates to be of carbon steel unless otherwise designated on the plans. All other material including rivets to be of carbon steel.

Note:
In the truss diagrams the vertical dimensions shown are computed to the center of the channels of the top chord members and not to the neutral axes or working lines which are to be used in the detailing in accordance with the specifications.
(The vertical dimensions are such as to keep the top of the cover plates of the top chord at a definite distance from the crown of the roadway.)

Notes:-
For General Plan and Elevations - See sheets Nos. 2 and 3.
For Deck Sections and Deck Details - See Sheets Nos. 4 and 5.
For Truss Bearings - See Sheet No. 17.
For Sections A-A, B-B, C-C, D-D. See Sheet No. 15.
Where consistent with shipping requirements, two or more panel lengths of chord members shall be fabricated as one member.
Joints in compression members shall be faced to bear.
Open holes for field rivets to be 13/16" ϕ unless otherwise noted. 1" ϕ for all Truss U_0 17 L_8.
Compression edges of main gusset plates to be stayed against buckling by angles or plates where unsupported lengths exceed 12 times the plate thickness wherever maximum allowable stress occurs at edge. For stresses less than maximum, unstayed lengths may be increased proportionally.
All rivets ⅞ ϕ.
All elevations are referred to a datum 100 feet below Mean Sea Level.

Note:
Thickness, number and size of gusset plates at all main truss joints to be determined by contractor to carry flexure, direct stress and shear.
Lattching - For members carrying compression only or compression and flexure, lattching is to be proportioned in accordance with the American Association of State Highway Officials Specifications.
For members, the design of which is controlled by tension but which also carry compression, lattching is to be proportioned to carry shear equal to 2½ per cent of the total compression divided equally between the two flanges; double lattching to be used with bars not less than 2½ inches x ⅜ inches.
For members carrying tension only, double lattching to be used with 2½ inches x ⅜ inch bars.

FAY, SPOFFORD & THORNDIKE, ENGINEERS
BY Charles H. Spofford

WAR DEPARTMENT
CORPS OF ENGINEERS U. S. ARMY
OFFICE OF DISTRICT ENGINEER, BOSTON, MASS.

HIGHWAY BRIDGES
OVER CAPE COD CANAL
AT BOURNE, MASSACHUSETTS

BOURNE BRIDGE
TRUSSES AND BRACING - SPAN 5

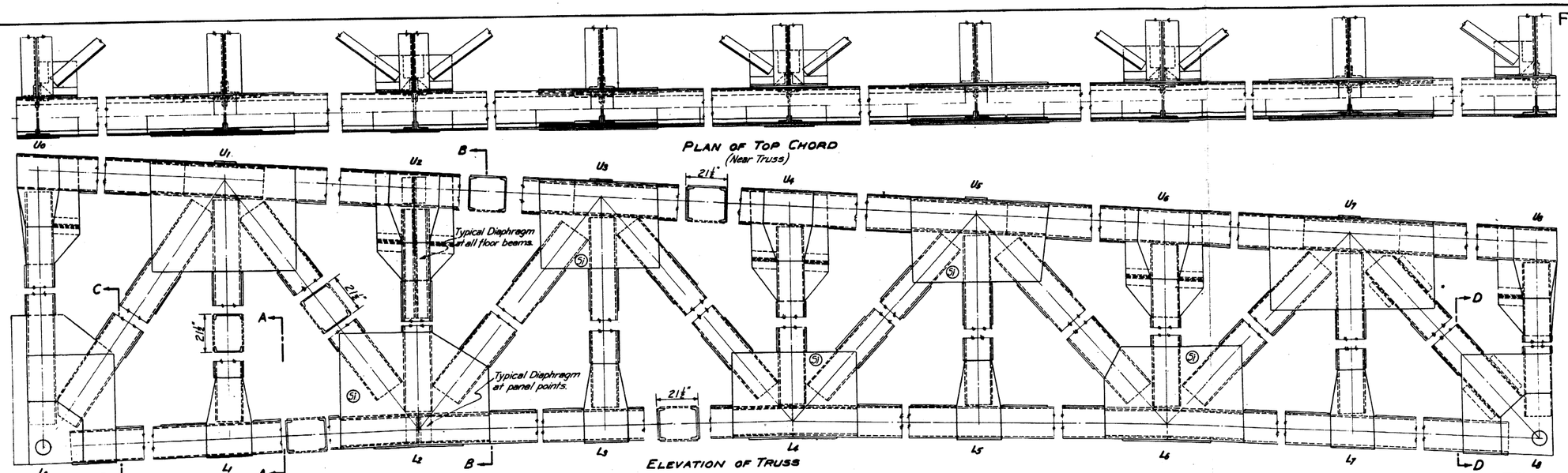
SCALE EXCEPT AS SHOWN
2 1 0 2 4 6 8 FT

APPROVED [signature]
LT. COL. CORPS OF ENGINEERS
DECEMBER 1933

SUPERSTRUCTURE CONTRACT PLANS SHEET NO. 16 OF 17

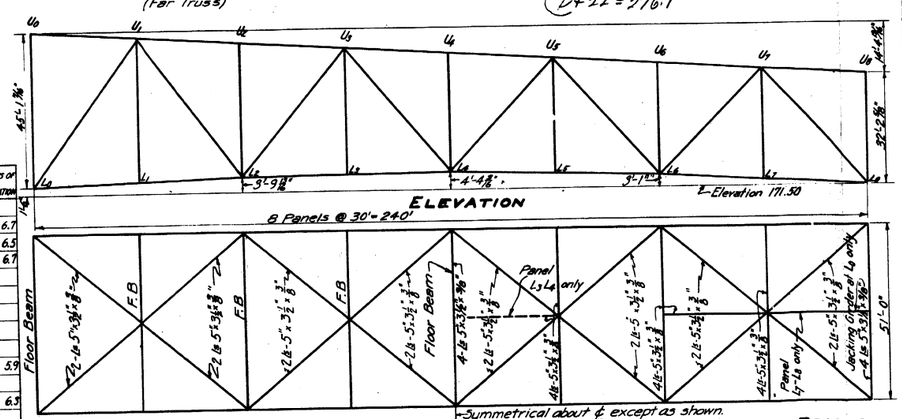
FAY, SPOFFORD & THORNDIKE
BOSTON, MASSACHUSETTS
DESIGNED BY W.L.C.
DRAWN BY F.M.
TRACED BY W.M.F.
CHECKED BY H.S.
SCALE 1"=5' EXCEPT AS SHOWN

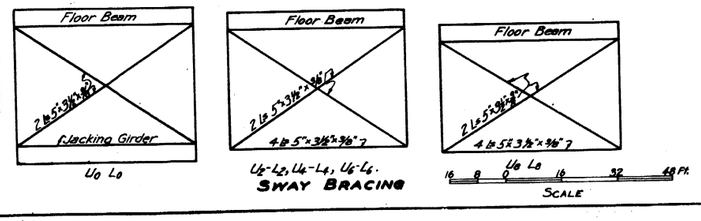
FIG. 16

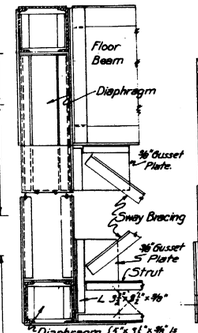


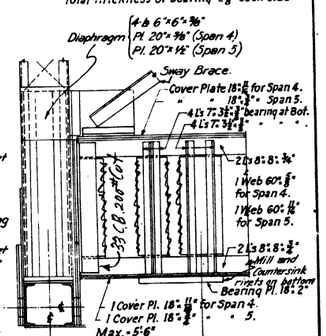
Member	Stresses in Kips: Dead	Live + Impact	Wind	Design Stress	51.9# Make-up of Section		Area: Gross	Area: Net	Assembly	Radius of Gyration
						45.77				
U_0U_1			-56	-56	2-18" B @ 42.7# Cover Pl. 21"x 9/16"		36.76			
U_1U_3	- 600	- 239	-93	-1171	2-18" B @ 58# Cover Pl. 21"x 9/16"	(51)	42.16			r_z = 6.7
U_3U_5	- 856	- 358	-93	-1665	2-18" B @ 58# Cover Pl. 21"x 9/16" - 2 Pl. [illegible]	(51)	63.76			r_z = 6.5
U_5U_7	- 686	- 288	-93	-1355	2-18" B @ 42.7# Cover Pl. 21"x 9/16" 2 Pl. [illegible]	(51)	50.26			r_z = 6.7
U_7U_8			-56	- 56	2-18" B @ 42.7# Cover Pl. 21"x 9/16"		36.76			
L_0L_2	+ 310	+ 130		+ 587	2-18" B @ 42.7#	(51)	24.96	22.26		
L_2L_4	+ 758	+ 317	+16	+1432	2-18" B @ 58# 2-Pl. 18"x 9/16"	(51)	56.46	45.98		
L_4L_6	+ 814	+ 343	+16	+1542	2-18" B @ 58# 2-Pl. 18"x ¾"	(51)	60.96	49.76		
L_6L_8	+ 417	+ 175		+ 790	2-18" B @ 51.9#	(51)	30.36	26.76		
L_0U_1	- 570	- 247		-1090	2-18" B @ 58# 4-Pl. 18"x 9/16"	(51)	65.48			r_z = 5.9
U_1L_2	+ 448	+ 220		+ 891	2-18" B @ 58#	(51)	33.96	29.76		
L_2U_3	- 289	- 171		- 631	2-18" B @ 58#	(51)	33.96			r_z = 6.3
U_3L_4	+ 157	+ 137		+491	2-15" B @ 33.9#		20.46	16.08		
L_4U_5	+ 60	+2190 - 86		+3285 -195	2-15" B @ 33.9#		19.80	17.40		r_z = 5.6
U_5L_6	- 194	- 156		-506	2-18" B @ 42.7#	(51)	24.96			r_z = 6.6
L_6U_7	+ 426	+ 198		+833	2-18" B @ 58#	(51)	33.96	27.26		
U_7L_8	- 620	- 259		-1172	2-18" B @ 58# 4-Pl. 18"x 9/16"	(51)	60.96			r_z = 5.8
U_0L_2, U_2L_4	- 69	- 112	- 60	- 347	2-15" B @ 33.9#	(51)	19.80			r_z = 5.6
U_2L_2	- 125	- 112	- 19	- 362	2-15" B @ 33.9# [illegible] U_0L_2, [illegible] U_2L_4	(51)	19.80			r_z = 5.6
R_0 Globe	520	227	60		2-15" B @ 33.9# U_1L_1, U_2L_3, U_5L_5, U_7L_7					
R_8 Globe	516	227	44							

Notes:
The stress in the column marked "Design Stress" equals for each member, the largest of the following two values: $\frac{4}{3}(D+L+I)$; $D+2(L+I)+W$. See Specifications.
Material listed under "Make-up of Section" and marked (51) to be of silicon steel. Main Truss gusset plates to be of carbon steel unless otherwise designated on the plans. All other material including rivets to be of carbon steel.









Note:- See Sheet No. 14 for additional notes.

Thickness, number and size of gusset plates at all main truss joints to be determined by contractor to carry flexure, direct stress and shear.

FAY, SPOFFORD & THORNDIKE, ENGINEERS
BY [signature]

WAR DEPARTMENT
CORPS OF ENGINEERS U.S. ARMY
OFFICE OF DISTRICT ENGINEER BOSTON, MASS.

HIGHWAY BRIDGES

OVER CAPE COD CANAL
AT BOURNE, MASSACHUSETTS

BOURNE BRIDGE
TRUSSES AND BRACING-SPAN 4

SCALE EXCEPT AS SHOWN
2 1 0 2 4 6 8 FT.

APPROVED [signature]
LT. COL. CORPS OF ENGINEERS

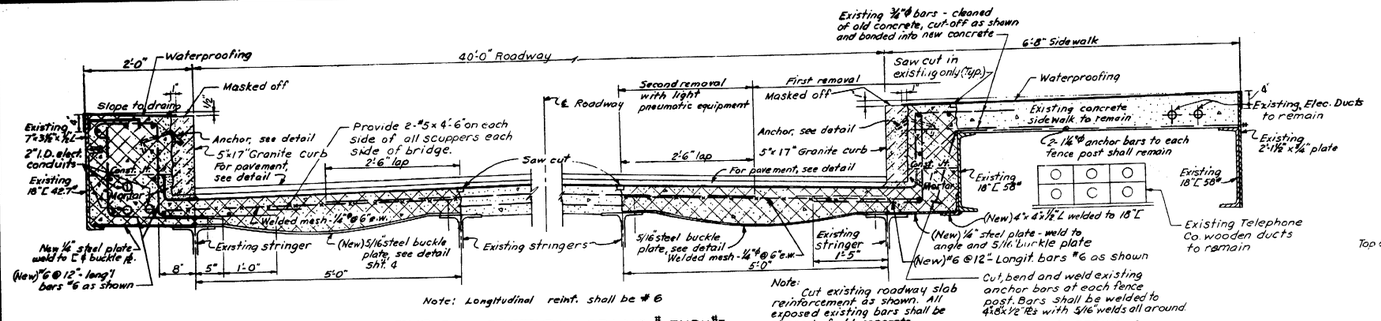
DECEMBER 1933

SUPERSTRUCTURE CONTRACT PLANS SHEET No. 15 OF 17 SHEETS

FAY, SPOFFORD & THORNDIKE
BOSTON, MASSACHUSETTS
DESIGNED BY W.L.C.
DRAWN BY E.M.
TRACED BY H.L.K.
CHECKED BY L.K.B.
SCALE AS INDICATED

CORPS OF ENGINEERS — U. S. ARMY

FIG. 17



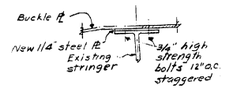
Note: Longitudinal reinf. shall be #6

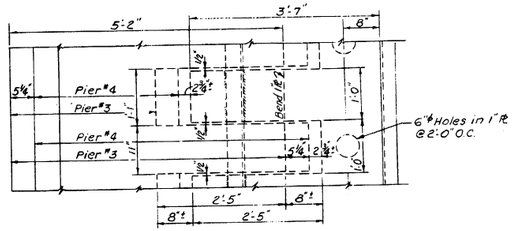
TYPICAL SECTION - SPANS #1 THRU #7

SCALE: 1" = 1'-0"

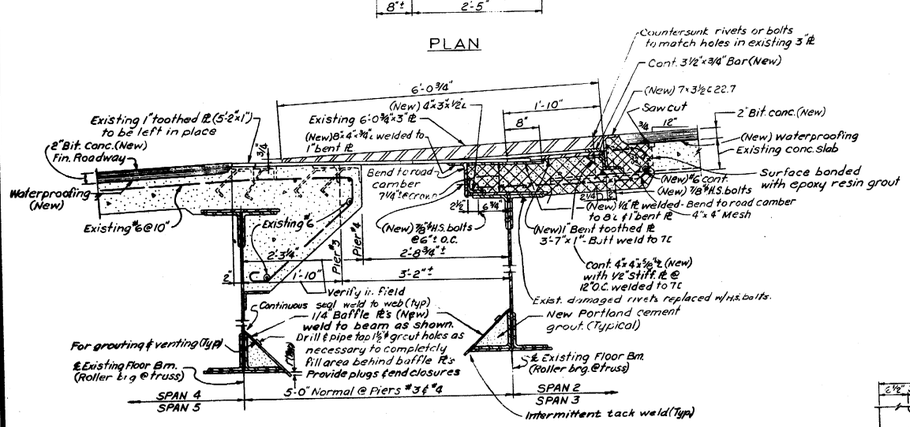
EXISTING STRINGERS

Spans 1,2,3 - 27"CB97 - Silicon Steel
" 4,7 - 27"CB85 - Carbon "
" 5 - 21"CB97 - " "
" 6 - 24"CB81 - " "

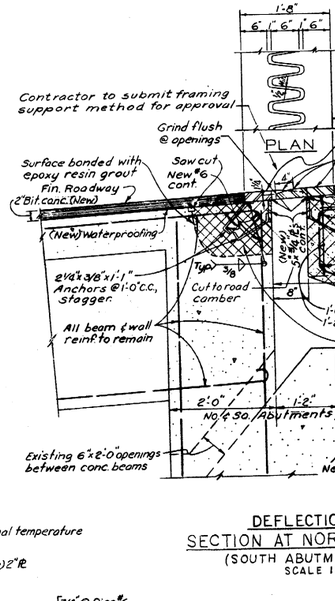




PLAN



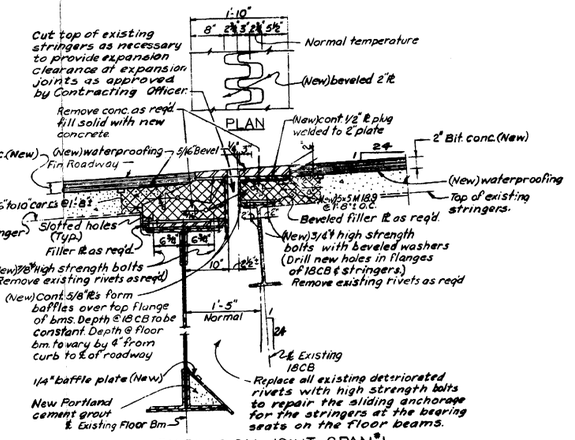
EXPANSION JOINT
SECTION AT PIERS #3 & #4
SCALE 1" = 1'-0"



SECTION AT PIERS #5 & #6

SCALE 1" = 1'-0"

DEFLECTION JOINT
SECTION AT NORTH ABUTMENT
(SOUTH ABUTMENT SIMILAR)
SCALE 1" = 1'-0"



EXPANSION JOINT - SPAN #1
SECTION AT P. P. 10 & 10'
SCALE 1" = 1'-0"

NOTE

ADDITIONAL DETAILS FOR EXISTING DECK AND EXPANSION JOINTS CAN BE FOUND ON THE FOLLOWING DRAWINGS
1156 E-1-1 DEC. 1963 SHEETS 3,4,5,6,7

GRAPHIC SCALES

SAFETY PAYS

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY	DR. BY	CK. BY
SUBMITTED		
CHIEF, STRUCT. SECTION		
APPROVAL RECOMMENDED		
CHIEF, DESIGN BRANCH		
REVIEWED		
PROJECT MANAGER		
APPROVAL RECOMMENDED		
CHIEF, PROJECT BRANCH		

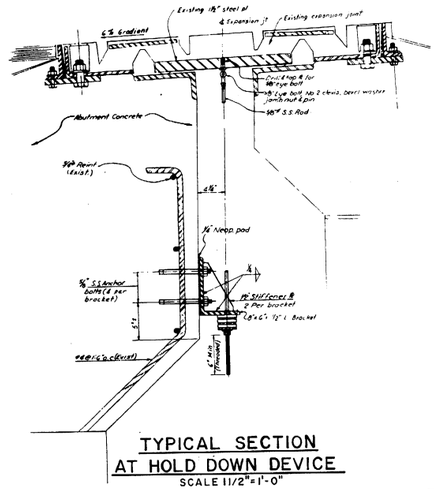
MAJOR REHABILITATION PROJECT
CAPE COD CANAL BRIDGES
BOURNE HIGHWAY BRIDGE
EXISTING DECK DETAILS
BOURNE MASSACHUSETTS
APPROVED DATE
CHIEF, ENGINEERING DIVISION

SCALE | SPEC. NO.
DRAWING NUMBER
SHEET

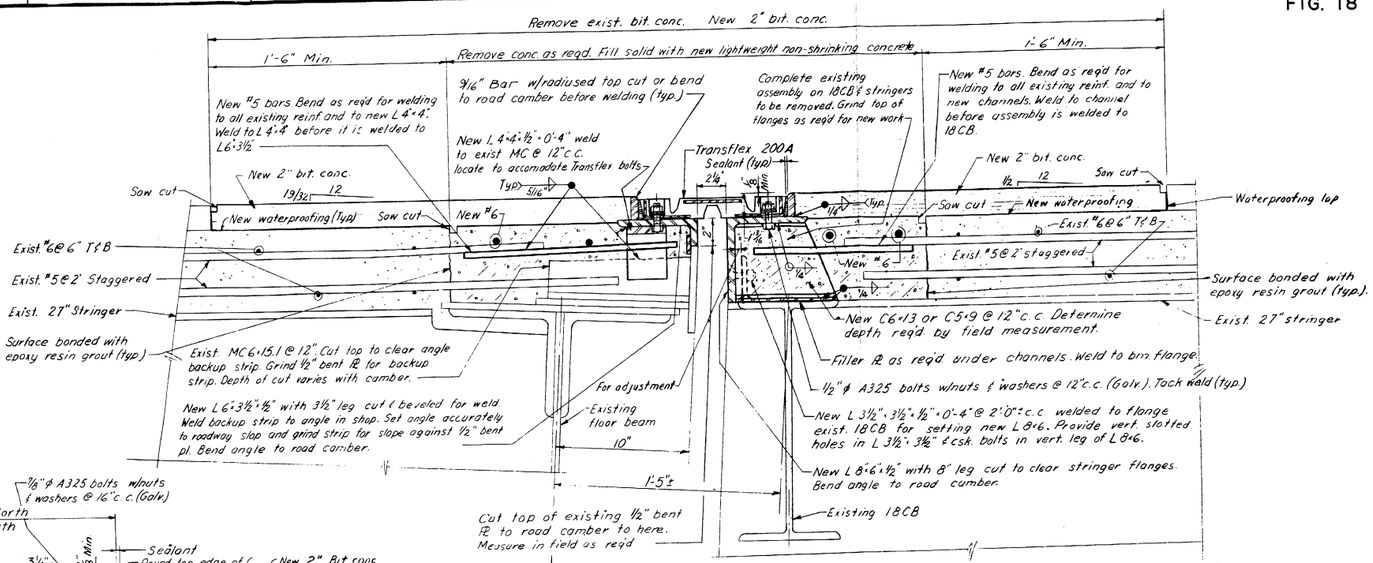
CORPS OF ENGINEERS

U. S. ARMY

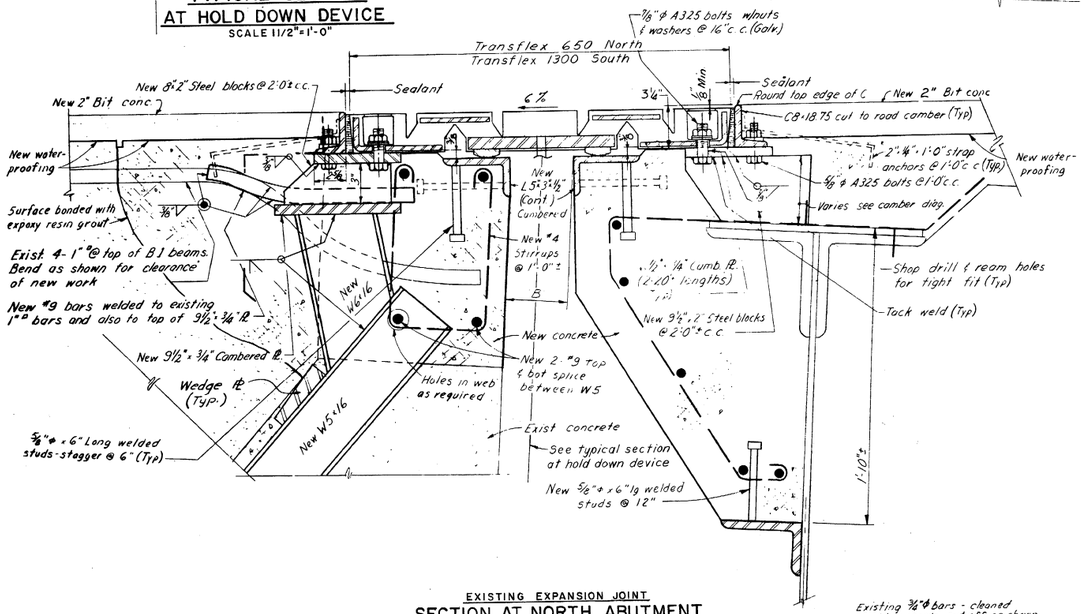
FIG. 18



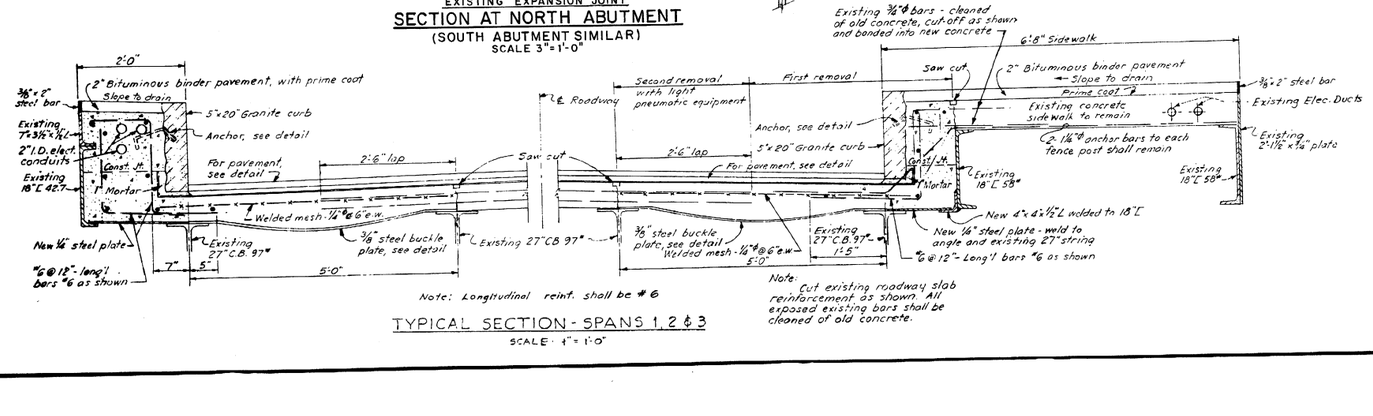
TYPICAL SECTION
AT HOLD DOWN DEVICE
SCALE 11/2"=1'-0"



EXISTING EXPANSION JOINT
SECTION AT P. P. 10 & 10'
SCALE 3"=1'-0"



EXISTING EXPANSION JOINT
SECTION AT NORTH ABUTMENT
(SOUTH ABUTMENT SIMILAR)
SCALE 3"=1'-0"



NOTE

ADDITIONAL DETAILS FOR EXISTING DECK AND EXPANSION JOINTS CAN BE FOUND ON THE FOLLOWING DRAWINGS

1137 E-6-1	MAY 1961	SHEETS 1-4
CAP-21	MAY 1972	SHEETS 1-6, 8
CAP 44	OCT. 1976	SHEET 1

SAFETY PAYS

GRAPHIC SCALES

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY	DR. BY	CK. BY
SUBMITTED:		
CHIEF, SECTION		
APPROVAL RECOMMENDED:		
CHIEF, BRANCH		
REVIEWED:		
APPROVAL RECOMMENDED:		
CHIEF BRANCH		

MAJOR REHABILITATION PROJECT
CAPE COD CANAL BRIDGES
SAGAMORE HIGHWAY BRIDGE
EXISTING DECK DETAILS
BOURNE MASSACHUSETTS
APPROVED
DATE
CHIEF, ENGINEERING DIVISION
SCALE
SPEC. NO.
DRAWING NUMBER
SHEET

SPAN BAY	REPAIR NO.	MEM. TYPE	LOCATION OF MEMBER	DESCRIPTION OF REPAIR	SHOP DRAWING NO.	REPAIR DETAIL NO.	SUMMARY OF REPAIRS RIVETS	PLATES	LACE	MEMBER	OTHER	BID ITEM NO.	NOTES
				SPAN 3									
SPAN	3												
0-1		A	L0E-L1E	REPAIR DETERIORATED LACING	CCC4 SH9					5			
		A	L0W-L0W	REPLACE + 5% OF LACING	CCC4 SH33					3			
		A	L0W-L1W	REPLACE + 5% OF LACING	CCC4 SH9					5			
		B	FB0N	REPLACE 2 BOTTOM FLANGE RIVETS @ EAST END	CCC4 SH3		2						
		B	FB0N	REPAIR FLOOR BEAM STIFFENER @ WEST END	CCC4 SH3					1			
		C	SIDEWALK	REPLACE UPPER BRACING GUSSET @ SOUTH END	CCC4 SH42			1					
		C	SIDEWALK	REPLACE 3 NUTS @ EAST SIDEWALK	CCC4 SH42		3						
	*	D		REPLACE DETERIORATED SOUTHEAST UPPER GUSSET	CCC4 SH61			1					
	*	D		REPLACE 20 SOUTHEAST UPPER GUSSET RIVETS	CCC4 SH61		20						
		D		REPLACE 9 SOUTHWEST LOWER GUSSET RIVETS	CCC4 SH60		9						
		D		REPLACE DETERIORATED SOUTHEAST LOWER GUSSET	CCC4 SH60			1					
		E	L0	REPLACE + 75% OF LACES OF STRUT @ L0	CCC4 SH51					93			
		E	L1	REPAIR + 25% OF LACES OF STRUT @ L1	CCC4 SH51					31			
		F		REPLACE + 75% OF LACES OF LOWER WEST BRACING	CCC4 SH66					52			
		F		REPLACE 1 LACE OF UPPER CAST	CCC4 SH66					1			
		F		REPLACE + 75% OF LACES OF UPPER WEST BRACING	CCC4 SH66					52			
1-2		A	U1W-L2W	REPAIR DETERIORATED LOWER LACING	CCC4 SH28					5			
		B	FB1N	REPLACE 3 BOTTOM FLANGE RIVETS @ EAST END	CCC4 SH1		3						
		B	FB1N	REPAIR FLOOR BEAM STIFFENER @ WEST END	CCC4 SH1					1			
		D		REPLACE 13 SOUTHEAST UPPER GUSSET RIVETS	CCC4 SH61		13						
	*	D		REPAIR DETERIORATED SOUTHEAST LOWER GUSSET	CCC4 SH61			1					
	*	D		REPLACE 8 SOUTHEAST LOWER GUSSET RIVETS	CCC4 SH61		8						
		D		REPAIR DETERIORATED SOUTHWEST LOWER GUSSET	CCC4 SH61			1					
		D	U1W-U2E	REPAIR DETERIORATED BRACING @ U1W	CCC4 SH60					1			
		D	U1E-U2W	REPAIR DETERIORATED LOWER FLANGE @ U2W	CCC4 SH60					1			
		C	SIDEWALK	REPAIR LOWER BRACING AND GUSSET @ NORTH END	CCC4 SH41			1		1			
2-3		A	L3W-U3W	REPAIR DETERIORATED LACING	CCC4 SH33					3			
		D		REPLACE 2 SOUTHWEST LOUVER GUSSET RIVETS	CCC4 SH61		2						
	*	D		REPAIR SOUTHEAST UPPER GUSSET	CCC4 SH62			1					
	*	D		REPLACE 9 SOUTHEAST UPPER GUSSET RIVETS	CCC4 SH62		9						
		D		REPLACE 6 NORTHEAST UPPER GUSSET RIVETS	CCC4 SH61		6						
		D		REPLACE 5 NORTHEAST LOWER GUSSET RIVETS	CCC4 SH61		5						
		E	L2E	REPLACE 1 UPPER GUSSET RIVET @ L2E	CCC4 SH51		1						
		E	L3W	REPLACE 1 UPPER GUSSET RIVET @ L3W	CCC4 SH11		1						
		E	L3E	REPLACE 1 UPPER GUSSET RIVET @ L3E	CCC4 SH11		1						
3-4		A	L3-L4E	REPAIR MIDDLE STIFFENER PLATE @ NORTH END	CCC4 SH12				1				
		B	FB3N	REPLACE 7 BOTTOM FLANGE RIVETS @ WEST END	CCC4 SH2		7						
		B	FB3N	REPLACE FLOOR BEAM STIFFENER @ WEST END	CCC4 SH2					1			
	*	D		REPAIR NORTHEAST LOWER GUSSET	CCC4 SH61				1				
	*	D		REPLACE 1 NORTHEAST LOWER GUSSET RIVETS	CCC4 SH61		1						
		D		REPLACE 2 NORTHEAST UPPER GUSSET RIVETS	CCC4 SH62		2						
		D		REPAIR NORTHWEST LOWER GUSSET	CCC4 SH61				1				
	*	D		REPAIR SOUTHEAST UPPER GUSSET	CCC4 SH61				1				
	*	D		REPLACE 24 SOUTHEAST UPPER GUSSET RIVETS	CCC4 SH61		24						
	*	D		REPAIR DETERIORATED SOUTHEAST LOWER GUSSET	CCC4 SH61				1				
	*	D		REPLACE 15 SOUTHEAST LOWER GUSSET RIVETS	CCC4 SH61		15						
4-5		A	L4E-L5E	REPAIR MIDDLE STIFFENER PLATE @ SOUTH END	CCC4 SH13				1				
		B	FB4N	REPLACE 6 BOTTOM FLANGE RIVETS @ EAST END	CCC4 SH1		6						
		B	FB4N	REPAIR TOP AND BOTTOM FLANGES @ EAST END	CCC4 SH1					2			
		B	FB5S	REPLACE 3 BOTTOM FLANGE RIVETS @ EAST END	CCC4 SH2		3						
		C	SIDEWALK	REPAIR LOWER BRACING @ NORTH END	CCC4 SH42					1			
		D		REPAIR DETERIORATED SOUTHWEST LOWER GUSSET	CCC4 SH61				1				
4-5		D		REPLACE 12 NORTHEAST UPPER GUSSET RIVETS	CCC4 SH62		12						
		D		REPAIR DETERIORATED NORTHEAST LOWER GUSSET	CCC4 SH62				1				
	*	D		REPAIR DETERIORATED SOUTHEAST UPPER GUSSET	CCC4 SH62				1				
	*	D		REPLACE 20 SOUTHEAST UPPER GUSSET RIVETS	CCC4 SH62		20						
	*	D		REPLACE DETERIORATED SOUTHEAST LOWER GUSSET	CCC4 SH61				1				
	*	D		REPLACE 11 SOUTHEAST LOWER GUSSET RIVETS	CCC4 SH61		11						
		E	L4	REPLACE + 10% OF LACES OF STRUT @ L4W	CCC4 SH47					12			
		E	L4	REPAIR DETERIORATED LOWER GUSSET @ L4W	CCC4 SH51				1				
		E	L4	REPLACE 2 UPPER GUSSET RIVETS @ L4W	CCC4 SH51		2						
	*	E	L4	REPLACE 4 LOWER GUSSET RIVETS @ L4E	CCC4 SH51		4						
	*	E	L4	REPAIR DETERIORATED LOWER GUSSET @ L4E	CCC4 SH51				1				
		E	L5	REPAIR DETERIORATED LOWER GUSSET @ L5E	CCC4 SH13				1				
		F		REPAIR ALL DETERIORATED LACES OF LOWER WEST BRACING	CCC4 SH66					70			
		F		REPAIR + 50% OF LACES OF UPPER WEST BRACING	CCC4 SH66					35			
		F		REPAIR DETERIORATED MIDDLE GUSSET	CCC4 SH66				1				
5-6		A	L5E-L6E	REPLACE DETERIRATED UPPER STAY PLATE @ SOUTH END	CCC4 SH14				1				
		A	L5W-U5W	REPLACE 4 DETERIORATED NUTS FOR UPPER STAY PLATE	CCC4 SH34		4						
		A	U5E-L6E	REPLACE + 90% OF LOWER LACING	CCC4 SH30					70			
		B	FB5N	REPLACE 6 BOTTOM FLANGE RIVETS @ EAST END	CCC4 SH2		6						
		B	FB5N	REPAIR FLOOR BEAM STIFFENER @ WEST END	CCC4 SH2					1			
		B	FB5N	REPLACE 1 BOTTOM COVER RIVET	CCC4 SH2		1						
		C	SIDEWALK	REPLACE 4 NUTS @ NORTH & SOUTH ENDS OF GUSSET	CCC4 SH43		4						
		C	SIDEWALK	REPAIR DETERIORATED BRACING GUSSETS	CCC4 SH43					1			
		F		REPAIR + 75% OF LACE OF UPPER EAST BRACING	CCC4 SH 64					52			
6-7		A	L7E-U7E	REPLACE 1 DETERIORATED NUT @ UPPER MIDDLE STIFFENER PLATE	CCC4 SH36		1						

SPAN BAY	REPAIR NO.	MEM. TYPE	LOCATION OF MEMBER	DESCRIPTION OF REPAIR	SHOP DRAWING NO.	REPAIR DETAIL NO.	SUMMARY OF REPAIRS RIVETS	PLATES	LACE	MEMBER	OTHER	BID ITEM NO.	NOTES
SPAN	3 (CONT'D)												
6-7		A	L6W-U7W	REPAIR DETERIORATED LACING	CCC4 SH31					7			
		A	L7W-U7W	REPAIR DETERIORATED LACING	CCC4 SH36					6			
		B	FB6N	REPAIR 2 FLOOR BEAM STIFFENERS	CCC4 SH1					2			
		B	FB6N	REPLACE 7 BOTTOM FLANGE RIVETS @ EAST END	CCC4 SH1		7						
		B	FB7S	REPLACE 2 BOTTOM FLANGE RIVETS @ EAST END	CCC4 SH4		2						
		C	SIDEWALK	REPLACE 3 DETERIORATED BRACING ANGLES	CCC4 SH44					3			
	*	E	L6W	REPLACE 4 UPPER GUSSET RIVETS @ L6W	CCC4 SH50		4						
	*	E	L6W	REPAIR DETERIORATED UPPER GUSSET @ L6W	CCC4 SH30				1				
		E	L6W	REPLACE 6 LOWER GUSSET RIVETS @ L6W	CCC4 SH50		6						
		E	L6W	REPAIR DETERIORATED UPPER GUSSET @ L6E	CCC4 SH30				1				
	*	E	L6E	REPAIR DETERIORATED LOWER GUSSET @ L6E	CCC4 SH50				1				
	*	E	L6E	REPLACE 3 LOWER GUSSET RIVETS @ L6E	CCC4 SH50		3						
		E	L7E	REPAIR DETERIORATED UPPER GUSSET @ L7E	CCC4 SH15				1				
		E	L7E	REPLACE 5 LOWER GUSSET RIVETS @ L7E	CCC4 SH15		5						
		E	L7	REPLACE 3 DETERIORATED LACES OF STRUT	CCC4 SH47					3			
		F		REPLACE + 40% OF LACES OF EAST BRACING	CCC4 SH64					28			
		F		REPLACE + 50% OF LACE OF UPPER WEST BRACING	CCC4 SH64					35			
7-8		A	L7E-L8E	REPAIR DETERIORATED LACING	CCC4 SH31					6			
		A	U7E-L8E	REPAIR DETERIORATED LOWER LACING	CCC4 SH31					4			
		B	FB7N	REPAIR FLOOR BEAM STIFFENER @ WEST END	CCC4 SH4					1			
		B	FB7N	REPAIR BOTTOM FLANGE @ WEST END	CCC4 SH4					1			
	*	C	SIDEWALK	REPLACE 3 BRACING GUSSET RIVETS @ NORTH END	CCC4 SH45		3						
	*	C	SIDEWALK	REPAIR DETERIORATED BRACING @ GUSSET @ NORTH END	CCC4 SH45				1			1	
		F		REPLACE 1 LOWER WEST GUSSET RIVET	CCC4 SH65		1						
		F		REPAIR + 40% OF LACE OF UPPER EAST BRACING	CCC4 SH65					28			
		F		REPLACE + 60% OF UPPER WEST BRACING LACE	CCC4 SH65					42			
8-9		A	L8E-U9E	REPAIR DETERIORATED LACING	CCC4 SH32					11			
		A	L8E-L9E	REPAIR DETERIORATED UPPER LACING	CCC4 SH17,18					3			
		A	L8W-L9W	REPLACE DETERIORATED SOUTH UPPER STAY PLATE	CCC4 SH17,18				1				
		A	L8E-L9E	REPLACE DETERIORATED NORTH UPPER STAY PLATE	CCC4 SH17,18				1				
		B	FB8N	REPAIR FLOOR BEAM STIFFNER @ EAST END	CCC4 SH5							1	
		B	FB8N	REPLACE 4 BOTTOM FLANGE RIVETS @ EAST END	CCC4 SH5		4						
		B	ST-9	REPAIR UNDERSIDE OF TOP FLANGE	CCC4 SH40							1	
		C		REPLACE 3 DETERIORATED BRACING ANGLES	CCC4 SH46					3			
		C		REPAIR 3 DETERIORATED BRACING GUSSETS	CCC4 SH46				3				
		E	L8	REPLACE 1 DETERIORATED LACE OF STRUT	CCC4 SH51					1			
		E	L8E	REPLACE 3 UPPER GUSSET RIVETS	CCC4 SH50		3						
		E	L8E	REPAIR DETERIORATED LOWER GUSSET	CCC4 SH50				1				
		E	L9W-L8E	REPAIR UPPER & LOWER FLANGE OF BRACING	CCC4 SH47					1			
		E	L9E	REPAIR DETERIORATED UPPER GUSSET	CCC4 SH51				1				
		E	L9	REPLACE 2 DETERIORATED LACES OF STRUT	CCC4 SH65					2			
		F		REPAIR + 80% OF LACE OF UPPER EAST BRACING	CCC4 SH65					58			
		F		REPAIR + 60% OF LACE OF UPPER WEST BRACING	CCC4 SH65					43			
SPAN	1			SPAN 1									
9-10		A	L9E-L10E	REPLACE DETERIORATED SOUTH UPPER STAY PLATE	CCC5 SH162				1				
		A	L9E-L10E	REPLACE 3 FLANGE RIVETS @ SOUTH END	CCC5 SH162		3						
		A	L9E-L10E	REPAIR DETERIORATED UPPER LACES	CCC5 SH162					10			
		A	U9E-U10E	REPAIR DETERIORATED LACING	CCC5 SH11					10			
		A	PP110E	REPLACE 5 GUSSET RIVETS	CCC5 SH2		5						
		A	L10E-U10E	REPAIR + 40% OF LACES	CCC4 SH25					46			
		B	FB0N	REPAIR BOTTOM FLANGE @ EAST END	CCC4 SH75							1	
		B	FB10S	REPLACE DETERIORATED BOTTOM FLANGE & COVER RIVETS	CCC5 SH28		10					1	
		B	ST-1	REPAIR BOTTOM FLANGE @ SOUTH END	CCC5 SH61669							1	
		B	ST-7	REPAIR DETERIORATED STIFFENER @ NORTH END	CCC5 SH61669							1	
		C	SIDEWALK	REPAIR DETERIORATED UPPER FLANGE OF WEST CHANNEL @ SOUTH END	CCC5 SH53							1	
		C	WALKWAY	TIGHTEN LOOSE GRATING SECTION								1	
		D	U10	REPLACE 9 LOWER FLANGE RIVETS OF STRUT @ U10	CCC5 SH41		9						
		D	U10W	REPLACE 2 LOWER GUSSET RIVETS @ U10W	CCC5 SH42		2						
		E	L10	REPLACE 16 DETERIORATED LACES OF STRUT @ L10	CCC5 SH62					16			
		E	L10E	REPLACE 6 UPPER GUSSET RIVETS @ L10E	CCC5 SH62		6						
		E	L9E-L10W	REPLACE 6 DETERIORATED LACES OF BRACING	CCC5 SH33					6			
		E	L9W-L10E	REPLACE 6 DETERIORATED LACES OF BRACING	CCC5 SH33					6			
	*	F		REPLACE ALL DETERIORATED LACES OF LOWER EAST - WEST TRUSS @ L10 (+ 90%)	CCC5 SH62					130			
	*	F		REPLACE ALL DETERIORATED RIVETS OF LOWER EAST-WEST TRUSS @ L10 (+ 90%)	CCC5 SH62		195						
		F		REPLACE 2 DETERIORATED STAY PLATES OF LOWER EAST-WEST @ L10	CCC5 SH62				2				
10-11		A	U10E-U11E	REPAIR DETERIORATED LACING	CCC5 SH12					10			
		A	L10E-U11E	REPAIR DETERIORATED LACING	CCC5 SH20					10			
		B	FB10N	REPLACE 1 MISSING BOLT @ SOUTH END OF ST-1	CCC5 SH28		1						
		B	FB10N	REPLACE 2 EAST CLIP ANGLE RIVETS	CCC5 SH28		2						
		B	FB10N	REPLACE 3 BOTTOM FLANGE RIVETS @ WEST END	CCC5 SH28		3						

SPAN BAY	REPAIR NO.	MEM. TYPE	LOCATION OF MEMBER	DESCRIPTION OF REPAIR	SHOP DRAWING NO.	REPAIR DETAIL NO.	SUMMARY OF REPAIRS RIVETS	PLATES	LACE	MEMBER	OTHER	BID ITEM NO.	NOTES
SPAN	1 (CONT'D)												
		B	FB11S	REPLACE 1 DETERIORATED BOTTOM COVER RIVET	CCC5 SH29		1						
		B	FB11S	REPAIR WEB SURFACE AT WEST END						1			
		B	ST-9	REPAIR UNDERSIDE OF TOP FLANGE	CCC5 SH61669						1		
		G	L10	REPLACE DETERIORATED LACE OF STRUT @ L10	CCC5 SH50				60				
		G	L10	REPLACE + 50% OF LACING RIVETS AT STRUT	CCC5 SH50		90						
		G	L10W	REPLACE 8 LOWER GUSSET RIVETS @ L10W	CCC5 SH46		8						
		G	L10E	REPLACE 20 UPPER GUSSET RIVETS @ L10E	CCC5 SH46		20						
		G	L10E	REPAIR DETERIORATED LOWER GUSSET @ L10E	CCC5 SH46			1					
		G	L10E	REPLACE + 80% OF RIVETS THROUGH WIND CHORD CHANNELS @ SOUTH END	CCC5 SH47		80						
		G	L10W-L11E	REPAIR UPPER FLANGE OF BRACING	CCC5 SH47						1		
		G	L10W-L11E	REPAIR LOWER FLANGE OF BRACING	CCC5 SH47						1		
11-12		A	L11W-L12W	REPLACE SOUTH UPPER STAY PLATE	CCC5 SH5				1				
		A	L11W-L10W	REPLACE NORTH UPPER & LOWER STAY PLATES	CCC5 SH5				2				
		A	L11W-L12W	REPAIR SHIM PLATES @ NORTH END	CCC5 SH5				1				
		A	L11E-L12E	REPLACE SOUTH UPPER & LOWER STAY PLATES	CCC5 SH5				2				
		A	L11E-L12E	REPLACE NORTH UPPER STAY PLATE	CCC5 SH5				1				
		B	FB11N	REPLACE 6 BOTTOM FLANGE RIVETS @ EAST END	CCC5 SH29		6						
		B	FB11N	REPAIR FLOOR BEAM STIFFENER ANGLE @ EAST END	CCC5 SH29						1		
		B	FB11N	REPLACE 6 BOTTOM FLANGE RIVETS @ WEST END	CCC5 SH29		6						
		B	FB11N	REPLACE 5 BOTTOM COVER RIVETS @ WEST END	CCC5 SH29		5						
			FB12S	REPLACE 2 BOTTOM FLANGE RIVETS @ WEST END	CCC5 SH30		2						
11-12		B	FB12S	REPLACE 1 TOP FLANGE RIVET @ WEST END	CCC5 SH30		1						
		D	U11	REPLACE 10 LOWER FLANGE RIVETS OF STRUT @ U11	CCC5 SH41		10						
		D	U12	REPLACE 7 LOWER FLANGE RIVETS OF STRUT @ U12	CCC5 SH41		7						
		E	L12	REPLACE + 80% OF LOWER FLANGE RIVETS OF STRUT @ L12	CCC5 SH35		144						
		G	L11E	REPLACE 3 UPPER GUSSET RIVETS @ L11E	CCC5 SH47		3						
		G	L10E-L11W	REPAIR DETERIORATED LOWER FLANGE OF BRACING @ L11W	CCC5 SH50						1		
		G	L10E-L11W	REPLACE 5 LOWER GUSSET RIVETS @ L10W	CCC5 SH47		5						
		G	L11-L12W	REPAIR DETERIORATED LOWER FLANGE OF BRACING UNDER CATWALK	CCC5 SH50						1		
		G	L11E-L12W	REPAIR 7 DETERIORATED LACES OF BRACING	CCC5 SH50					7			
12-13		A	L13E-U13E	REPAIR + 70% OF LACING	CCC5 SH26					70			
		A	L12E-U13E	REPLACE 7 TOP LACING RIVETS	CCC5 SH22		7						
		A	U12E-U13E	REPLACE NORTH UPPER STAY PLATE	CCC5 SH14				1				
		B	FB12N	REPAIR FLOOR BEAM STIFFENER @ WEST END	CCC5 SH30						1		
		B	FB12N	REPLACE 5 BOTTOM FLANGE RIVETS @ EAST END	CCC5 SH30		5						
		C	SIDEWALK	REPAIR DETERIORATED BRACING GUSSET @ NORTH END	CCC5 SH56				1				
		G	L12E-L13W	REPAIR DETERIORATED LOWER FLANGE OF BRACING UNDER CATWALK	CCC5 SH50						1		
		G	L12E-L13W	REPAIR 2 LACING RIVETS OF BRACING	CCC5 SH50		2						
		A	L12E-L13E	REPLACE + 10% OF TOP LACING RIVETS	CCC5 SH6		11						
13-14		A	U13E-L14E	REPAIR + 60% OF LACING	CCC5 SH23					75			
		A	L13E-L14E	REPAIR + 50% OF LACING	CCC5 SH7					38			
		A	L14E-U14E	REPAIR + 45% OF LACING	CCC5 SH27					41			
		A	U13W-U14W	REPLACE DETERIORATED NORTH STAY PLATE	CCC5 SH15				1				
		B	FB13N	REPLACE 1 BOTTOM COVER RIVET @ WEST END	CCC5 SH29		1						
		B	FB14S	REPAIR FLOOR BEAM STIFFENER @ WEST END	CCC5 SH30						1		
		D	U13	REPLACE 6 LOWER FLANGE RIVETS OF STRUT	CCC5 SH41		6						
		D	U14E	REPAIR DETERIORATED UPPER GUSSET @ U14E	CCC5 SH44				1				

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY	DR. BY	CK. BY

SUBMITTED:
CHIEF STRUCT. SECTION
APPROVAL RECOMMENDED:
CHIEF, DESIGN BRANCH
REVIEWED:
PROJECT MANAGER
APPROVAL RECOMMENDED:
CHIEF PROJECT BRANCH

MAJOR REHABILITATION PROJECT

CAPE COD CANAL BRIDGES

BOURNE HIGHWAY BRIDGE

STRUCTURAL STEEL REPAIR SUMMARY I

BOURNE MASSACHUSETTS

APPROVED DATE

CHIEF, ENGINEERING DIVISION

SCALE SPEC. NO.

DRAWING NUMBER

SHEET

CORPS OF ENGINEERS

U. S. ARMY

FIG. 20

SPAN BAY	REPAIR NO.	MEM. TYPE	LOCATION OF MEMBER	DESCRIPTION OF REPAIR	SHOP DRAWING NO.	REPAIR DETAIL NO.	SUMMARY OF REPAIRS RIVETS	PLATES	LACE	MEMBER	OTHER	BID ITEM NO.	NOTES
SPAN	1 (CONT'D)												
13-14		D	U13W-U14E	REPAIR DETERIORATED LOWER FLANGE OF BRACING @ U14E	CCC5 SH44					1			
		D	U13W-U14E	REPLACE 2 LOWER GUSSET RIVETS @ U14E	CCC5 SH44		2						
		E	L13	REPLACE 9 LOWER FLANGE RIVETS OF STRUT	CCC5 SH35		9						
		E	L14	REPLACE 8 LOWER FLANGE RIVETS OF STRUT	CCC5 SH35		8						
		G		REPLACE 3 UPPER LACING RIVETS OF EAST WIND CHORD	CCC5 SH48		3						
		G		REPLACE 3 UPPER FLANGE RIVETS OF WEST WIND CHORD	CCC5 SH48		3						
		G		REPLACE 3 LOWER GUSSET RIVETS @ L14W	CCC5 SH48		3						
		G	L13W-L14W	REPAIR DETERIORATED LACE OF BRACING					1				
		G	L13W-L14E	REPAIR DETERIORATED LOWER FLANGE OF BRACING @ L13W	CCC5 SH50						1		
		G	L13E-L14W	REPAIR DETERIORATED LOWER FALNGE OF BRACING @ CATWALK	CCC5 SH50						1		
14-15		A	L14E-L15E	REPALCE SOUTH UPPER AND LOWER STAY PLATES	CCC5 SH8			2					
		A	L14W-L15W	REPLACE SOUTH UPPER AND LOWER STAY PLATES	CCC5 SH8			2					
		A	U14E-U15E	REPLACE 1 STAY PLATE RIVET	CCC5 SH16		1						
		A	L14E-L15E	REPLACE NORTH LOWER STAY PLATE	CCC5 SH8			1					
		A	L14W-L15W	REPLACE NORTH UPPER AND LOWER STAY PLATE	CCC5 SH8			2					
		B	FB15S	REPAIR WEB @ WEST END	CCC5 SH29						1		
		G	L14W-L15W	REPLACE ± 30% OF LACES OF BRACING	CCC5 SH50					8			
		G		REPLACE 2 BOTTOM FLANGE RIVETS OF WEST CHORD	CCC5 SH48		2						
15-16		A	L15E-L16E	REPLACE SOUTH UPPER & LOWER STAY PLATES	CCC5 SH9			2					
		A	L15E-L16E	REPLACE NORTH LOWER STAY PLATE	CCC5 SH9			1					
		A	U15E-L16E	REPLACE DETERIORATED LACING	CCC5 SH24					10			
		A	U15E-L16E	REPLACE ± 40% OF LACING RIVETS	CCC5 SH24			80					
		A	U15E-U16E	REPLACE DETERIORATED NORTH STAY PLATE	CCC5 SH17				1				
		A	U15E-U16E	REPLACE DETERIORATED LACING	CCC5 SH17					10			
		A	L16E-U16E	REPAIR + 10% OF LACING	CCC5 SH27					10			
		A	U15W-L16W	REPLACE ± 50% OF LACING	CCC5 SH24					60			
15-16		A	L15W-L16W	REPLACE NORTH & SOUTH LOWER & UPPER STAY PLATES	CCC5 SH9				4				
		B	FB16S	REPAIR FLOOR BEAM STIFFENER @ WEST END	CCC5 SH31						1		
		D	U15E	REPLACE 7 LOWER GUSSET RIVETS @ U15E	CCC5 SH45		7						
		D	U16E	REPLACE 3 LOWER GUSSET RIVETS @ U16E	CCC5 SH45		3						
		G		REPLACE 2 UPPER FLANGE RIVETS OF WEST WIND CHORD	CCC5 SH49		2						
		G		REPLACE 9 LOWER GUSSET RIVETS @ L15W	CCC5 SH49		9						
		G		REPLACE 2 LOWER GUSSET RIVETS @ L16W	CCC5 SH49		2						
		G	L15E-L16W	REPAIR DETERIORATED LOWER FLANGE OF BRACING	CCC5 SH50						1		
		G	L15E-L16W	REPLACE 2 GUSSET RIVETS @ BRACING INTERSECTION	CCC5 SH50		2						
		G	L15W-L16E	REPLACE ± 50% OF LACES OF BRACING	CCC5 SH50					13			
		G	L15W-L16E	REPLACE 10 UPPER GUSSET RIVETS @ L16E	CCC5 SH50		10						
16-15'		A	L16W-L15'W	REPLACE SOUTH LOWER AND UPPER STAY PLATE	CCC5 SH9				2				
		A	L16E-L15'E	REPLACE NORTH LOWER AND UPPER STAY PLATE	CCC5 SH9				2				
		A	U16E-U15'E	REPLACE DETERIORATED NORTH STAY PLATE	CCC5 SH17				1				
		B	FB15'S	REPAIR WEB @ WEST END	CCC5 SH29						1		
		B	FB15'S	REPLACE 2 TOP FLANGE RIVETS @ WEST END	CCC5 SH29		2						
		B	ST-1	REPAIR DETERIORATED TOP& BOTTOM FLANGES	CCC5 SH61669						1		
		B	ST-4	REPAIR DETERIORATED TOP & BOTTOM FLANGES	CCC5 SH61669						1		
		B	ST-5	REPAIR DETERIORATED TOP & BOTTOM FLANGES	CCC5 SH61669						1		
		D	U15'E	REPLACE 1 UPPER GUSSET RIVET @ U15'E	CCC5 SH45		1						
		E	L16E-L15'W	REPAIR + 75% OF LACES OF BRACING	CCC5 SH37					32			
		E		REPAIR DETERIORATED LOWER GUSSET @ L15'E	CCC5 SH36				1				
		G	L16E-L15'W	REPAIR DETERIORATED UPPER FLANGE OF BRACING @ L16E	CCC5 SH50						1		
		G	L16W-L15'E	REPAIR + 60% OF LACES OF BRACING	CCC5 SH50					16			
		G		REPLACE 3 LOWER FLANGE RIVETS OF WEST CHORD	CCC5 SH49		3						
		G		REPLACE 8 UPPER FLANGE RIVETS OF WEST CHORD	CCC5 SH49		8						
15'-16'		A	U15'-U14'E	REPLACE DETERIORATED SOUTH STAY PLATE	CCC5 SH16				1				
		A	L15'E-L14'E	REPLACE SOUTH UPPER & LOWER STAY PLATES	CCC5 SH8				2				
		A	U14'W-U15'W	REPLACE DETERIORATED NORTH STAY PLATE	CCC5 SH16				1				
		A	L15'E-L14'W	REPLACE DETERIORATED NORTH UPPER STAY PLATE	CCC5 SH8				1				
		A	U15'W-L14'W	REPLACE + 60% OF LACING RIVETS	CCC5 SH23		35						
		A	L15'W-L14'W	REPLACE DETERIORATED NORTH UPPER STAY PLATE	CCC5 SH8				1				
		B	FB14'S	REPLACE 1 BOTTOM FLANGE RIVET @ WEST END	CCC5 SH30		1						
		B	FB14'S	REPLACE 2 BOTTOM FLANGE RIVETS @ EAST END	CCC5 SH30		2						
		G	L14'W	REPLACE 7 LOWER GUSSET RIVETS @ L14'W	CCC5 SH49		7						
		G	L15'E-L14'W	REPAIR DETERIORATED LOWER FLANGE OF BRACING	CCC5 SH50						1		
14'-13'		B	FB13'S	REPLACE 7 BOTTOM FLANGE RIVETS @ EAST END	CCC5 SH29		7						
		B	FB13'S	REPAIR TOP FLANGE @ EAST END	CCC5 SH29						1		
		C	WALKWAY	REPAIR DETERIORATED NORTH-SOUTH SUPPORTING ANGLE	CCC5 SH64666						1		
		D	U14'W	REPLACE LOWER GUSSET RIVET @ U14'W	CCC5 SH42		1						
		D	U14'W-U13'E	REPAIR DETERIORATED LOWER FLANGE OF BRACING @ U13'E	CCC5 SH40						1		
		E	L14'E-L13'W	REPAIR DETERIORATED FLANGES OF BRACING @ L14'E	CCC5 SH37						1		
		E	L13'	REPLACE ± 50% OF LOWER FLANGE RIVETS OF STRUT L13'	CCC5 SH35		90						
		G	L14'E-L13'W	REPLACE ± 10% OF LACES OF BRACING	CCC5 SH50					3			
		G	L13'E	REPLACE 13 UPPER GUSSET RIVETS @ L13'E	CCC5 SH44		13						
13'-12'		A	U13'E-U12'E	REPLACE + 60% OF LACING	CCC5 SH16					23			
		A	U13'E-U12'E	REPLACE DETERIORATED SOUTH STAY PLATE	CCC5 SH14				1				
		A	U13'E-L12'E	REPLACE DETERIORATED SOUTH LOWER STAY PLATE	CCC5 SH21				1				
		A	U13'E-L12'E	REPAIR ± 30% OF LACING	CCC5 SH21					40			
		A	U13'W-L12'W	REPAIR SOUTH MIDDLE STIFFENER PLATE	CCC5 SH21				1				
		A	U13'W-U12'W	REPLACE DETERIORATED SOUTH LOWER STAY PLATE	CCC5 SH21				1				
		A	U13'W-L12'W	REPLACE + 60% OF LOWER LACING RIVETS	CCC5 SH21		120						

SPAN BAY	REPAIR NO.	MEM. TYPE	LOCATION OF MEMBER	DESCRIPTION OF REPAIR	SHOP DRAWING NO.	REPAIR DETAIL NO.	SUMMARY OF REPAIRS RIVETS	PLATES	LACE	MEMBER	OTHER	BID ITEM NO.	NOTES
SPAN	1 (CONT'D)												
13'-12'		A	U13'E-L12'E	REPLACE DETERIORATED NORTH LOWER STAY PLATE	CCC5 SH21				1				
		B	FB13'N	REPLACE 4 BOTTOM FLANGE RIVETS @ EAST END	CCC5 SH29			4					
		B	FB12'S	REPLACE 4 BOTTOM FLANGE RIVETS @ EAST END	CCC5 SH30			4					
		C	L13'W-L12'E	REPLACE ± 20% OF LACES OF BRACING	CCC5 SH50					5			
12'-11'		A	U12'-U11'E	REPLACE DETERIORATED LACING	CCC5 SH13					1			
		A	L12'E-L11'E	REPLACE SOUTH UPPER AND LOWER STAY PLATES	CCC5 SH6				2				
		A	U12'E-U11'E	REPAIR + 45% OF LACING	CCC5 SH13					19			
		A	L12'E-U11'E	REPLACE 2 DETERIORATED LACES	CCC5 SH13					2			
		A	L11'E-U11'E	REPAIR ± 35% OF LACING	CCC5 SH26					41			
		A	FPL12'W	REPAIR SHIP PLATES INSIDE CHORD	CCC5 SH5				1				
		A	L12'W-L11'W	REPLACE DETERIORATED SOUTH UPPER & LOWER STAY PLATE	CCC5 SH5				2				
		B	FB11'S	REPLACE 12 BOTTOM FLANGE RIVETS @ EAST END				12					
		C	WALKWAY	REPAIR DETERIORATED NORTH-SOUTH SUPPORTING ANGLE	CCC5 SH55						1		
		D		REPLACE 2 UPPER GUSSET RIVETS @ U12'W	CCC5 SH43		2						
		D		REPLACE 2 LOWER GUSSET RIVETS @ U12'E	CCC5 SH43		2						
		D	U11'	REPLACE 10 LACING RIVETS @ STRUT	CCC5 SH41		10						
		E		REPLACE + 40% OF LOWER FLANGE RIVETS OF STRUT @ L12'	CCC5 SH35		72						
		G		REPLACE 1 LOWER GUSSET RIVET @ L12'E	CCC5 SH47		1						
		G		REPLACE 6 UPPER GUSSET RIVETS @ L11'E	CCC5 SH47		6						
		G	L12'W-L11'E	REPAIR DETERIORATED LOWER FLANGE OF BRACING @ L12'W	CCC5 SH50						1		
11'-10'		A	L11'E-L10'E	REPLACE DETERIORATED NORTH UPPER STAY PLATE	CCC5 SH344				1				
		A	L11'E-L10'E	REPAIR DETERIORATED NORTH MIDDLE STIFFENER PLATE	CCC5 SH344				1				
		A	L11'E-L10'E	REPLACE 12 DETERIORATED LACINGS	CCC5 344					12			
		A	L11'E-L10'E	REPLACE 3 TOP LACING RIVETS	CCC5 SH344		3						
		A	U11'W-L10'W	REPLACE DETERIORATED NORTH LOWER STAY PLATE	CCC5 SH12				1				
		B	FB11'N	REPAIR FLOOR BEAM STIFFENER @ WEST END	CCC5 SH29						1		
		B	FB10'S	REPAIR WEB @ EAST END	CCC5 SH28						1		
11'-10'		B	FB10'S	REPLACE 3 BOTTOM FLANGE RIVETS @ WEST END	CCC5 SH28		3						
		B	ST-5	REPLACE 6 RIVETS @ NORTH END	CCC5 SH61669		6						
		B	ST-8	REPLACE 17 RIVETS @ NORTH SUPPORT			17						
		C	WALKWAY	TIGHTEN LOOSE GRATING SECTIONS							1		
		C	SIDEWALK	REPAIR SIDEWALK CHANNEL SUPPORT ON EAST & WEST SIDES							2		
		G	L11'E-L10'W	REPAIR DETERIORATED UPPER AND LOWER FLANGES	CCC5 SH50						1		
		G	L11'E-L10'W	REPLACE ± 5% OF LACES OF BRACING	CCC5 SH50					3			
		G		REPLACE 3 UPPER GUSSET RIVETS @ L10'W	CCC5 SH40		3						
		G		REPLACE 5 LOWER GUSSET RIVETS @ L10'W	CCC5 SH46		5						
		G		REPLACE 8 WEST WIND CHORD RIVETS @ NORTH END	CCC5 SH47		8						
		G		REPLACE DETERIORATED LACES OF STRUT @ L10' (+90%)	CCC5 SH50					58			
		G		REPLACE 40 LOWER LACING RIVETS OF STRUT L10'	CCC5 SH50		40						
		G		REPLACE 40 UPPER LACING RIVETS OF STRUT L10'	CCC5 SH50		40						
		G		REPLACE 14 RIVETS OF NORTH CHANNEL OF STRUT @ L10'	CCC5 SH50		14						
		G		REPALCE 45 RIVETS OF EAST WIND CHORD @ NORTH END q	CC5 SH47		45						
		G		REPLACE 4 UPPER FLANGE RIVETS OF EAST WIND CHORD	CCC5 SH47		4						
		G		REPLACE 6 LOWER GUSSET RIVETS @ L10'W	CCC5 SH46		6						
		G	L11'W-L10'E	REPAIR DETERIORATED LOWER FLANGE OF BRACING @ L10'E	CCC5 SH50						1		
10'-9'		A	L10'E-L9'E	REPLACE DETERIORATED SOUTH UPPER STAY PLATE	CCC5 SH162				1				
		A	L10'E-L9'E	REPLACE 4 MIDDLE STIFFENER PLATE RIVETS	CCC5 SH162		4						
		A	L10'E-L9'E	REPLACE DETERIORATED NORTH UPPER STAY PLATE	CCC5 SH162				1				
		A	U10'E-U9'E	REPLACE 8 DETERIORATED LACE	CCC5 SH162					8			
		B	FB10'N	REPLACE 4 BOTTOM FLANGE RIVETS @ EAST END	CCC5 SH28		4						
		B	FB10'N	REPLACE 4 BOTTOM FLANGE RIVETS @ WEST END	CCC5 SH28		4						
		B	FB9'S	REPLACE 1 BOTTOM COVER RIVET	CCC4 SH75		1						
		B	FB9'S	REPAIR WEB @ WEST END	CCC4 SH75						1		
		B	FB9'S	REPAIR 2 FLOOR BEAM STIFFENERS @ WEST END	CCC4 SH75						2		
		B	ST-1	REPAIR UNDERSIDE OF TOP FLANGE	CCC5 SH61669							1	
		B	ST-5	REPAIR DETERIORATED BOTTOM FLANGE @ NORTH END	CCC5 SH61669							1	
10'-9'		B	ST-6	REPAIR DETERIORATED BOTTOM FLANGE @ NORTH END	CCC5 SH61669							1	
		C	SIDWALK	REPAIR DETERIORATED BRACING AROUND MANHOLE	CCC5 SH53							1	
		D		REPAIR ± 50 % OF LOWER FACES OF STRUT @ U10'	CCC5 SH41					62			
		D		REPALCE 10 LACING RIVETS @ STRUT U10'	CCC5 SH41		10						
		D		REPAIR DETERIORATED UPPER GUSSET @ U10'E	CCC5 SH42				1				
		E		REPLACE + 20% OF LACES OF STRUT @ L10'	CCC5 SH62					24			
		F		REPLACE + 50% OF DETERIORATED LACES OF LOWER EAST-WEST TRUSS @ L10'	CCC5 SH62					35			
		F		REPLACE + 25% RIVETS OF LOWER EAST-WEST TRUSS @ L10'	CCC5 SH62		35						
				REPLACE 1 DETERIORATED STAY PLATE OF LOWER EAST-WEST TRUSS @ L10'	CCC5SH62				1				

SPAN BAY	REPAIR NO.	MEM. TYPE	LOCATION OF MEMBER	DESCRIPTION OF REPAIR	SHOP DRAWING NO.	REPAIR DETAIL NO.	SUMMARY OF REPAIRS RIVETS	PLATES	LACE	MEMBER	OTHER	BID ITEM NO.	NOTES
SPAN 2													
9' -8'		A	L9'E-L8'E	REPLACE DETERIORATED NORTH UPPER STAY PLATE	CCC4 SH17,18				1				
		A	U9'W-U8'W	REPLACE 5 DETERIORATED LACES	CCC4 SH 27					5			
		C	SIDEWALK	REPLACE 3 CLIP ANGLE RIVETS AT NORTH END	CCC4 SH 46		3						
		C	SIDEWALK	REPAIR DETERIORATED BRACING AT SOUTH END	CCC4 SH 46					1			
		C	SIDE WALK	REPAIR DETERIORATED LOWER FLANGE OF EAST CHANNEL	CCC4 SH 46					1			
		C	WALKWAY	REPAIR ALL DETERIORATED EAST-WEST SUPPORT ANGLES	CCC4 SH70,71					2			
		B	FB8'S	REPLACE ± 40% LOWER FLANGE RIVETS AT EAST END	CCC4 SH 5		6						
		B	FB3'S	REPAIR FLOOR BEAM STIFFENER AT WEST END	CCC4 SH 5					1			
		E	L9'	REPLACE 10 UPPER LACES OF STRUT AT L9'	CCC4 SH 51					10			
		E	L9'W	REPAIR DETERIORATED UPPER GUSSET AT L9'W	CCC4 SH 62				1				
		E	L9'E	REPAIR DETERIORATED UPPER GUSSET AT L9'E	CCC4 SH 62				1				
		F	L9'E-L8'W	REPLACE 3 DETERIORATED LACES OF BRACING	CCC4 SH 47					3			
		E	L8'W	REPAIR DETERIORATED UPPER GUSSET AT L8'W	CCC4 SH 50				1				
		E	L8'E	REPLACE 5 UPPER GUSSET RIVETS AT L8'E	CCC4 SH 50		5						
		E	L8'	REPLACE 6 DETERIORATED LACES OF STRUT AT L8'	CCC4 SH 51					6			
		F		REPAIR DETERIORATED FLANGES OF UPPER EAST BRACING	CCC4 SH 65						1		
		F		REPLACE ± 40% AT LACES AT UPPER EAST BRACING	CCC4 SH 65					28			
		F		REPAIR DETERIORATED UPPER EAST GUSSETS	CCC4 SH 65				1				
		F		REPAIR DETERIORATED UPPER WEST GUSSET	CCC4 SH 65				1				
		F		REPAIR ALL STAY PLATES OF BRACES AT MIDDLE GUSSET	CCC4 SH 64				4				
8' -7'		A	L8'W-L7'E	REPLACE 4 DETERIORATED LOWER LACES	CCC4 SH15,16					4			
		B	FB 7'S	REPAIR FLOOR BEAM, STIFFNERS AT WEST END	CCC4 SH 4						1		
		C	SIDEWALK	REPLACE 3 DETERIORATED BRACING GUSSETS	CCC4 SH 45				3				
		F		REPAIR ± 20% OF LACES AT UPPER EAST BRACING	CCC4 SH 65					14			
		F		REPAIR ± 5% OF LACES AT UPPER WEST BRACING	CCC4 SH 65					4			
		F		REPAIR DETERIORATED UPPER WEST GUSSETS	CCC4 SH 65				1				
7' -6'		B	FB6'S	REPLACE 4 BOTTOM FLANGE RIVETS AT EAST END	CCC4 SH 1		4						
		E	L7'	REPLACE 10 DETERIORATED LACES AT STRUT AT L7'	CCC4 SH 47					10			
		E	L7'W	REPLACE 1 UPPER GUSSET RIVET AT L7'W	CCC4 SH 15		1						
	*	E	L7'E	REPAIR DETERIORATED UPPER GUSSET AT L7'E	CCC4 SH 15				1				
	*	E	L7'E	REPLACE 4 UPPER GUSSET RIVETS AT L7'E	CCC4 SH 35		4						
		E	L7'E	REPAIR DETERIORATED LOWER GUSSET AT L7'E	CCC4 SH 15				1				
	*	E	L6'W	REPLACE DETERIORATED UPPER GUSSET AT L6'W	CCC4 SH 50				1				
	*	E	L6'W	REPLACE 2 UPPER GUSSET RIVETS AT L6'W	CCC4 SH 50		2						
	*	E	L6'W	REPLACE DETERIORATED LOWER, GUSSET AT L6'W	CCC4 SH 50				1				
	*	E	L6'W	REPLACE 8 LOWER GUSSET RIVETS AT L6'W	CCC4 SH 50		8						
	*	E		REPLACE DETERIORATED LOWER GUSSET AT L6'E	CCC4 SH 50				1				
	*	E		REPLACE 9 LOWER GUSSET RIVETS	CCC4 SH 50		9						
		E		REPLACE UPPER GUSSET AT L6'E	CCC4 SH 50				1				
		F		REPLACE 6 LOWER GUSSET RIVETS	CCC4 SH 64		6						
		F		REPAIR DETERIORATED FLANGES OF UPPER EAST BR	CCC4 SH 64						1		
6' -5'		A	L6'E-L5'E	REPLACE 5 DETERIOATED UPPER STAY PLATE RIVETS	CCC4 SH13,14		5						
		B	FB6'N	REPLACE 3 BOTTOM FLANGE RIVETS AT EAST END	CCC4 SH 7		3						
		B	FB5'S	REPLACE 6 BOTTOM FLANGE RIVETS AT EAST END	CCC4 SH 2		6						
		F		REPAIR ± 50% OF LACES OF UPPER EAST BRACING	CCC4 SH 64					35			
		F		REPLACE ± 30% OF LACES AT UPPER WEST BRACING	CCC4 SH 64					21			
5' -4'		A	L5'E -L4'E	REPLACE 6 DETERIORATED UPPER STORY PLATE RIVETS	CCC4 SH13,14		6						
		B	FB4'S	REPLACE 7 BOTTOM FLANGE RIVETS AT EAST END	CCC4 SH 1		7						
		B	FB4'S	REPAIR TOPS BOTTOM FLANGES AT EAST END	CCC4 SH 1						2		
		B	FB4'S	REPLACE 4 BOTTOM FLANGE RIVETS AT WEST END	CCC4 SH 1		4						
		D		REPAIR DETERIORATED NORTHWEST LOWER GUSSET	CCC4 SH 61				1				
	*	D		REPAIR DETERIORATED NORTHEST UPPER GUSSET	CCC4 SH 61				1				

SAFETY PAYS

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY | DR. BY | CK. BY

SUBMITTED

CHIEF, STRUCT. SECTION
APPROVAL RECOMMENDED

CHIEF, DESIGN BRANCH
APPROVED

PROJECT MANAGER
APPROVAL RECOMMENDED

CHIEF, PROJECT BRANCH

MAJOR REHABILITATION PROJECT

CAPE COD CANAL BRIDGES

BOURNE HIGHWAY BRIDGE

STRUCTURAL STEEL REPAIR SUMMARY II

BOURNE MASSACHUSETTS

APPROVED DATE

CHIEF, ENGINEERING DIVISION

SCALE: SPEC. NO. DACW33-78

DRAWING NUMBER

SHEET

SPAN BAY	REPAIR NO.	MEM. TYPE	LOCATION OF MEMBER	DESCRIPTION OF REPAIR	SHOP DRAWING NO.	REPAIR DETAIL NO.	SUMMARY OF REPAIRS RIVETS	PLATES	LACE	MEMBER	OTHER	BID ITEM NO.	NOTES
SPAN 2 (CONT'D)													
	*	D		REPLACE 26 NORTHEAST UPPER GUSSET RIVETS	CCC4 SH 61		26						
	*	D		REPLACE DETERIORATED NORTHEAST LOWER GUSSET	CCC4 SH 61				1				
	*	D		REPLACE 13 DETERIORATED NORTHEAST LOWER GUSSET RIVETS	CCC4 SH 61		13						
		D	U3'W-L4'W	REPAIR DETERIORATED LOWER FLANGE OF BRACING AT U4'E	CCC4 SH 60					1		
	*	D		REPAIR DETERIORATED SOUTHEAST UPPER GUSSET	CCC4 SH 62			1					
	*	D		REPLACE 2 SOUTHEAST UPPER GUSSET RIVET	CCC4 SH 62		2						
	*	D		REPAIR DETERIORATED SOUTHEAST LOWER GUSSET	CCC4 SH 62				1				
	*	D		REPLACE SOUTHEAST LOWER GUSSET RIVETS	CCC4 SH 62		1						
		F	L5'	REPLACE 13 DETERIORATED LACES OF STRUT AT L5'E	CCC4 SH 47					13			
		E	L5'	REPLACE 16 UPPER GUSSET RIVETS AT L5'E	CCC4 SH 13		16						
		E	L5'	REPLACE 17 LOWER GUSSET RIVETS AT L5'E	CCC4 SH 13		17						
	*	E	L4'	REPLACE DETERIORATED UPPER GUSSET AT L4'E	CCC4 SH 51				1				
	*	E	L4'	REPLACE 7 UPPER GUSSET RIVETS AT L4'E	CCC4 SH 51		7						
		E	L4'	REPAIR DETERIORATED LOWER GUSSET AT L4'E	CCC4 SH 51				1				
		E	L4'	REPLACE 3 DETERIORATED LACES OF STRUT AT L4'	CCC4 SH 47					3			
	*	E	L4'	REPAIR DETERIORATED LOWER GUSSET AT L4'W	CCC4 SH 51				1				
	*	E	L4'	REPLACE 20 LOWER GUSSET RIVETS AT L4'W	CCC4 SH 51		20						
		F		REPLACE 2 DETERIORATED LACE AT UPPER EAST BRACING	CCC4 SH 65					2			
		F		REPLACE 1 DETERIORATED LACE AT UPPER WEST BRACING	CCC4 SH 65					1			
		F		REPLACE 3 LACING RIVETS AT UPPER WEST BRACING	CCC4 SH 65		3						
		F		REPAIR DETERIORATED MIDDLE GUSSETS	CCC4 SH 65				1				
2' - 3'		B	FB4'N	REPLACE 2 BOTTOM FLANGE RIVETS AT EAST END	CCC4 SH1		2						
		B	FB3'S	REPAIR FLOOR BEAM STIFFENER AT WEST AND EAST END	CCC4 SH 2					2			
		B	FB3'S	REPLACE 6 BOTTOM FLANGE RIVETS AT EAST END	CCC4 SH 2		6						
		B	ST-9	REPAIR UNDERSIDE AT TOP FLANGE	CCC4 SH40,63					1			
		D		REPLACE DETERIORATED NORTHWEST LOWER GUSSET	CCC4 SH 61				1				
		D		REPLACE 4 NORTHWEST LOWER GUSSET RIVETS	CCC4 SH 61		4						
	*	D		REPAIR DETERIORATED NORTHEAST UPPER GUSSET	CCC4 SH 61				1				
	*	D		REPLACE 13 NORTHEAST UPPER GUSSET RIVETS	CCC4 SH 61		13						
	*	D		REPAIR DETERIORATED NORTHEAST LOWER GUSSET	CCC4 SH 61				1				
	*	D		REPLACE 1 NORTHEAST LOWER GUSSET RIVET	CCC4 SH 61		1						
		D		REPAIR DETERIORATED SOUTHEAST LOWER GUSSET	CCC4 SH 61				1				
1'-0'		A	L1'E-L0'E	REPLACE ± 10% LOWER LACES	CCC4 SH 9					9			
		B	FB0'S	REPLACE ± 80% OF BOTTOM FLANGE RIVETS	CCC4 SH 3		12						
		B	FB0'S	REPAIR 2 FLOOR BEAM STIFFENERS	CCC4 SH 3					2			
		B	FB0'S	REPLACE 3 BOTTOM FLANGE RIVETS AT EAST END	CCC4 SH 3		3						
		C		REPAIR 2 DETERIORATED BRACING GUSSETS AT NORTH END	CCC4 SH 61				2				
		D		REPLACE 3 NORTHWEST UPPER GUSSET RIVETS	CCC4 SH 61		3						
		D		REPAIR DETERIORATED NORTHWEST LOWER GUSSET	CCC4 SH 61				1				
		D		REPAIR DETERIORATED NORTHEAST LOWER GUSSET	CCC4 SH 61				1				
	*	D		REPAIR DETERIORATED NORTHEAST UPPER GUSSET	CCC4 SH 61				1				
	*	D		REPLACE ± 90% OF NORTHEAST UPPER GUSSET RIVETS	CCC4 SH 61		45						
		D	L1'W-L0'E	REPAIR LOWER FLANGE OF BRACING AT NORTHEAST GUSSETS	CCC4 SH 60						1	
		D		REPAIR DETERIORATED SOUTHEAST LOWER GUSSET					1				
		E	L3'E	REPLACE 1 LOWER GUSSET RIVET			1						
		E	L1'	REPAIR ± 40% OF LOWER LACES OF STRUT	CCC4 SH 47					50			
		E	L1'	REPLACE 7 UPPER GUSSET RIVETS AT L1'	CCC4 SH 9		7						
		E	L0'	REPLACE 15% OF DETERIORATED LACES OF STRUT	CCC4 SH 51					19			
		F		REPAIR ± 50% OF LACES OF LOWER EAST BRACING	CCC4 SH 60					35			
		F		REPAIR DETERIORATED FLANGES AT UPPER EAST BRACING	CCC4 SH 66						1		
		F		REPAIR DETERIORATED UPPER EAST GUSSET	CCC4 SH 66				1				
		F		REPLACE ± 45% OF LACES OF UPPER WEST BRACING	CCC4 SH 66					32			
		F		REPLACE ± 60% OF BRACING RIVETS AT UPPER WEST BRACING	CCC4 SH 60		32						
		D		REPLACE 3 NORTHEAST UPPER GUSSET RIVETS	CCC4 SH 61		3						
	*	D		REPLACE DETERIORATED NORTHEAST LOWER GUSSET	CCC4 SH 61				1				
	*	D		REPLACE 5 NORTHEAST LOWER GUSSET RIVETS	CCC4 SH 61		5						
	*	D		REPAIR DETERIORATED CORNER OF SOUTHEAST LOWER GUSSET	CCC4 SH 61				1				
	*	D		REPLACE 3 SOUTHEAST LOWER GUSSET RIETS	CCC4 SH 61		3						
3' -2'		B	FB2'S	REPAIR FLOOR BEAM STIFFENER AT WEST END	CCC4 SH 1						1		
		B	FB2'S	REPLACE 8 BOTTOM FLANGE RIVETS AT EAST END	CCC4 SH 1		8						
		B	FB2'S	REPAIR FLOOR BEAM STIFFENER AT EAST END	CCC4 SH 1						1		
		B	ST-9	REPAIR UNDERSIDE AT TOP FLANGE	CCC4 SH40,63						1		
		D		REPAIR DETERIORATED NORTHWEST UPPER GUSSET	CCC4 SH 61				1				
		D		REPAIR DETERIORATED NORTHWEST LOWER GUSSET	CCC4 SH 61				1				
	*	D		REPLACE 16 NORTHEAST UPPER GUSSET RIVETS	CCC4 SH 61		16						
	*	D		REPAIR DETERIORATED NORTHEAST UPPER GUSSET	CCC4 SH 61				1				
	*	D		REPAIR DETERIORATED NORTHEAST LOWER GUSSET	CCC4 SH 61				1				
	*	D		REPLACE 1 NORTHEAST LOWER GUSSET RIVET	CCC4 SH 61		1						
		E	L3'	REPLACE ± 60% OF LOWER GUSSET RIVETS AT L3'W	CCC4 SH 11		16						
		E	L3'	REPLACE 10 UPPER GUSSET RIVETS AT L3'E	CCC4 SH 11		10						
		E	L3'	REPAIR DETERIORATED LOWER GUSSET AT L3'E	CCC4 SH 11				1				
		E	L3'	REPLACE ± 60% OF LOWER LACE AT STRUT	CCC4 SH 47					75			
		E	L2'	REPAIR ± 60% OF LACE OF STRUT	CCC4 SH 47					75			
		E	L2'	REPLACE ± 30% OF LOWER FLANGE RIVETS AT 2'	CCC4 SH 47		20						
		E		REPAIR DETERIORATED UPPER GUSSET AT L2'E	CCC4 SH 51		13	1					
		E		REPLACE ± 50% OF UPPER GUSSET RIVETS AT L2'E	CCC4 SH 51								
2' -1'		B	FB1'S	REPLACE 2 BOTTOM FLANGE RIVETS AT WEST END	CCC4 SH 2		2						
		B	FB1'S	REPLACE 9 BOTTOM FLANGE RIVETS AT EAST END	CCC4 SH 2		9						
		B	FB1'S	REPAIR FLOOR BEAM STIFFENER AT EAST END	CCC4 SH 2						1		

SPAN BAY	REPAIR NO.	MEM. TYPE	LOCATION OF MEMBER	DESCRIPTION OF REPAIR	SHOP DRAWING NO.	REPAIR DETAIL NO.	SUMMARY OF REPAIRS RIVETS	PLATES	LACE	MEMBER	OTHER	BID ITEM NO.	NOTES
SPAN 7				SPAN 7									
0-1		A	PP-L1W	REPLACE 4 BOTTOM GUSSET RIVETS	CCC3 SH25		4						
		D		REPAIR SOUTHEAST GUSSET	CCC3 SH35			1					
		D		REPAIR SAGGING BRACING ANGLES	CCC3 SH35					2			
		E		REPAIR EAST BRACING ANGLES	CCC3 SH7					1			
		E		REPLACE 1 MIDDLE STRUT GUSSET RIVET	CCC3 SH33		1						
1-2	*	D		REPAIR NORTHEAST GUSSET	CCC3 SH35			1					
	*	D		REPLACE 9 NORTHEAST GUSSET RIVETS	CCC3 SH35		9						
2-3		D		REPLACE 7 SOUTHEAST GUSSET RIVETS	CCC3 SH35		7						
		D		REPAIR WEST BRACING ANGLES	CCC3 SH35					1			
3-4		D		REPLACE 4 NORTHEAST GUSSET RIVETS	CCC3 SH35		4						
		D		REPAIR SAGGING WEST BRACING ANGLES	CCC3 SH35					1			
		E		REPLACE 5 MIDDLE GUSSET RIVETS	CCC3 SH33		5						
		E	L4E	REPLACE 8 GUSSET RIVETS	CCC3 SH35		8						
		E	L4W	REPLACE 5 GUSSET RIVETS	CCC3 SH35		5						
4-5		A	L4E-U5E	REPLACE 1 LOWER LACE	CCC3 SH30					1			
	*	D		REPAIR SOUTHEAST GUSSET	CCC3 SH35			1					
	*	D		REPLACE 3 SOUTHEAST GUSSET RIVETS	CCC3 SH35		3						
		D		REPAIR SAGGING BRACING ANGLES	CCC3 SH35					1			
6-7		D		REPLACE 2 SOUTHEAST GUSSET RIVETS	CCC3 SH35		2						
		D		REPAIR SAGGING EAST BRACING ANGLES	CCC3 SH35					1			
7-8		A	L8W-U8W	REPAIR UPPER MIDDLE STIFFNER PLATE	CCC3 SH29				1				
		B	FB8S	REPLACE 1 TOP FLANGE RIVET EAST END	CCC3 SH61		1						
		C	SIDEWALK	REPAIR UPPER SIDEWALK BRACING @ NORTH END	CCC3 SH37					1			
		E		REPAIR DETERIORATED WEST BRACING ANGLE	CCC3 SH35					1			
SPAN 5				SPAN 5									
0-1		B	FB0N	REPLACE 3 BOTTOM FLANGE RIVETS @ EAST END	CCC3 SH61		3						
		D		REPLACE 1 SOUTHWEST GUSSET RIVET	CCC3 SH94		1						
		D		REPLACE 3 SOUTHEAST GUSSET RIVETS	CCC3 SH94		3						
		D		REPAIR SAGGING EAST BRACING ANGLES	CCC3 SH94					1			
		D		REPAIR DETERIORATED WEST BRACING ANGLES	CCC3 SH94					1			
		E	L0	REPAIR FLANGES OF STRUT @ L0	CCC3 SH93						1		
		E	L0E	REPLACE 3 GUSSET RIVETS @ L0E	CCC3 SH99		3						
		E		REPAIR DETERIORATED EAST BRACING ANGLE	CCC3 SH99					1			
1-2		B	FB1N	REPLACE 1 TOP FLANGE RIVET @ EAST END	CCC3 SH39		1						
2-3	*	D		REPAIR SOUTHEAST GUSSET	CCC3 SH94			1					
	*	D		REPLACE 6 SOUTHEAST GUSSET RIVETS	CCC3 SH94		6						
		D		REPAIR SAGGING EAST BRACING ANGLES	CCC3 SH94					1			
		E	L2E	REPLACE 4 GUSSET RIVETS @ L2E	CCC3 SH94		4						
		E		REPAIR DETERIORATED EAST BRACING ANGLE	CCC3 SH94					1			
		E	L3	REPLACE 1 MIDDLE GUSSET RIVET @ L3	CCC3 SH94		1						
3-4		A	L3W-L4W	REPLACE SOUTH UPPER STAY PLATE	CCC3 SH84				1				
		B	FB3N	REPLACE 1 TOP FLANGE RIVET @ EAST END	CCC3 SH39		1						
		D		REPAIR SAGGING BRACING ANGLES (2)	CCC3 SH94					2			
		E	L4E	REPLACE 1 GUSSET RIVET @ L4E	CCC3 SH94		1						
4-5		D		REPLACE 2 SOUTHEAST GUSSET RIVETS	CCC3 SH94		2						
		D		REPAIR SAGGING BRACING ANGLES (2)	CCC3 SH94					2			
		E		REPAIR DETERIORATED EAST BRACING ANGLES	CCC3 SH94					1			
5-6		A	L5E-L6E	REPLACE SOUTH UPPER STAY PLATE	CCCe SH85				1				
		A	L5W-L6W	REPAIR DETERIORATED LACING	CCC3 SH85					6			
		B	ST-1	REPAIR TOP SURFACE OF BOTTOM FLANGE @ SOUTH END	CCC3 SH36						1		
		E	L5E	REPLACE 2 GUSSET RIVETS @ L5E (STRUT)	CCC3 SH92		2						
5-6		E	L6	REPAIR DETERIORATED LACING OF STRUT @ L6	CCC3 SH92					(25)			
6-7		A	L6E-U7E	REPAIR DETERIORATED LACING (APPROX. FULL LENGTH)	CCC3 SH88					(16)			
		A	L6E-L7E	REPAIR DETERIORATED LACING (APPROX. FULL LENGTH)	CCC3 SH86					(56)			
		A	L6W-L7W	REPLACE NORTH UPPER STAY PLATE	CCC3 SH86				1				
		B	FB6N	REPLACE 3 BOTTOM FLANGE RIVETS @ EAST END	CCC3 SH40		3						
		D		REPAIR DETERIORATED AND SAGGING BRACING ANGLES	CCC3 SH94					2			
		E		REPLACE 2 MIDDLE GUSSET RIVETS	CCC3 SH94		2						
7-8		A	L7E-L8E	REPAIR DETERIORATED LACING (APPROX. FULL LENGTH)	CCC3 SH86					(52)			
		A	L7W-L8W	REPLACE SOUTH SUPPER STAY PLATE	CCC3 SH86				1				
		A	L7W-L8W	REPAIR + 25% OF LOWER LACES	CCC3 SH86					52			
		B	FB7N	REPLACE 1 BOTTOM COVER RIVET	CCC3 SH39		1						
		B	FB8S	REPLACE 5 BOTTOM COVER RIVETS	CCC3 SH41		5						
	*	B	FB8N	REPAIR ALL FLOOR BEAM STIFFENERS	CCC3 SH41						11		
	*	B	FB8N	REPLACE 18 FLOOR BEAM STIFFENER RIVETS	CCC3 SH41		18						
		C	SIDEWALK	REPAIR UPPER SIDEWALK BRACING @ AROUND MANHOLE	CCC3 SH96						1		
		D		REPAIR NORTHEAST GUSSET	CCC3 SH94				1				
		D		REPLACE 1 NORTHWEST GUSSET RIVET	CCC3 SH94		1						
		D		REPLACE 3 NORTHWEST GUSSET RIVETS	CCC3 SH94		3						

SPAN BAY	REPAIR NO.	MEM. TYPE	LOCATION OF MEMBER	DESCRIPTION OF REPAIR	SHOP DRAWING NO.	REPAIR DETAIL NO.	SUMMARY OF REPAIRS RIVETS	PLATES	LACE	MEMBER	OTHER	BID ITEM NO.	NOTES
SPAN 5 (CONT'D)		D		REPAIR DETERIORATED BRACING ANGLES (2)	CCC3 SH94					2			
		E		REPAIR DETERIORATED BRACING ANGLES (2)						2			
SPAN 4				SPAN 4									
0-1		A	L0W L1W	REPAIR ± 50% OF LACE	CCC3 SH 65					21			
		B	FB0N	REPAIR FLOOR BEAM STIFFNER AT WEST END	CCC3 SH 76					1			
		B	FB0N	REPAIR GAP BETWEEN TOP FLANGE AND DECK	CCC3 SH 76						1		
		B	FB1S	REPLACE TOP FLANGE RIVET AT WEST END	CCC3 SH 74		1						
		B	FB0S	REPAIR 4 FLOOR BEAM STIFFNERS	CCC3 SH 76					4			
		B	FB0S	REPLACE 1 TOP FLANGE RIVET AT WEST END	CCC3 SH 76		1						
		B	FB0S	REPAIR WEB SURFACE AT WEST END	CCC3 SH 76					1			
		B	FB0S	REPAIR CONCRETE HAUNCH AT EAST END	-						1		
		B	FB0S	REPLACE 3 RIVETS AT EAST END	CCC3 SH 76		3						
		B	FB0S	REPAIR BROKEN ELECTRICAL CONDUIT	CCC3 SH 76						1		
		B	ST-1	REPAIR TOP SURFACE OF BOTTOM FLANGE	CCC3 SH 36					1			
		B	ST-9	REPAIR TOP SURFACE OF BOTTOM FLANGE	CCC3 SH 36					1			
	*	D		REPAER SOUTHWEST GUSSET	CCC3 SH 94			1					
	*	D		REPLACE 4 SOUTHWEST GUSSET RIVETS	CCC3 SH 94		4						
		D		REPAIR DETERIORATED BRACING ANGLES	CCC3 SH 94					2			
		E	L-0	REPLACE 115 RIVETS OF JACKING GIRDER AT L0	CCC3 SH100		115						
		E	LO-E	REPLACE 8 GUSSET RIVETS AT LO E	CCC3 SH 99		8						
		E	LO-W	REPLACE 5 GUSSET RIVETS AT LO W	CCC3 SH 99		5						
		E		REPAIR DETERIORATED BRACING	CCC3 SH 99					1			
		E	L1	REPAIR DETERIORATED BOTTOM FLANGES OF STRUT AT L1	CCC3 SH 92					1			
		F		REPAIR DETERIORATED LOWER WEST BRACING	CCC3 SH 90					1			
		F		REPAIR DETERIORATED MIDDLE GUSSET	CCC3 SH 90			1					
1-2		A	U1E-L2E	REPAIR ± 40% OF LACES	CCC3 SH 70					44			
		B	FB2S	REPAIR FLOOR BEAM STIFFNER AT EAST END	CCC3 SH 75					1			
		B	FB2S	REPLACE 4 BOTTOM FLANGE RIVETS AT EAST END	CCC3 SH 75		4						
		B	FB2S	REPAIR TOP SURFACE OF BOTTOM FLANGE AT WEST END	CCC3 SH 75					1			
		B	ST-1	REPAIR BOTTOM FLANGE AND WEB AT NORTH END	CCC3 SH 36					1			
		B	ST-9	REPAIR BOTTOM FLANGE AND WEB	CCC3 SH 36					1			
		D		REPAIR MIDDLE BRACING GUSSET	CCC3 SH 94			1					
	*	D		REPAIR NORTHEAST GUSSET	CCC3 SH 94			1					
	*	D		REPLACE 2 NORTHEAST GUSSET RIVETS	CCC3 SH 74		2						
		E	L2 E	REPLACE 2 GUSSET RIVETS AT L2E	CCC3 SH 74		2						
		F	L2 W	REPAIR BOTTOM FLANGE OF STRUT AT L2W	CCC3 SH 74					1			
2-3		A	L2E - L3E	REPLACE NORTH UPPER STAY PLATE	CCC3 SH 70			1					
		B	FB3S	REPAIR FLOOR BEAM STIFFENER AT EAST END	CCC3 SH 74					1			
		B	ST-1	REPAIR BOTTOM FLANGE AND WEB AT NORTH END	CCC3 SH 36					1			
		B	ST-9	REPAIR BOTTOM FLANGE	CCC3 SH 36					1			
		D		REPAIR DETERIORATED BRACING ANGLES 2	CCC3 SH 94					2			
		E	L2	REPAIR BOTTOM FLANGE OF STRUT AT L2E	CCC3 SH 91					1			
		E		REPAIR EAST DETERIORATED BRACING ANGLE	CCC3 SH 94					1			
		E	L3	REPAIR 2 DETERIORATED LACES AT STRUT AT L3	CCC3 SH 97					2			
		E		REPLACE 1 MIDDLE GUSSET RIVET	CCC3 SH 92		1						
3-4		A	L3E-L4E	REPLACE SOUTH UPPER STAY PLATE	CCC3 SH 70			1					
		B	FB4S	REPLACE 6 BOTTOM FLANGE RIVETS AT EAST END	CCC3 SH 75		6						
		B	ST-1	REPLACE BOTTOM FLANGE AND WEB AT NORTH END	CCC3 SH 36					1			
		B	ST-1	REPAIR UNDERSIDE OF TOP FLANGE	CCC3 SH 36					1			
		B	ST-9	REPAIR WEB AND BOTTOM FLANGE AT NORTH END	CCC3 SH 36					1			
	*	D		REPAIR NORTHEAST GUSSET	CCC3 SH 94	*	3						
	*	D		REPLACE ALL NORTHEAST GUSSET RIVETS	CCC3 SH 94		22						
		D		REPLACE 3 NORTHWEST GUSSET RIVETS	CCC3 SH 94		3						
		D		REPAIR DETERIORATED BRACING ANGLES	CCC3 SH 94					1			
		E	L-4	REPAIR BOTTOM FLANGE OF STRUT AT L4	CCC3 SH 91					1			

GRAPHIC SCALES

SAFETY PAYS

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY	DR. BY	CK. BY

SUBMITTED:
CHIEF, STRUCT. SECTION
APPROVAL RECOMMENDED:
CHIEF DESIGN BRANCH
REVIEWED:
PROJECT MANAGER
APPROVAL RECOMMENDED:
CHIEF PROJECT BRANCH

MAJOR REHABILITATION PROJECT
CAPE COD CANAL BRIDGES
BOURNE HIGHWAY BRIDGE
STRUCTURAL STEEL REPAIR SUMMARY III
BOURNE MASSACHUSETTS

APPROVED DATE
CHIEF, ENGINEERING DIVISION

SCALE
SPEC. NO.
DRAWING NUMBER
SHEET

SPAN BAY	REPAIR NO.	MEM. TYPE	LOCATION OF MEMBER	DESCRIPTION OF REPAIR	SHOP DRAWING NO.	REPAIR DETAIL NO.	SUMMARY OF REPAIRS RIVETS	PLATES	LACE	MEMBER	OTHER	BID ITEM NO.	NOTES
SPAN	4 (CONT'D)												
4-5		B	ST-1	REPAIR BOTTOM FLANGE AND WEB AT NORTH END	CCC3 SH 36					1			
		B	ST-9	REPAIR BOTTOM FLANGE AND WEB AT NORTH END	CCC3 SH 36					1			
		D		REPLACE 1 SOUTH EAST GUSSET RIVET	CCC3 SH 94		1						
		E		REPAIR DETERIORATED BRACING ANGLES	CCC3 SH 94					2			
5-6		B	FB6S	REPAIR FLOOR BEAM STIFFENER AT EAST END	CCC3 SH 75					1			
		B	FB6S	REPAIR TOP SURFACE OF LOWER FLANGE AT EAST END	CCC3 SH 75					1			
		B	FB6S	REPLACE 2 LOWER FLANGE RIVETS AT EAST END	CCC3 SH 75		7						
		B	ST-9	REPAIR BOTTOM FLANGE AND WEB AT NORTH END	CCC3 SH 36					1			
	*	D		REPAIR NORTHEAST GUSSET	CCC3 SH 94			1					
	*	D		REPLACE ALL NORTHEAST GUSSET RIVETS	CCC3 SH 94		22						
		D		REPAIR DETERIORATED BRACING ANGLES	CCC3 SH 94					1			
		E	L5	REPAIR BOTTOM FLANGE OF STRUT AT L5	CCC3 SH 91					1			
6-7		A	L6E-L7E	REPLACE 1 DETERIORATED LACING AT NORTH END	CCC3 SH 70				1				
		B	FB7S	REPAIR FLOOR BEAM STIFFENER AT EAST END	CCC3 SH 74					1			
		B	ST-1	REPAIR BOTTOM FLANGE AT NORTH END	CCC3 SH 36					1			
		B	ST-9	REPAIR BOTTOM FLANGE AND WEB AT NORTH END	CCC3 SH 36					1			
		D		REPAIR DETERIORATED BRACING ANGLES	CCC3 SH 94					1			
		E		REPAIR DETERIORATED EAST BRACING ANGLES	CCC3 SH 94					1			
		E	L-7	REPAIR SOUTH LOWER FLANGE OF STRUT AT L7	CCC3 SH 92					1			
7-8		A	U7E-L8E	REPAIR COVER PLATE	CCC3 SH 70			1					
		A	U7W-L8W	REPAIR COVER PLATE	CCC3 SH 70			1					
		A	L7E-L8E	REPLACE DETERIORATED LACING AT NORTH AND SOUTH ENDS	CCC3 SH 70				2				
		A	L7W-L8W	REPLACE DETERIORATED LACING AT NORTH END	CCC3 SH 70				1				
		B	FB7N	REPLACE 1 TOP FLANGE RIVET AT EAST END	CCC3 SH 74		1						
		B	FB8S	REPAIR FLOOR BEAM STIFFENER AT EAST END	CCC3 SH 76					1			
		B	FB8S	REPLACE 5 BOTTOM FLANGE RIVETS AT EAST END	CCC3 SH 76		5						
		B	FB8N	REPAIR FLOOR BEAM STIFFENER AT EAST END	CCC3 SH 76					1			
		B	FB8N	REPLACE 5 FLOOR BEAM STIFFENER RIVETS	CCC3 SH 76		5						
		B	FB8N	REPLACE HORIZONTAL HAUNCH ANGLES	CCC3 SH 76						1		
		B	ST-1	REPAIR UNDERSIDE OF TOP FLANGE AND TOP SURFACE OF BOTTOM FLANGE AT NORTH END	CCC3 SH 36					1			
		B	ST-9	REPAIR BOTTOM FLANGES WEB AT NORTH END	CCC3 SH 36					1			
		D		REPLACE 5 NORTHWEST GUSSET RIVETS	CCC3 SH 94		5						
		D		REPLACE 10 NORTHEAST GUSSET RIVETS	CCC3 SH 94		10						
		D		REPLACE DETERIORATED BRACING ANGLES	CCC3 SH 94					1			
		E	L8	REPLACE DETERIORATED FLANGES OF STRUT L8	CCC3 SH 93					1			
		E	L7	REPAIR DETERIORATED BOTTOM FLANGE OF STRUT AT L7	CCC3 SH 92					1			
		F	@ 8	REPAIR DETERIORATED BRACING ANGLES	CCC3 SH 31					2			
SPAN	6			SPAN 6									
0-1		A	L0W-L1W	REPAIR ± 10% of laces	CCC3 SH 13				(5)				
		A	L0E-L1E	REPLACE SOUTH UPPER STAY PLATE	CCC3 SH 13			1					
		A	FF-L1E	REPAIR LOWER EDGE OF EAST GUSSET	CCC3 SH 13			1					
		A	L0W-L1W	REPLACE SOUTH UPPER STAY PLATE	CCC3 SH 13			1					
		D		REPAIR DETERIORATED AND SAGGING BRACING ANGLES	CCC3 SH 35					2			
		E	L1	REPLACE 1 MIDDLE GUSSET RIVET AT L1	CCC3 SH 33		1						
1-2	*	D		REPAIR NORTH EAST GUSSET	CCC3 SH 35			1					
	*	D		REPLACE 7 NORTH EAST GUSSET RIVETS	CCC3 SH 35		7						
		D		REPAIR EAST BRACING ANGLES	CCC3 SH 35					1			
		E	L2E	REPAIR DETERIORATED GUSSET AT L2E	CCC3 SH 34			1					
		E	L2W	REPLACE 1 GUSSET RIVET AT L2W	CCC3 SH 34		1						
		E	L2	REPAIR DETERIORATED BOTTOM FLANGE OF STRUT L2 AT L2E	CCC3 SH 34					1			
2-3		B	FB3S	REPLACE 1 BOTTOM FLANGE RIVET AT EAST END	CCC3 SH 46		1						
		B	ST-1	REPAIR BOTTOM FLANGE AT SOUTH END	CCC3 SH 36					1			
		D		REPAIR DETERIORATED AND SAGGING BRACING ANGLES	CCC3 SH 35					1			
3-4		A	U3W-U4W	REPAIR VERTICAL STIFFNER PLATE AT NORTH END	CCC3 SH 10			1					
		A	L3W-L4W	REPAIR ± 10% TOP AND BOTTOM LACES	CCC3 SH 14				(5)				
		B	ST-1	REPAIR EAST BOTTOM FLANGE	CCC3 SH 36					1			
		B	ST 1	REPAIR WEB AT NORTH END	CCC3 SH 36					1			
		C	SIDEWALK	REPAIR DETERIORATED UPPER SIDEWALK BRACING						1			
		D		REPLACE 3 NORTH EAST GUSSET RIVETS	CCC3 SH 35		3						
		D		REPAIR DETERIORATED AND SAGGING BRACING	CCC3 SH 35					1			
		E	L4	REPAIR DETERIORATED BOTTOM FLANGE OF STRUT L4 AT L4W	CCC3 SH 35					1			
	*	E	L4W	REPAIR DETERIORATED GUSSET	CCC3 SH 34			1					
	*	E	L4W	REPLACE 1 GUSSET RIVET	CCC3 SH 34		1						
4-5		A	L4E-L5E	REPLACE 1 DETERIORATED LACE	CCC3 SH 15					1			
		A	L4E-U5E	REPAIR ± 20% OF LACE	CCC3 SH 18					(20)			
		B	ST-1	REPAIR BOTTOM FLANGE AND WEB	CCC3 SH 36						1		
		C		REPAIR DETERIORATED SIDEWALK BRACING ANGLES							1		
		D		REPAIR DETERIORATED AND SAGGING BRACING	CCC3 SH 35						1		

SPAN BAY	REPAIR NO.	MEM. TYPE	LOCATION OF MEMBER	DESCRIPTION OF REPAIR	SHOP DRAWING NO.	REPAIR DETAIL NO.	SUMMARY OF REPAIRS RIVETS	PLATES	LACE	MEMBER	OTHER	BID ITEM NO.	NOTES
SPAN	6 (CONT'D)												
5-6		A	L5W-L6W	REPLACE 1 DETERIORATED LACE	CCC3 SH 15				1				
		A	L5E-L6E	REPAIR ± 40% OF LOWER LACE	CCC3 SH 15					(18)			
		A	L5E-L6E	REPLACE NORTH AND SOUTH UPPER STORY PLATES	CCC3 SH 15			2					
		A	L5E-L6E	REPAIR ± 30% OF UPPER LACE	CCC3 SH 15					(10)			
		B	FB6S	REPAIR SIDEWALK CLIP ANGLE AT WEST END	CCC3 SH 47						1		
		B	FB6S	REPLACE 2 TOP FLANGE RIVETS AT EAST END	CCC3 SH 47								
		B	ST-9	REPAIR BOTTOM FLANGE AT SOUTH END	CCC3 SH 35								
		B	ST-9	REPAIR BOTTOM FLANGE AND WEB AT NORTH END	CCC3 SH 36					1			
		C	SIDEWALK	REPAIR SIDEWALK UPPER BRACING GUSSET AT NORTH END				1					
	*	D		REPAIR DETERIORATED CONNECTION ANGLES OF NORTHEAST GUSSET	CCC3 SH 35						1		
	*	D		REPLACE 11 NORTHEAST GUSSET RIVETS	CCC3 SH 35		11						
		D		REPAIR SAGGING BRACING ANGLES	CCC3 SH 35					1			
		E		REPLACE 1 MIDDLE GUSSET RIVET AT L5	CCC3 SH 33		1						
		E	L5	REPAIR DETERIORATED LACING AT STRUT	CCC3 SH 33				2				
		E	L6E	REPAIR DETERIORATED GUSSET	CCC3 SH 34			1					
		E	L6	REPAIR DETERIORATED BOTTOM FLANGE OF STRUT	CCC3 SH 34					1			
6-7		B	ST-1	REPAIR BOTTOM FLANGE AND WEB AT NORTH END	CCC3 SH 36					1			
		B	ST-9	REPAIR TOP AND BOTTOM FLANGES	CCC3 SH 36					1			
		B	ST-9	REPAIR BOTTOM FLANGE AND WEB AT NORTH END	CCC3 SH 36					1			
		C	SIDEWALK	REPAIR NORTH END OF WEST SIDEWALK CHANNEL						1			
		D		REPLACE 3 SOUTH EAST GUSSET RIVETS	CCC3 SH 35		3						
7-8		B	FB8S	REPAIR FLOOR BEAM STIFFENER AT WEST END	CCC3 SH 48					1			
		B	FB8N	REPAIR 4 FLOOR BEAM STIFFENERS	CCC3 SH 48					4			
		C	SIDEWALK	REPAIR LOWER FLANGE OF SIDEWALK CHANNEL AT NORTH END						1			
		D		REPAIR CONNECTION ANGLES OF NORTHEAST GUSSET	CCC3 SH 35						1		
		D		REPAIR DETERIORATED AND SAGGING BRACING	CCC3 SH 35					1			
		E	L7E	REPAIR DETERIORATED TOP FLANGES OF STRUT AT L7E	CCC3 SH 33					1			
		E	L8E	REPAIR DETERIORATED GUSSET AT L8E	CCC3 SH 4			1					
		E		REPAIR DETERIORATED EAST BRACING ANGLE	CCC3 SH 4					1			
		E	L8	REPAIR DETERIORATED TOP FLANGE OF STRUT	CCC3 SH 4					1			
		F		REPAIR DETERIORATED UPPER WEST BRACING ANGLES	CCC3 SH 31					1			

NUMBER	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY	DR. BY	CK. BY

SUBMITTED:
CHIEF, STRUCT. SECTION
APPROVAL RECOMMENDED:
CHIEF, DESIGN BRANCH
REVIEWED:
PROJECT MANAGER
APPROVAL RECOMMENDED:
CHIEF, PROJECT BRANCH

MAJOR REHABILITATION PROJECT
CAPE COD CANAL BRIDGES
BOURNE HIGHWAY BRIDGE
STRUCTURAL STEEL REPAIR SUMMARY IV
BOURNE MASSACHUSETTS
APPROVED: DATE:
CHIEF, ENGINEERING BRANCH

SCALE: AS SHOWN
SPEC. NO. DACW33-78-B-
DRAWING NUMBER
SHEET

CORPS OF ENGINEERS

U. S. ARMY

FIG. 23

SPAN BAY	REPAIR NO.	MEM. TYPE	LOCATION OF MEMBER	DESCRIPTION OF REPAIR	SHOP DRAWING NO.	REPAIR DETAIL NO.	SUMMARY OF REPAIRS RIVETS	PLATES	LACE	MEMBER	OTHER	BID ITEM NO.	NOTES
				SPAN 3									
SPAN	3												
0-1		E	L-0	REPAIR ALL LACES OF STRUT @ L-0	CCC4 SH51				124				
		E	L-0	REPLACE 10 LACING RIVETS OF STRUT @ L-0	CCC4 SH51		10						
		E	L-1	REPLACE 2 LACES OF STRUT @ L-1	CCC4 SH47				2				
		E	L-1	REPLACE 1 LACING RIVET OF STRUT @ L-1	CCC4 SH47		1						
		F		REPLACE 3 LACES OF LOWER WEST BRACING	CCC4 SH66				3				
		F		REPLACE 14 LACE OF LOWER EAST BRACING	CCC4 SH66				14				
		F		REPLACE 8 DETERIORATED LACING RIVETS	CCC SH66		8						
		F		REPLACE 12 LACES OF UPPER WEST BRACING	CCC4 SH66				12				
		F		REPLACE 11 DETERIORATED LOWER WEST GUSSET RIVETS	CCC4 SH66		11						
		F		REPLACE 10 DETERIORATED LOWER EAST GUSSET RIVETS	CCC4 SH66		10						
1-2		A	L2W-U2W	REPLACE 15 DETERIORATED LACES	CCC4 SH34				15				
		B	FB1N	REPLACE 3 LOWER FLANGE RIVETS @ EAST END	CCC4 SH3		3						
		B	FB1N	REPLACE 8 LOWER FLANGE RIVETS @ WEST END	CCC4 SH3		8						
		B	FB2S	REPLACE 1 LOWER FLANGE RIVET @ EAST END	CCC4 SH2		1						
		D		REPLACE 3 NORTHWEST UPPER GUSSET RIVETS	CCC4 SH61		3						
		D		REPAIR DETERIORATED NORTHEAST LOWER GUSSET	CCC4 SH61			1					
		D		REPLACE 3 SOUTHEAST LOWER GUSSET RIVETS	CCC4 SH60		3						
		D		REPLACE DETERIORATED LOWER FLANGE OF LATERAL @ SOUTHEAST GUSSET	CCC4 SH60						1		
		D		REPLACE 12 SOUTHWEST UPPER GUSSET RIVETS	CCC4 SH60		12						
		D		REPAIR DETERIORATED SOUTHWEST LOWER GUSSET	CCC4 SH60			1					
2-3		B	FB2N	REPLACE 2 LOWER FLANGE RIVETS @ EAST END	CCC4 SH2		2						
		B	FB2N	REPLACE 7 LOWER FLANGE RIVETS @ WEST END	CCC4 SH2		7						
		B	FB3S	REPLACE 2 LOWER FLANGE RIVETS @ EAST END	CCC4 SH1		2						
		D		REPLACE 5 NORTHWEST UPPER GUSSET RIVETS	CCC4 SH61		5						
		D		REPLACE 7 SOUTHWEST UPPER GUSSET RIVETS	CCC4 SH61		7						
		D		REPAIR DETERIORATED SOUTHWEST LOWER GUSSET	CCC4 SH61			1					
2-3		D		REPAIR DETERIORATED SOUTHEAST LOWER GUSSET	CCC4 SH61			1					
		D		REPAIR DETERIORATED NORTHEAST LOWER GUSSET	CCC4 SH61			1					
		E	L2E	REPLACE 2 LOWER GUSSET RIVETS @ L2E	CCC4 SH51		2						
		E	L3W	REPLACE 2 UPPER GUSSET RIVETS @ L3W	CCC4 SH11		2						
3-4		A	L3E-L4E	REPLACE 6 LOWER LACING RIVETS	CCC4 SH11012		6						
		B	FB3N	REPLACE 7 LOWER FLANGE RIVETS @ WEST END	CCC4 SH1		7						
		D		REPLACE 12 SOUTHWEST UPPER GUSSET RIVETS	CCC4 SH61		12						
		D		REPLACE 2 SOUTHWEST LOWER GUSSET RIVETS	CCC4 SH61		2						
		D		REPAIR DETERIORATED LOWER FLANGE OF LATERIAL @ SOUTHEAST GUSSET	CCC4 SH60						1		
4-5		A	L4E-U5E	REPLACE 2 DETERIORATED LACES	CCC4 SH30				2				
		A	L4W-U5W	REPLACE 28 DETERIORATED LACES	CCC4 SH30				28				
		A	L5W-U5W	REPAIR 12 DETERIORATED LACES	CCC4 SH34				12				
		B	FB4N	REPLACE 3 LOWER FLANGE RIVETS @ EAST END	CCC4 SH2		3						
		B	FB4N	REPLACE 4 CLIP ANGLE RIVETS @ EAST END	CCC4 SH2		4						
		B	FB5S	REPLACE 3 LOWER FLANGE RIVETS @ WEST END	CCC4 SH1		3						
		B	FB5S	REPLACE 2 CLIP ANGLE RIVETS @ EAST END	CCC4 SH1		2						
		D		REPAIR DETERIORATED SOUTHWEST LOWER GUSSET	CCC4 SH61			1					
	*	D		REPLACE 3 SOUTHWEST LOWER GUSSET RIVETS	CCC4 SH61		3						
	*	D		REPAIR DETERIORATED SOUTHEAST LOWER GUSSET	CCC4 SH61			1					
		E		REPLACE 6 UPPER GUSSET RIVETS @ L4W	CCC4 SH51		6						
		E		REPAIR DETERIORATED UPPER GUSSET @ L4E	CCC4 SH51			1					
		E		REPLACE 4 DETERIORATED LACES AT STRUT L5	CCC4 SH47				4				
		E		REPLACE 2 LACING RIVETS OF STRUT L5	CCC4 SH47		2						
		E		REPLACE 3 UPPER GUSSET RIVETS @ L5E	CCC4 SH13		3						
4-5		E		REPLACE 12 UPPER GUSSET RIVETS @ L5W	CCC4 SH13		12						
		E	L5E-L6W	REPLACE 4 DETERIORATED LACES OF BRACING @ L5E	CCC4 SH48				4				
		F	L5	REPLACE 2 LACES OF UPPER WEST BRACING	CCC4 SH66				2				
		F	L5	REPLACE 4 LACES OF UPPER EAST BRACING	CCC4 SH66				4				
		F	L5	REPLACE 6 DETERIORATED UPPER EAST BRACING RIVETS	CCC4 SH66		6						
5-6		A	L5E-L6E	REPLACE 1 LOWER FLANGE RIVET @ NORTH END	CCC4 SH13&14		1						
		A	L5W-L6W	REPLACE 7 LOWER FLANGE RIVETS @ L6W	CCC4 SH13&14		7						
		A	L6W-U6W	REPLACE 4 DETERIORATED RIVETS @ U6W	CCC4 SH35		4						
		B	FB5N	REPLACE 16 LOWER FLANGE RIVETS @ WEST END	CCC4 SH1		16						
		B	FB5N	REPLACE 4 LOWER FLANGE RIVETS @ EAST END	CCC4 SH1		4						
		B	FB6S	REPLACE 2 CLIP ANGLE RIVETS @ EAST END	CCC4 SH4		2						
		B	ST-1	REPAIR DETERIORATED LOWER FLANGE @ SOUTH END	CCC4 SH40&63						1		
		F	#6	REPLACE 3 DETERIORATED LOWER WEST GUSSET RIVETS	CCC4 SH64		3						
		F		REPLACE 10 LACES OF UPPER EAST BRACING	CCC4 SH64					10			
		F		REPLACE 6 LACES OF UPPER WEST BRACING	CCC4 SH64					6			
		F		REPLACE DETERIORATED BATTEN PLATE OF UPPER WEST BRACING	CCC4 SH64				1				
6-7		A	L6E-L7E	REPLACE 3 LOWER FLANGE RIVETS @ SOUTH END	CCC4 SH15&16		3						
		B	FB6N	REPLACE 4 LOWER FLANGE RIVETS @ WEST END	CCC4 SH4		4						
		B	FB6N	REPLACE 2 LOWER FLANGE RIVETS @ EAST END	CCC4 SH4		2						
		B	ST-1	REPAIR DETERIORATED LOWER FLANGE @ SOUTH	CCC4 SH40&63						1		
		B	ST-9	REPAIR DETERIORATED LOWER FLANGE	CCC4 SH40&63						1		
		E		REPLACE 16 UPPER GUSSET RIVETS @ L6W	CCC4 SH49		16						
		E	L6E-L7W	REPLACE 2 DETERIORATED LACES OF BRACING L6E-L7W @ L6E	CCC4 SH50				2				
		E	L6	REPLACE 10 DETERIORATED LACES OF STRUT @ L6	CCC4 SH51				10				

SPAN BAY	REPAIR NO.	MEM. TYPE	LOCATION OF MEMBER	DESCRIPTION OF REPAIR	SHOP DRAWING NO.	REPAIR DETAIL NO.	SUMMARY OF REPAIRS RIVETS	PLATES	LACE	MEMBER	OTHER	BID ITEM NO.	NOTES
SPAN	3 (CONT'D)												
6-7		E	L7W	REPLACE 9 UPPER GUSSET RIVETS @ L7W	CCC4 SH15		9						
		E		REPLACE 5 UPPER GUSSET RIVETS @ L7E	CCC4 SH15		5						
		F	@7	REPLACE 6 LACES OF LOWER EAST BRACING	CCC4 SH64					6			
		F		REPLACE 4 LACES OF UPPER WEST BRACING	CCC4 SH64					4			
		F		REPAIR DETERIORATED UPPER WEST GUSSET	CCC4 SH64				1				
		F		REPLACE 4 LACES OF UPPER CAST BRACING	CCC4 SH64					4			
		F		REPLACE 1 DETERIORATED RIVET OF LOWER EAST GUSSET	CCC4 SH64		1						
7-8		A	L7W-L8W	REPLACE 2 UPPER STAY PLATE RIVETS	CCC4 SH15,16		2						
		B	FB7N	REPLACE 4 CLIP ANGLE RIVETS @ EAST END	CCC4 SH4		4						
		B	FB8S	REPLACE 3 CLIP ANGLE RIVETS @ EAST END	CCC4 SH5		3						
		B	ST-1	REPAIR DETERIORATED LOWER FLANGE	CCC4 SH40,63						1		
		B	ST-9	REPAIR DETERIORATED WEB AND FLANGE @ SOUTH END	CCC4 SH40,63						1		
		F	#8	REPLACE 4 LACES OF LOWER EAST BRACING	CCC4 SH65					4			
		F		REPLACE 10 LACES OF UPPER WEST BRANCH	CCC4 SH65					10			
8-9		A	U8E-U9E	REPLACE 9 DETERIORATED LACES	CCC4 SH27					9			
		A	L8W-L9W	REPLACE DETERIORATED SOUTH UPPER STAY PLATE	CCC4 SH17,18				1				
		A	U8W-U9W	REPLACE 9 DETERIORATED LACES	CCC4 SH27					9			
		A	L8W-U9W	REPLACE 32 DETERIORATED LACES	CCC4 SH32					32			
		B	FB8N	REPAIR DETERIORATED FLOOR BEAM STIFFNER @ ST-9	CCC4 SH5						1		
		B	FB8N	REPAIR DETERIORATED BOTTOM FLANGE @ ST-9	CCC4 SH5						1		
		B	FB8N	REPAIR 3 DETERIORATED BOTTOM COVER RIVETS	CCC4 SH5		3						
		B	FB9S	REPLACE 7 LOWER FLANGE RIVETS @ WEST END	CCC5 SH28		7						
		B	FB9S	REPAIR DETERIORATED BOTTOM FLANGE @ ST-1	CCC5 SH61						1		
		B	ST-1	REPAIR DETERIORATED FLOWER PLANGE @ SOUTH END	CCC4 SH40,63						1		
		E		REPLACE 20 DETERIORATED LACES OF STRUT @ L8	CCC4 SH40,53					20			
	*	E	L8W	REPAIR DETERIORATED UPPER GUSSET @ L8W	CCC4 SH50				1				
8-9	*	E	L8W	REPLACE 8 UPPER GUSSET RIVETS @ L8W	CCC4 SH50		8						
		E	L9	REPLACE 20 DETERIORATED LACES OF STRUT L9	CCC4 SH51					20			
		E	L9E	REPAIR DETERIORATED BOTTOM GUSSET @ L9E	CCC4 SH62				1				
		E	L9E	REPLACE 10 UPPER GUSSET RIVETS @ L9E	CCC4 SH62		10						
		F		REPLACE 8 LACES OF LOWER WEST BRACING	CCC4 SH65					8			
		F		REPLACE 2 DETERIORATED LOWER WEST GUSSET RIVETS	CCC4 SH65		2						
		F		REPLACE 8 LACES OF LOWER EAST BRACING	CCC4 SH65					8			
		F		REPLACE 4 DETERIORATED LOWER EAST BRACING RIVETS	CCC4 SH65		4						
		F		REPLACE 8 LACES OF UPPER CAST BRACING	CCC4 SH65					8			
		F		REPLACE 8 LACE OF UPPER WEST BRACING	CCC4 SH65					8			
		F		REPAIR DETERIORATED UPPER WEST GUSSET	CCC4 SH65				1				
				SPAN 1									
SPAN	1												
9-10		A	L9W-L10W	REPLACE 2 LOWER CONNECTION ANGLE RIVETS			2						
			U9W-U10W	REPLACE 18 DETERIORATED LACES						18			
		B	FB9N	REPLACE 13 LOWER FLANGE RIVETS @ WEST END			13						
		B	FB9N	REPLACE 3 LOWER FLANGE RIVETS @ EAST END			3						
		B	FB9N	REPLACE 4 BOTTOM COVER RIVETS @ ST-8			4						
		C	WALKWAY	REPLACE 6 DETERIORATED GRATING SECTIONS							6		
		D	U10	REPLACE 10 LOWER LACES OF STRUT @ U10						10			
		E	L9E	REPLACE 4 LOWER GUSSET RIVETS @ L9E			4						
		E	L9W-L10E	REPLACE 2 DETERIORATED LACES OF BRACING @ L10E						2			
		E		REPLACE 60 DETERIORATED LACES OF STRUT @ L10						60			
		F	#10	REPLACE ALL DETERIORATED STAY PLATES OF LOWER EAST CREST TRUSS @ L10						12			
10-11		A	L10E-L11E	REPLACE DETERIORATED SOUTH UPPER STAY PLATE					1				
		A	L10W-U11W	REPLACE DETERIORATED SOUTH LOWER STAY PLATE					1				
		A	U10W-U11W	REPLACE 2 DETERIORATED LACES						2			
		A	PP-L11W	REPLACE 2 CABLE HANGER RIVETS			2						
		B	FB10N	REPAIR SUPPORT BRACKET FOR SIDEWALK CHANNEL ON WEST SIDE							1		
		B	FB11S	REPAIR DETERIORATED LOWER FLANGE @ EAST END							1		
		B	FB11S	REPLACE 2 LOWER FLANGE RIVETS @ WEST END			2						
		B	ST-1	REPAIR DETERIORATED LOWER FLANGE							1		
		B	ST-9	REPLACE 13 STIFFNER ANGLE RIVETS			13						
		C	SIDEWALK	REPAIR DETERIORATED SIDEWALK CHANNEL SUPPORT ON WEST SIDE @ SOUTH END							1		
		G	L-10	REPLACE 14 DETERIORATED LACES OF STRUT @ 40						14			
11-12		A	L11E-L12E	REPLACE DETERIORATED SOUTH LOWER STAY PLATE					1				
		A	U11E-U12E	REPLACE 5 DETERIORATED LACES						5			
11-12		A	L11E-L12E	REPLACE DETERIORATED NORTH UPPER AND LOWER STAY PLATE					2				
		A	U11W-U12W	REPLACE 8 DETERIORATED LACES						8			
		A	L17W-L12W	REPLACE 3 DETERIORATED LACING RIVETS			3						
		B	FB11N	REPLACE 7 LOWER FLANGE RIVETS @ WEST END			7						
		B	FB11N	REPAIR DETERIORATED LOWER FLANGE @ EAST END							1		
		B	ST-9	REPAIR DETERIORATED LOWER FLANGE							1		
		C	WALKWAY	REPAIR DETERIORATED WALK SUPPORTING ANGLES							1		
		C	WALKWAY	REPLACE 5 DETERIORATED GRATING SECTIONS							5		
		D	U11	REPLACE 1 LOWER LACE OF STRUT @ U11						1			
		D	U11	REPLACE 17 LOWER FLANGE RIVETS OF STRUT @ U11			17						
		D	U11E	REPLACE 1 LOWER GUSSET RIVET @ U11E			1						
		D	U12	REPLACE 4 LOWER FLANGE RIVETS OF STRUT @ U12			4						
		E	L12	REPLACE 20 LACING RIVETS OF STRUT @ L12			20						

SPAN BAY	REPAIR NO.	MEM. TYPE	LOCATION OF MEMBER	DESCRIPTION OF REPAIR	SHOP DRAWING NO.	REPAIR DETAIL NO.	SUMMARY OF REPAIRS RIVETS	PLATES	LACE	MEMBER	OTHER	BID ITEM NO.	NOTES
SPAN	1 (CONT'D)												
		E	L12W	REPLACE 1 UPPER GUSSET RIVET @ L12 W			1						
		G	L11W-L12E	REPAIR DETERIORATED LOWER FLANGE OF BRACING						1			
		G	L11W-L12E	REPLACE 2 DETERIORATED LOWER FLANGE RIVETS			2						
		G	L11E-L12W	REPAIR DETERIORATED LOWER FLANGE OF BRACING						1			
		G	L11E-L12W	REPLACE 5 DETERIORATED LACE					5				
		G	L11W	REPLACE 3 DETERIORATED UPPER GUSSET RIVETS @ L11W			3						
12-13		A	U12E-U13E	REPLACE 10 DETERIORATED LACES						10			
		A	L12E-U13E	REPLACE DETERIORATED SOUTH UPPER STAY PLATE				1					
		A	L12E-U13E	REPLACE DETERIORATED NORTH UPPER STAY PLATE				1					
		A	L12E-U13E	REPLACE 3 UPPER CONNECTION ANGLE RIVETS			3						
		A	L12E-U13E	REPLACE DETERIORATED NORTH UPPER AND LOWER STAY PLATES				2					
		A	PP-L13E	REPLACE 3 CABLE HANGE RIVETS			3						
		A	L12W-U13W	REPLACE DETERIORATED NORTH LOWER STAY PLATE				1					
12-13		B	FB12N	REPAIR DETERIORATED FLOOR BEAM STIFFENER @ ST-1				1					
		B	FB13S	REPLACE 4 LOWER FLANGE RIVETS @ EAST END			4						
		C	WALKWAY	REPLACE 1 DETERIORATED GRATING SECTION							1		
		C	WALKWAY	REPAIR DETERIORATED WALKWAY SUPPORTING PLATES				1					
		G	L12E-L13W	REPLACE 12 DETERIORATED LACES OF BRACING						12			
		G	L12W-L13E	REPLACE 2 DETERIORATED LACES OF BRACING						2			
13-14		A	U13E-U14E	REPLACE DETERIORATED SOUTH STAY PLATE				1					
		A	U13W-44W	REPLACE 15 DETERIORATED LOWER LACE RIVETS			15						
		B	FB13N	REPAIR DETERIORATED FLOOR BEAM STIFFENER @ WEST END									
		B	FB13N	REPLACE 10 LOWER FLANGE RIVETS @ EAST END			10						
		B	FB14S	REPAIR DETERIORATED UPPER FLANGE @ EAST END							1		
		E	L13	REPLACE 2 LACING RIVETS OF STRUT @ 43			2						
		E	L13E-L14W	REPAIR DETERIORATED LOWER FLANGE OF BRACING						1			
		E	L14W	REPLACE 2 UPPER GUSSET RIVETS @ L14W			2						
		E	L13W-L14E	REPAIR DETERIORATED LOWER FLANGE OF BRACING						1			
		G	L13W-L14E	REPAIR DETERIORATED LOWER FLANGE OF BRACING @ CATWALK						1			
		G	L13W-L14E	REPLACE 6 DETERIORATED LOWER FLANGE RIVETS			6						
		G	L13W-L14E	REPLACE 4 DETERIORATED LACES OF BRACING						4			
		G	L13E-L14W	REPAIR DETERIORATED LOWER FLANGE OF BRACING @ CATWALK						1			
		G	L13E-L14W	REPLACE 2 DETERIORATED LOWER FLANGE RIVETS			2						
		G	L13E-L14W	REPLACE 4 DETERIORATED LACES OF BRACING						4			
		G	L13W-L14E	REPAIR DETERIORATED LOWER FLANGE OF BRACING @ L13W							1		
14-15		A	L14W-U15W	REPLACE 5 DETERIORATED LOWER LACE RIVETS				5					
		A	U14E-U15E	REPLACE DETERIORATED NORTH STAY PLATE					1				
		A	U14W-U15W	REPLACE DETERIORATED NORTH STAY PLATE				1					
		B	FB14N	REPLACE 2 LOWER FLANGE RIVETS @ WEST END			2						

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY	DR. BY	CK. BY

SUBMITTED:
CHIEF, STRUCT. SECTION
APPROVAL RECOMMENDED:
CHIEF, DESIGN BRANCH
REVIEWED:
PROJECT MANAGER
APPROVAL RECOMMENDED:
CHIEF PROJECT BRANCH

MAJOR REHABILITATION PROJECT

CAPE COD CANAL BRIDGES

SAGAMORE HIGHWAY BRIDGE

STRUCTURAL STEEL REPAIR SUMMARY I

BOURNE MASSACHUSETTS

APPROVED DATE

CHIEF, ENGINEERING DIVISION

SCALE AS SHOWN SPEC. NO. DACW33-78-B

DRAWING NUMBER

SHEET

CORPS OF ENGINEERS

U. S. ARMY

FIG. 24

SPAN BAY	REPAIR NO.	MEM. TYPE	LOCATION OF MEMBER	DESCRIPTION OF REPAIR	SHOP DRAWING NO.	REPAIR DETAIL NO.	SUMMARY OF REPAIRS RIVETS	PLATES	LACE	MEMBER	OTHER	BID ITEM NO.	NOTES
SPAN	1(CONT'D)												
14-15'		B	FB14N	REPLACE 7 BOTTOM COVER RIVETS			7						
		B	FB15S	REPLACE 4 BOTTOM COVER RIVETS			4						
		C	WALKWAY	REPLACE 9 DETERIORATED GRATING SECTIONS							9		
		C	WALKWAY	REPLACE 1 DETERIORATED BRACING ANGLE RIVET			1						
15-16		A	L15E-L16E	REPLACE DETERIORATED NORTH UPPER & LOWER STAY PLATE				2					
		A	PP-L16E	REPLACE 3 CABLE HANGER RIVETS			3						
		B	FB15N	REPLACE 3 LOWER FAINGE RIVETS @ WEST END			3						
		C	SIDEWALK	REPLACE 8 UPPER GUSSET RIVETS @ NORTH END			8						
		D	U15E	REPLACE 1 UPPER GUSSET RIVET @ U15E			1						
		D		REPLACE 1 UPPER GUSSET RIVET @ U16E			1						
		E	L15W-L16E	REPAIR DETERIORATED UPPER FLANGE OF BRACING @ INTERSECTION						1			
		E	L10W	REPAIR DETERIORATED UPPER GUSSET @ L16W				1					
	*	E	L10E	REPAIR DETERIORATED UPPER GUSSET @ 46E				1					
	*	E	L10E	REPLACE 4 UPPER GUSSET RIVETS @ L10E			4						
		G	L15W	REPLACE 3 UPPER GUSSET RIVETS @ L15W			3						
		G	L10E	REPLACE 12 UPPER CUSSET RIVETS @ L10E			12						
		G	L10W	REPLACE 16 UPPER GUSSET RIVETS @ L16W			16						
16-15'		A	L16E-L15'E	REPLACE DETERIORATED SOUTH UPPER AND LOWER STAY PLATES				2					
		A	L16E-L15'W	REPLACE DETERIORATED SOUTH LOWER STAY PLATE				1					
		A	L16E-L15'E	REPLACE NORTH UPPER AND LOWER STAY PLATES				2					
		A	L16W-L15'W	REPLACE DETERIORATED NORTH LOWER STAY PLATE				1					
		B	FB16N	REPLACE 6 LOWER FLANGE RIVETS @ WEST END			6						
		B	FB16N	REPAIR DETERIORATED LOWER FLANGE @ ST-9							1		
		B	FB16N	REPLACE 4 LOWER FLANGE RIVETS @ EAST END			4						
		D	U16E-U15'E	REPAIR DETERIORATED LOWER FLANGE OF BRACING @ U16E							1		
		G	L16E-L15'W	REPLACE 20 DETERIORATED LACES OF BRACING					20				
16-15'		G	L16W-L15'E	REPLACE 4 DETERIORATED LACES OF BRACING					4				
15-14'		A	L15'E-L14'E	REPLACE SOUTH LOWER STAY PLATE				1					
		A	L15'E-L14'E	REPLACE NORTH UPPER AND LOWER STAY PLATES				2					
		A	U15'W-U14W	REPLACE DETERIORATED NORTH STAY PLATE				1					
		A	L15'W-L14'W	REPLACE DETERIORATED NORTH UPPER AND LOWER STAY PLATE				2					
		B	FB15'N	REPLACE 12 BOTTOM COVER RIVETS			12						
		B	FB14'S	REPLACE 3 LOWER FLANGE RIVETS @ WEST END			3						
		C	WALKWAY	REPLACE 2 DETERIORATED GRATING SECTIONS							2		
		G	L15'W-L14'E	REPLACE 2 DETERIORATED LACES OF BRACING						2			
		G	L15'E-L14W	REPLACE 32 DETERIORATED LACES OF BRACING					32				
		G	L15'E-L14'W	REPLACE 3 LOWER GUSSET RIVETS @ L16'W			3						
14'13'		A	U14'E-U13'E	REPLACE DETERIORATED SOUTH STAY PLATE				1					
		A	PP-L13'E	REPLACE 1 CABLE HANGER RIVET			1						
		A	U14'W-U13'W	REPLACE DETERIORATED NORTH STAY PLATE				1					
		B	FB14'N	REPLACE 2 BOTTOM COVER RIVETS			2						
		B	FB13'S	REPLACE 17 LOWER FLANGE RIVETS @ WEST END			17						
		D	U14'E-U13'W	REPAIR DETERIORATED LOWER FLANGE OF BRACING @ U14'E							1		
		E	L14'	REPLACE 6 LACING RIVETS OF STRUT @ L14'			6						
		K	L14'E	REPAIR DETERIORATED UPPER GUSSET @ L14'E				1					
		E	L13'	REPLACE 5 LACING RIVETS OF STRUT @ L13'			5						
		G	L14'W-L13'E	REPLACE 12 DETERIORATED LACES OF BRACING						12			
		G	L14'E-L13'E	REPLACE 4 DETERIORATED LACES OF BRACING						4			
		G		REPLACE 7 UPPER GUSSET RIVETS @ L13'W			7						
13'-12'		A	U13'E-U12'E	REPLACE 6 DETERIORATED LACES						6			
		A	U13'W-L12'W	REPLACE DETERIORATED SOUTH LOWER STAY PLATE				1					
		B	FB13'N	REPLACE 4 LOWER FLANGE RIVETS @ WEST END			4						
13'-12'		B	FB13'N	REPLACE 4 BOTTOM COVER PLATE RIVETS			4						
		B	FB12'S	REPAIR 1 DETERIORATED FLOOR BEAM STIFFENER				1					
		B	FB12'S	REPALCE 1 LOWER FLANGE RIVET @ EAST END			1						
		B	FB12'S	REPLACE 6 LOWER FLANGE RIVETS @ WEST END			6						
		D	U13'E-U12'W	REPAIR DETERIORATED LOWER FLANGE OF BRACING							1		
		D	U13'E-U12'W	REPAIR DETERIORATED LOWER FLANGE OF BRACING @ INTERSECTION							1		
		G	L13'W-L12'E	REPLACE 4 DETERIORATED UPPER FLANGE OF BRACING						4			
		G	L13'W-L12'E	REPAIR DETERIORATED UPPER FLANGE OF BRACING							1		
		G	L13'E-L12'W	REPLACE 26 DETERIORATED LACES OF BRACING						26			
12'-11'		B	FB11'S	REPLACE 2 LOWER FLANGE RIVETS @ EAST END			2						
		B	FB11'S	REPLACE 20 LOWER FLANGE RIVETS @ WEST END			20						
		C	WALKWAY	REPLACE 9 DETERIORATED GRATING SECTIONS							9		
		D	U11'W	REPLACE 1 LOWER GUSSET RIVET @ U11'W			1						
		E	L12'	REPLACE 31 LOWER FLANGE RIVETS OF STRUT @ 42'			31						
		G	L12'E-L11'W	REPAIR DETERIORATED LOWER FLANGES OF BRACING @ CATWALK							1		
		G	L12'W	REPLACE 8 LOWER GUSSET RIVETS @ L12'W			8						
11'-10'		A	U11'E-L10'E	REPLACE 6 DETERIORATED LACING RIVETS			6						
		A	L11'W-L10'W	REPLACE DETERIORATED NORTH UPPER AND LOWER STAY PLATES				2					
		B	FB11'N	REPLACE 11 LOWER FLANGE RIVETS @ WEST END			11						
		B	FB11'N	REPLACE 5 LOWER FLANGE RIVETS @ EAST END			5						
		C	SIDEWALK	REPAIR DETERIORATED SIDEWALK CHANNEL SUPPORT ON EAST SIDE @ NORTH END							1		
		C	WALKWAY	REPLACE 2 DETERIORATED GRATING SECTIONS							2		
		G	L10'	REPLACE 12 DETERIORATED LOWER LACES OF STRUT @ L10'						12			
		G	L10'	REPLACE 12 DETERIORATED UPPER LACES OF STRUT @ L10'						12			
		G	L10'	REPLACE 20 DETERIORATED LACING RIVETS OF STRUT @ L10'			20						

SPAN BAY	REPAIR NO.	MEM. TYPE	LOCATION OF MEMBER	DESCRIPTION OF REPAIR	SHOP DRAWING NO.	REPAIR DETAIL NO.	SUMMARY OF REPAIRS RIVETS	PLATES	LACE	MEMBER	OTHER	BID ITEM NO.	NOTES
SPAN	1 (CONT'D)												
11'-10'		G		REPLACE 10 DETERIORATED RIVETS @ NORTH END OF EAST WIND CHORD		10							
		G	L10'W	REPLACE 4 LOWER GUSSET RIVETS @ L10'W		4							
		G	L11'W-L10'E	REPLACE 2 DETERIORATED LACES OF BRACING					2				
		G		REPLACE 2 MISSING BOLTS THROUGH SHIP PLATE @ NORTH END OF WEST WIND CHORD		2							
10'-9'		A	L10'E-L9'E	REPLACE DETERIORATED SOUTH UPPER STAY PLATE							1		
		A	L10'E-L9'E	REPLACE 5 DETERIORATED LACING RIVETS		5							
		B	FB10'N	REPLACE 5 LOWER FLANGE RIVETS @ EAST END		5							
		B	FB10'N	REPAIR DETERIORATED FLOOR BEAM STIFFENER @ ST-1					1				
		B	FB9'S	REPLACE 11 LOWER FLANGE RIVETS @ WEST END		11							
		B	ST-1	REPAIR DETERIORATED LOWER FLANGE							1		
		B	ST-1	REPAIR DETERIORATED WEB @ NORTH & SOUTH END							1		
		B	ST-3	REPAIR DETERIORATED LOWER FLANGE & WEB @ SOUTH END							1		
		B	ST-4	REPAIR DETERIORATED WEB @ SOUTH ENDS							1		
		B	ST-9	REPAIR DETERIORATED WEB @ NORTH END							1		
		B	ST-9	REPAIR DETERIORATED BOTTOM FLANGE @ SOUTH END							1		
		C	SIDEWALK	REPLACE DETERIORATED UPPER GUSSET @ SOUTH END					1				
		D	U10'	REPLACE 8 DETERIORATED LOWER LACES OF STRUT @ U10'						8			
		E	L10'E	REPLACE 7 UPPER GUSSET RIVETS @ L10'E		7							
		F	@10'	REPLACE ALL DETERIORATED STAY PLATES OF LOWER EAST WEST TRUSS @ L10'				12					
		F		REPLACE 7 DETERIORATED RIVETS OF LOWER EAST-WEST TRUSS @ L10'		7							
SPAN	2			SPAN 2									
9'-8'		A	U9'E-U8'E	REPLACE 7 DETERIORATED LACES						7			
		A	U9'E-L8'E	REPLACE 9 DETERIORATED LACES						9			
		A	U9'W-U8'W	REPLACE 8 DETERIORATED LACES						8			
		A	PP-29'W	REPAIR DETERIORATED VERTICAL STIFFENER					1				
		A	U9'W-L8'W	REPLACE 35 DETERIORATED LACES						35			
		A	U9'W-L8'W	REPLACE DETERIORATED NORTH UPPER STAY PLATE					1				
		A	U9'W-L8'W	REPLACE 3 LOWER FLANGE RIVETS @ NORTH END		3							
		B	FB9'N	REPLACE 8 LOWER FLANGE RIVETS @ WEST END		8							
		B	FB8'S	REPLACE 5 LOWER FLANGE RIVETS @ WEST END		5							
		B	ST-1	REPAIR DETERIORATED BOTTOM FLANGE @ NORTH END							1		
		C	SIDEWALK	REPAIR WEST CHANNEL LOWER FLANGE @ NORTH END							1		
		C	WALKWAY	REPLACE 8 DETERIORATED GRATING SECTIONS							8		
		E	L9'	REPLACE 8 UPPER LACING RIVETS OF STRUT @ L9'		8							
		E	L8'W	REPLACE 9 UPPER GUSSET RIVETS @ L8'W		9							
		E	L8'W	REPAIR DETERIORATED LOWER GUSSET @ L8'W						1			
		E	L8'E	REPAIR DETERIORATED LOWER GUSSET @ L8'E						1			
		F	@9'	REPLACE 14 DETERIORATED UPPER WEST GUSSET RIVETS		14							
8'-7'		C	SIDEWALK	REPLACE 2 DETERIORATED LOWER GUSSET RIVETS @ NORTH END		2							
		C	WALKWAY	REPLACE 5 DETERIORATED GRAING SECTIONS							5		
7'-6'		A	L7'E-L6'E	REPLACE 3 LOWER FLANGE RIVETS @ NORTH END		3							
		B	FB6'S	REPLACE 1 LOWER FLANGE RIVETS @ WEST END		1							
		C	WALKWAY	REPLACE 2 DETERIORATED GRATING SECTIONS							2		
		E	L6'W	REPAIR DETERIORATED UPPER AND LOWER GUSSET @ L6'W				2					
		E	L6'E	REPAIR DETERIORATED UPPER AND LOWER GUSSET @ L6'E				2					
		F	@7'	REPLACE 5 LACES OF UPPER WEST BRACING					5				
6'-5'		A	L6'E-L5'E	REPLACE 6 LOWER FLANGE RIVETS @ SOUTH END		6							
6'-5'		B	FB5'S	REPLACE 15 LOWER FLANGE RIVETS @ WEST END		15							
		C	SIDEWALK	REPLACE 2 DETERIORATED LOWER GUSSET RIVETS @ NORTH END		2							
		F	@6'	REPLACE 3 DETERIORATED UPPER WEST BRACING RIVETS		3							
5'-4'		B	FB5'N	REPLACE 5 LOWER FLANGE RIVE S @ EAST END		5							
		B	FB4'S	REPLACE 7 LOWER FLANGE RIVETS @ WEST END		7							
		B	FB4'S	REPAIR DETERIORATED FLOOR BEAM STIFFENER							1		
		C	WALKWAY	REPLACE 2 DETERIORATED GRATING SECTIONS							2		
		D		REPAIR DETERIORATED NORTH EAST UPPER GUSSET					1				
		D		REPLACE 4 SOUTHEAST UPPER GUSSET RIVETS		4							
		D		REPLACE 26 SOUTHWEST UPPER & LOWER GUSSET RIVETS		26							
	*	D		REPAIR DETERIORATED NORTHWEST LOWER GUSSET					1				
	*	D		REPLACE 12 NORTHWEST LOWER GUSSET RIVETS		12							
		E	L5'	REPLACE + 10% LACES OF STRUT @ L5'						13			
		E	L4'W	REPAIR DETERIORATED UPPER GUSSET @ L4'W					1				
		F	@5'	REPLACE 1 LACE OF UPPER EAST BRACING						1			
		F		REPAIR DETERIORATED MIDDLE GUSSET					1				
4'-3'		B	FB3'S	REPLACE 1 LOWER FLANGE RIVET @ EAST END		1							
		D		REPAIR DETERIORATED NORTHEAST LOWER GUSSET					1				
		D		REPLACE 6 NORTHEAST LOWER GUSSET RIVETS		6							
		D		REPAIR DETERIORATED SOUTHEAST UPPER & LOWER GUSSETS					2				
		D		REPLACE 2 NORTHWEST UPPER GUSSET RIVETS		2							
3'-2'		D		REPLACE 14 NORTHWEST UPPER GUSSET RIVETS		14							
		D		REPLACE 4 NORTHEAST UPPER GUSSET RIVETS		4							

SPAN BAY	REPAIR NO.	MEM. TYPE	LOCATION OF MEMBER	DESCRIPTION OF REPAIR	SHOP DRAWING NO.	REPAIR DETAIL NO.	SUMMARY OF REPAIRS RIVETS	PLATES	LACE	MEMBER	OTHER	BID ITEM NO.	NOTES
SPAN	(CONT'D)												
		D		REPLACE 7 NORTHEAST LOWER GUSSET RIVETS			7						
		D		REPLACE 3 SOUTHEAST UPPER GUSSET RIVETS			3						
		E	L3'	REPLACE 1 DETERIORATED LACE OF STRUT @ L3'					1				
		E	L3'E	REPAIR DETERIORATED UPPER & LOWER GUSSET				2					
3'-2"		E	L2'E	REPAIR DETERIORATED UPPER GUSSET @ L2'E				1					
		E	L2'	REPLACE 1 DETERIORATED LACE OF STRUT @ L2'					1				
		E	L2'W	REPAIR DETERIORATED UPPER GUSSET @ L2'W					1				
2'-1'		B	FB2'N	REPLACE 2 LOWER FLANGE RIVETS @ WEST END			2						
		B	FB1'S	REPLACE 6 LOWER FLANGE RIVETS @ EAST END			6						
		B	FB1'S	REPAIR DETERIORATED FLOOR BEAM STIFFENER				1					
		C	SIDEWALK	REPAIR DETERIORATED WEST CHANNEL FLANGES							1		
	*	D		REPAIR DETERIORATED NORTHEAST LOWER GUSSET				1					
	*	D		REPLACE 3 NORTHEAST LOWER GUSSET RIVETS			3						
1'-0'		A	L1'W-L0'W	REPLACE 2 DETERIORATED LACES					2				
		A	L0'W-U0'W	REPLACE 3 DETERIORATED LACING RIVETS			3						
		C	SIDEWALK	REPLACE DETERIORATED LOWER GUSSET @ SOUTH END				1					
		D		REPAIR DETERIORATED NORTHEAST UPPER & LOWER GUSSETS				2					
		E	L1'	REPAIR + 30% OF LOWER LACES OF STRUT @ L1'					40				
		F	@0'	REPLACE 13 LACES OF LOWER WEST BRACING					13				
		F		REPLACE + 50% LACES OF UPPER EAST BRACING					35				
		F		REPLACE + 10% LACES OF UPPER WEST BRACING					7				
		F		REPAIR DETERIORATED UPPER WEST GUSSET				1					

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY	DR. BY	CK. BY

SUBMITTED:
CHIEF, STRUCT. SECTION
APPROVAL RECOMMENDED:
CHIEF, DESIGN BRANCH
REVIEWED:
PROJECT MANAGER
APPROVAL RECOMMENDED:
CHIEF PROJECT BRANCH

MAJOR REHABILITATION PROJECT

CAPE COD CANAL BRIDGES

SAGAMORE HIGHWAY BRIDGE

STRUCTURAL STEEL REPAIR SUMMARY II

BOURNE MASSACHUSETTS

APPROVED DATE

CHIEF, ENGINEERING DIVISION

SCALE

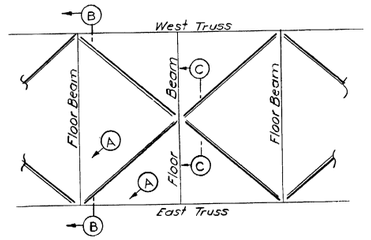
SPEC. NO.

DRAWING NUMBER

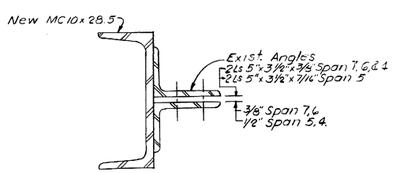
SHEET

CORPS OF ENGINEERS U. S. ARMY

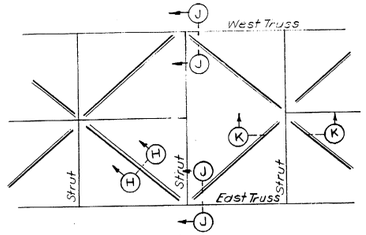
FIG. 25



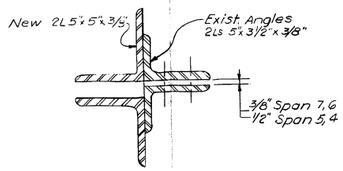
TYPICAL PLAN OF TOP LATERAL BRACING
SCALE 1/16"=1'-0"



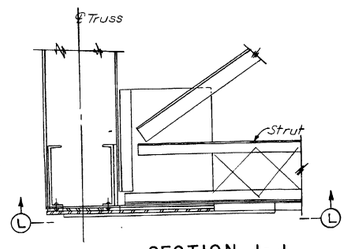
SECTION A-A
SCALE 3"=1'-0"



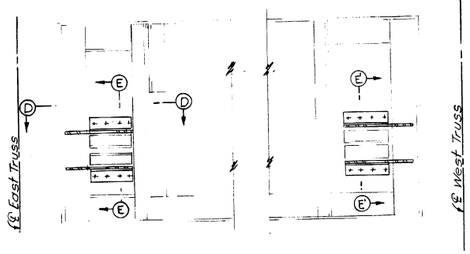
TYPICAL PLAN OF TOP LATERAL BRACING
SCALE 1/16"=1'-0"



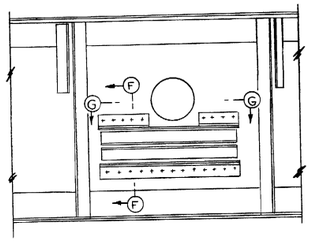
SECTION H-H
SCALE 3"=1'-0"



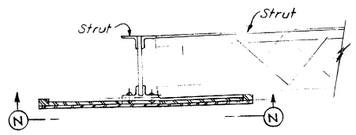
SECTION J-J
SECTION J'-J'
SCALE 3/4"=1'-0"



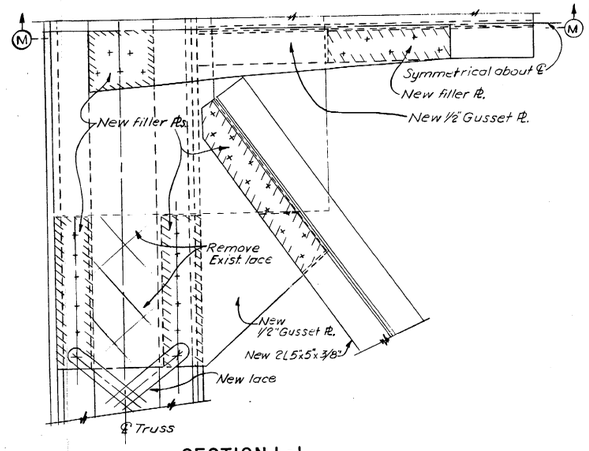
SECTION B-B
SCALE 3/4"=1'-0"



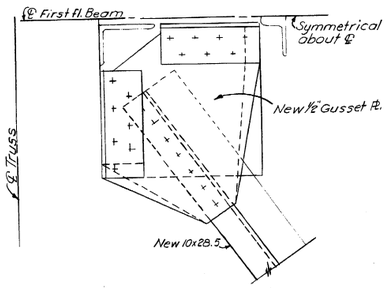
SECTION C-C
SCALE 3/4"=1'-0"



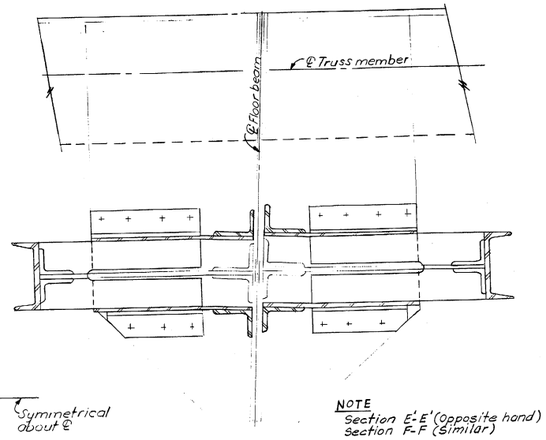
SECTION K-K
SCALE 3/4"=1'-0"



SECTION L-L
SCALE 1 1/2"=1'-0"

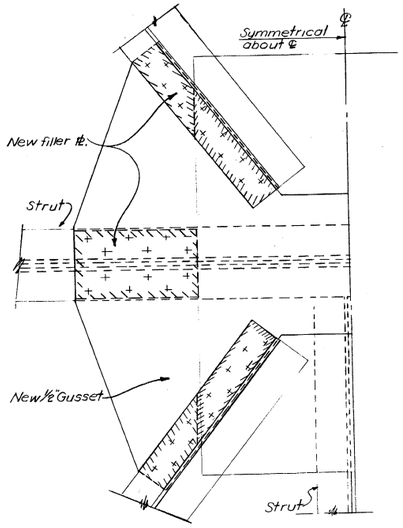


SECTION D-D
SCALE 1 1/2"=1'-0"

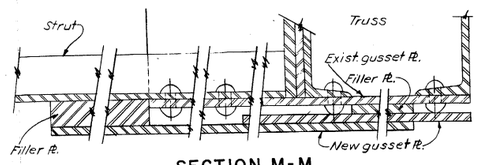


NOTE
Section E-E' (Opposite hand)
Section F-F (Similar)

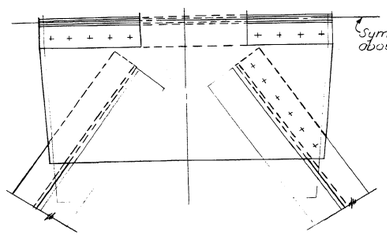
SECTION E-E
SCALE 1 1/2"=1'-0"



SECTION N-N
SCALE 1 1/2"=1'-0"



SECTION M-M
SCALE 3"=1'-0"



SECTION G-G
SCALE 1 1/2"=1'-0"

GRAPHIC SCALES

SAFETY PAYS

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY	DR. BY	CK. BY

SUBMITTED:
CHIEF, SECTION
APPROVAL RECOMMENDED:
CHIEF, DESIGN BRANCH
REVIEWED:
PROJECT
APPROVAL RECOMMENDED:
CHIEF BRANCH

MAJOR REHABILITATION PROJECT
CAPE COD CANAL BRIDGES
BOURNE HIGHWAY BRIDGE
LATERAL BRACING STRENGTHENING
SPANS 4-5-6-7

BOURNE MASSACHUSETTS

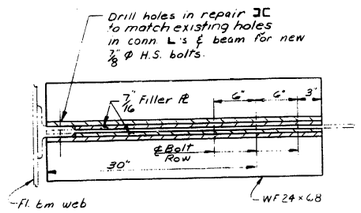
APPROVED DATE
CHIEF, ENGINEERING DIVISION

SCALE SPEC. NO.
DRAWING NUMBER
SHEET

CORPS OF ENGINEERS

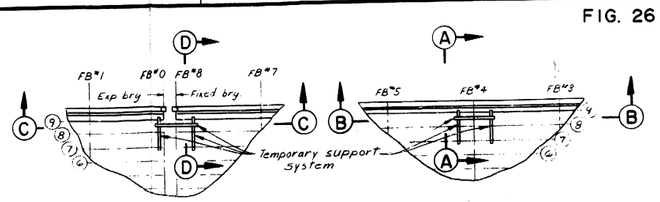
U. S. ARMY

FIG. 26



SECTION E-E

SCALE 1½"=1'-0"

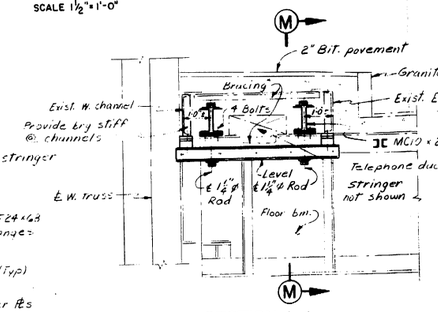


REPAIR AREA NO. 2

SCALE 1"=20'

REPAIR AREA NO. 1

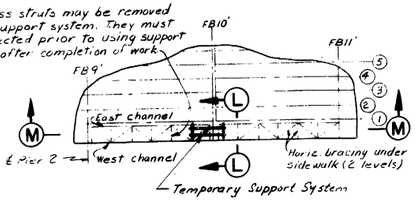
SCALE 1"=20'



SECTION L-L

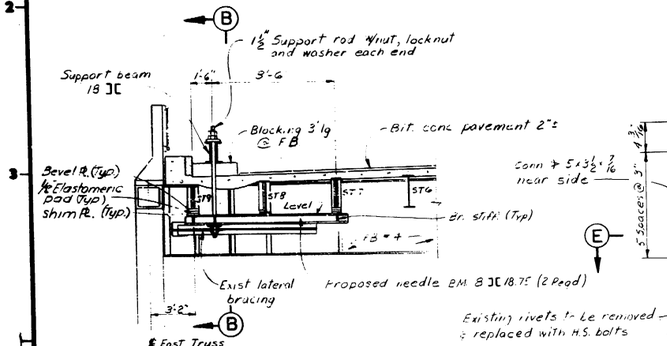
SCALE 1/2"=1'-0"

Bottom cross struts may be removed to install support system. They must be reconnected prior to using support system and after completion of work.



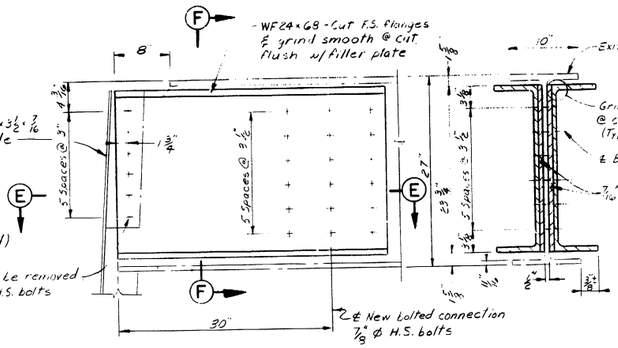
REPAIR AREA NO. 3

SCALE 1"=20'



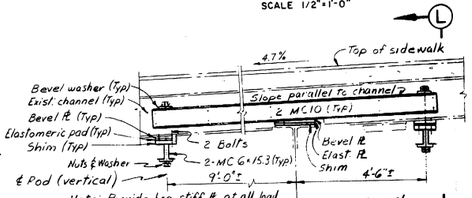
SECTION A-A (Section D-D similar)

SCALE 1/4"=1'-0"



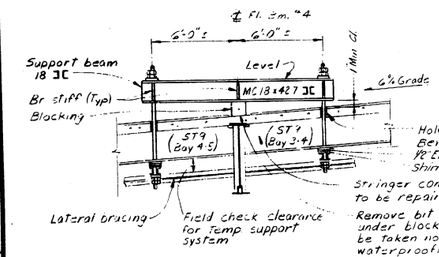
REPAIR DETAILS-AREAS 1 & 2 ELEVATION

SCALE 1½"=1'-0"



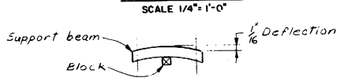
SECTION F-F

SCALE 1½"=1'-0"

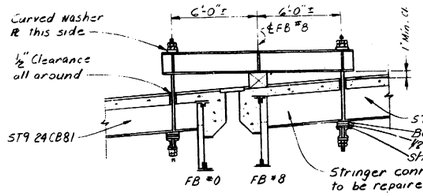


SECTION B-B

SCALE 1/4"=1'-0"



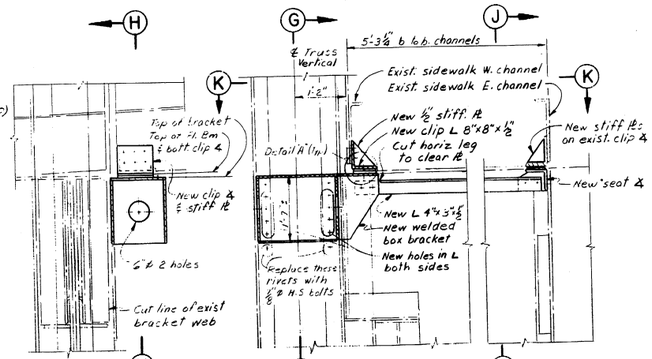
After installation of support system tighten nuts to induce 1/16 deflection in support beam. Further adjustment as required when removing connecting rivets



NOTE: For details see Sec. B-B

SECTION C-C

SCALE 1/4"=1'-0"

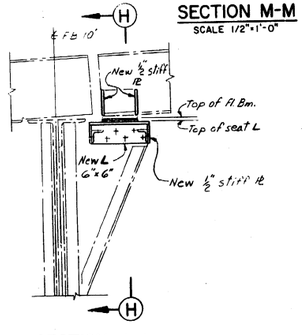


SECTION G-G

SCALE 3/4"=1'-0"

SECTION H-H

SCALE 3/4"=1'-0"



SECTION M-M

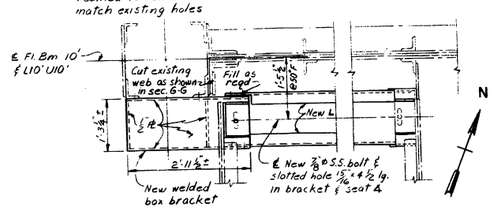
SCALE 1/2"=1'-0"

SECTION J-J

SCALE 3/4"=1'-0"

+ Indicates new ⅞" Ø H.S. bolt all holes subpunched & reamed to full size to match existing holes

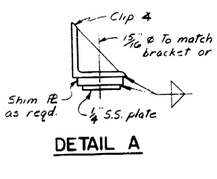
New bracket to be fully groove welded



SECTION K-K

SCALE 3/4"=1'-0"

REPAIR DETAILS-AREA 3



DETAIL A

GRAPHIC SCALES

1/4" = 1'-0"
1/2" = 1'-0"
3/4" = 1'-0"
1½" = 1'-0"
1" = 20'

GENERAL NOTES

1. All steel in temporary and permanent work shall be ASTM A-36 except as noted.
2. New field connections shall be made with ⅞" Ø high strength str. bolts ASTM A325
3. All existing rivets that are removed shall be replaced with high strength bolts of the same size.
4. The contractor shall submit shop drawings of support systems and permanent work including construction sequence in detail.
5. A complete set of structural steel shop drawings for the bridge is available at the office of the Division Engineer.
6. The contractor shall field check dimensions and arrangement of members prior to fabrication.
7. All double members shall be tied together with bolts and spacers.
8. Bearing stiffeners shall be provided at all load points.
9. All new material and damaged painting on existing steel shall be painted in accordance with the specifications.

SEQUENCE OF CONSTRUCTION

REPAIR AREAS 1 AND 2

1. Install Temporary support system.
2. Blast clean areas of stringer and connection angles which will come in contact with new splice material, to remove all paint and scale.
3. Remove six rivets connecting stringer to connection angles.
4. Install new splice. New holes in stringers shall be sub drilled and reamed for proper fit of all parts.
5. All bolts shall be tightened to proper tension by calibrated wrench, or tension indicator washer.
6. Remove temporary support system.
7. Paint as per specifications.
8. Fill holes in slab and patch bituminous concrete as per specifications.

REPAIR AREA 3

1. Install temporary support system.
2. Tighten the nuts at north and south ends of temporary support (keeping 10" JC from tilting) until reactions of bridge channels at expansion side are relieved.
3. Remove west channel bracket by cutting the web along the face of the vertical member.
4. Remove the clip angle at the west channel.
5. Remove the two lacings above the stay plates and drill holes in the vertical angles.
6. Install the new welded box bracket and clip angles at the west channel.
7. Remove the east channel bracket seat angle.
8. Install the new seat angle at the east channel bracket and new stiffener plates in the existing clip angle.
9. Install two new horizontal strut angles between the two brackets.
10. Remove the temporary support system.
11. Paint as per specifications.

SAFETY PAYS

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY	DR. BY	CK. BY

SUBMITTED:
CHIEF, SECTION
APPROVAL RECOMMENDED:
CHIEF, BRANCH
REVIEWED:
PROJECT
APPROVAL RECOMMENDED:
CHIEF BRANCH

MAJOR REHABILITATION PROJECT

CAPE COD CANAL BRIDGES

SAGAMORE AND BOURNE BRIDGES

STRINGER AND BRACKET REPAIRS

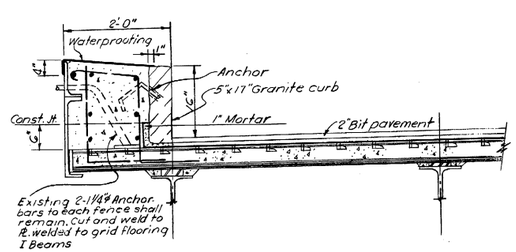
BOURNE MASSACHUSETTS

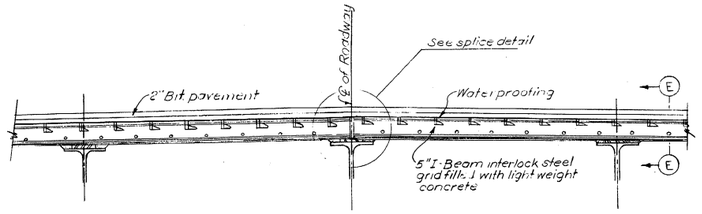
APPROVED
CHIEF, ENGINEERING DIVISION
DATE

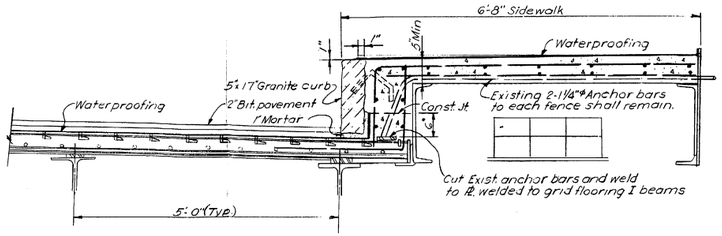
SCALE
SPEC. NO.
DRAWING NUMBER
SHEET

CORPS OF ENGINEERS — U. S. ARMY

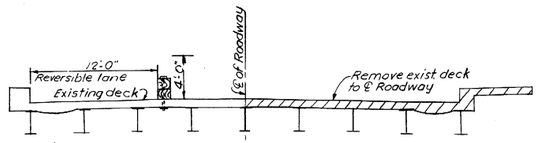
FIG. 27



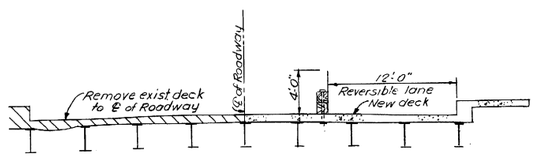




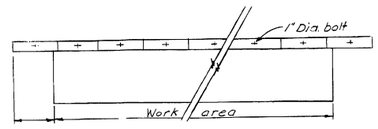
TYPICAL SECTIONS BOURNE BRIDGE



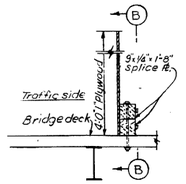
DECK REMOVAL SCHEME SIDEWALK SIDE



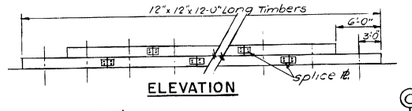
DECK REMOVAL SCHEME CURB SIDE



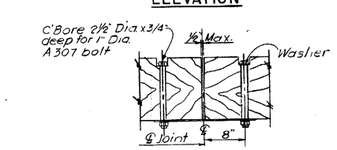
PLAN



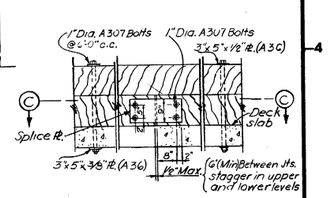
SECTION A-A



ELEVATION



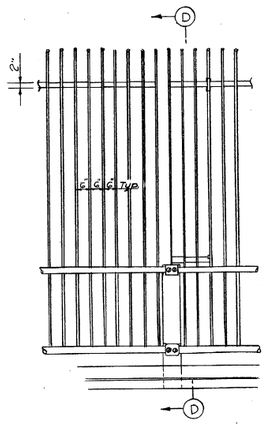
SECTION C-C



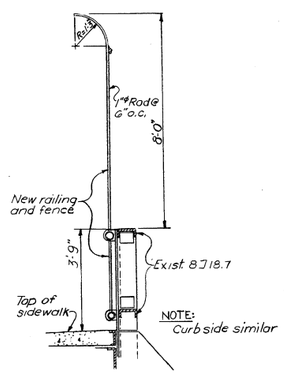
SECTION B-B

STACKED TIMBER BARRIER

SECTION E-E

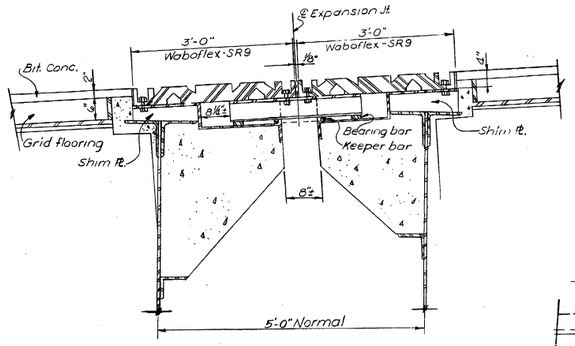


ELEVATION

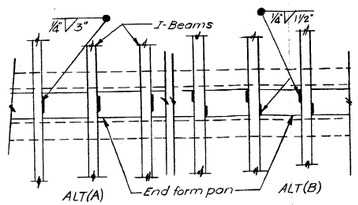


SECTION D-D

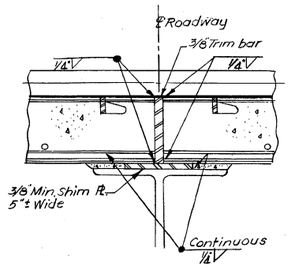
PROPOSED SUICIDE DETERRING FENCE
SCALE 1/2"=1'-0"



EXPANSION JOINT AT PIER NO. 4 (BOURNE)



WELDING OF GRID FLOORING TO SHIMS
SCALE 11/2"=1'-0"



SPLICE AT ℄ ROADWAY
SCALE 3" = 1'-0"

SAFETY PAYS

GRAPHIC SCALES

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY	DR. BY	CK. BY

SUBMITTED:
CHIEF, STRUCT. SECTION
APPROVAL RECOMMENDED:
CHIEF, DESIGN BRANCH
REVIEWED:
PROJECT MANAGER
APPROVAL RECOMMENDED:
CHIEF PROJECT BRANCH

MAJOR REHABILITATION PROJECT
CAPE COD CANAL BRIDGES
SAGAMORE AND BOURNE BRIDGES
NEW DECK DETAILS

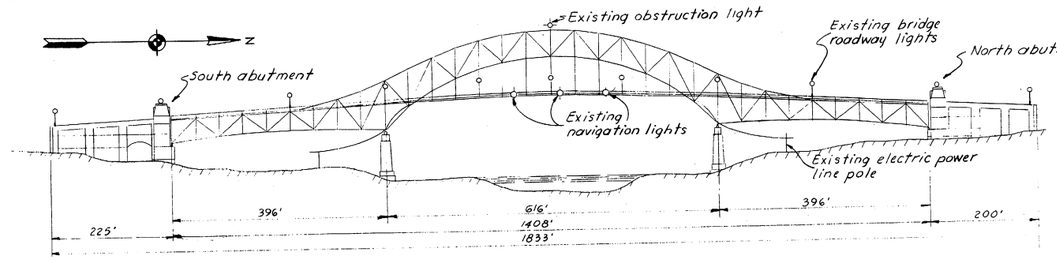
BOURNE MASSACHUSETTS

APPROVED DATE
CHIEF, ENGINEERING DIVISION

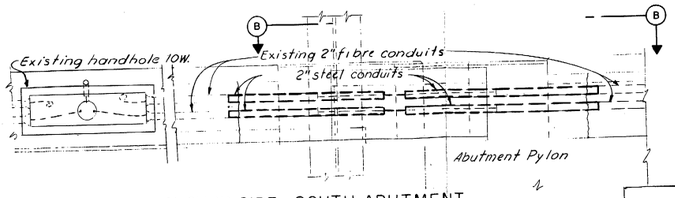
SCALE | SPEC. NO.
DRAWING NUMBER

SHEET

CORPS OF ENGINEERS — U. S. ARMY — FIG. 28

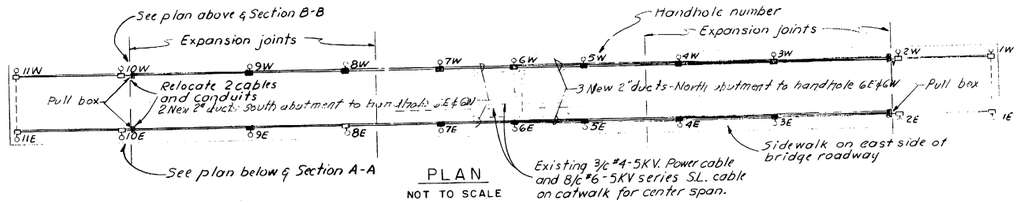


ELEVATION OF BRIDGE
SCALE 1" = 100'

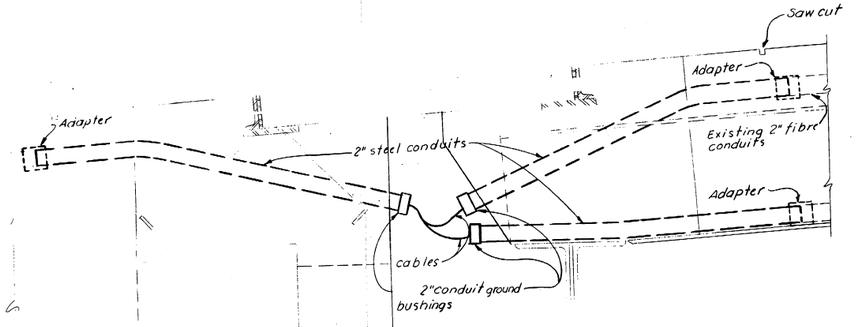


PLAN CURB SIDE - SOUTH ABUTMENT
SCALE 3/4" = 1'-0"

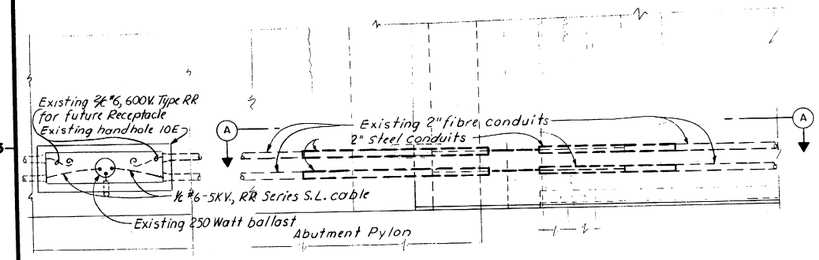
NEW	EXISTING	DESCRIPTION
	○	BRIDGE ROADWAY LIGHT.
	✧	OBSTRUCTION & NAVIGATION LIGHT.
■	□	ELECTRIC HANDHOLE.
———	———	DUCTS & CABLES IN OR ABOVE BRIDGE AS NOTED.
	- - -	CABLES RUN OTHER THAN IN DUCTS.



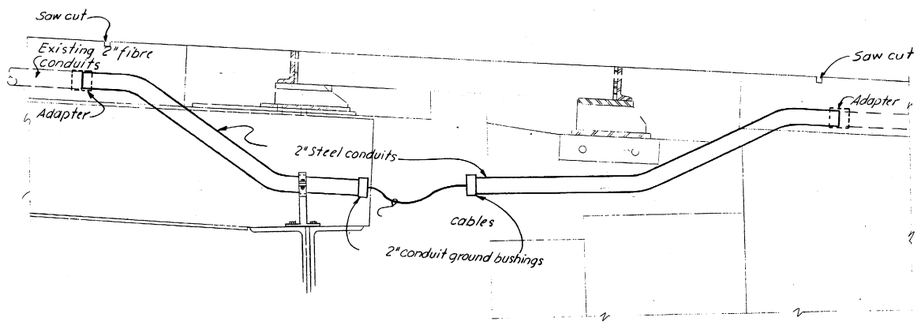
PLAN
NOT TO SCALE



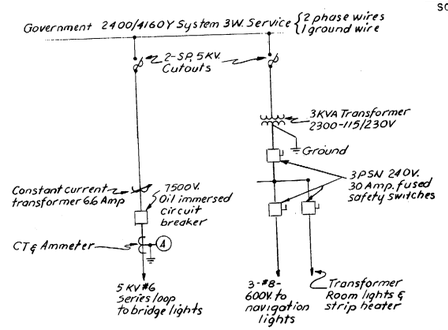
SECTION B-B
SCALE 1-1/2" = 1'-0"



PLAN SIDEWALK - SOUTH ABUTMENT
SCALE 3/4" = 1'-0"



SECTION A-A
SCALE 1-1/2" = 1'-0"



ONE LINE DIAGRAM

Note - All equipment and wiring is located in North Pylon Transformer Room and is existing except as otherwise indicated.

NOTES:
1. Details for North Abutment shall be the same as South Abutment except for one more conduit and extra cable
2. Series circuit shall be maintained for night lighting throughout construction

SAFETY PAYS

GRAPHIC SCALES
1" = 100'
3/4" = 1'-0"
1½" = 1'-0"

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY | DR. BY | CK. BY

SUBMITTED:
CHIEF, SECTION
APPROVAL RECOMMENDED:
CHIEF, BRANCH
REVIEWED:
PROJECT
APPROVAL RECOMMENDED:
CHIEF, PROJECT BRANCH

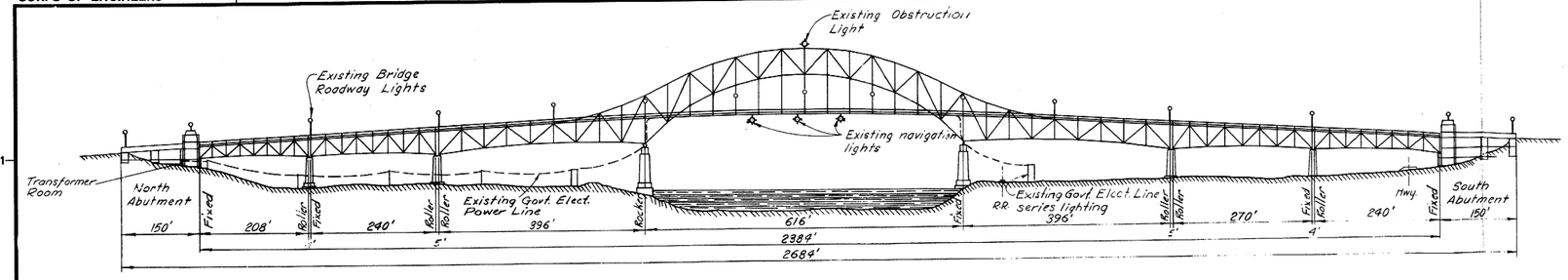
MAJOR REHABILITATION PROJECT
CAPE COD CANAL BRIDGES
SAGAMORE HIGHWAY BRIDGE
ELECTRICAL
PLANS, SECTIONS AND ELEVATION
BOURNE MASSACHUSETTS

APPROVED — DATE
CHIEF, ENGINEERING DIVISION

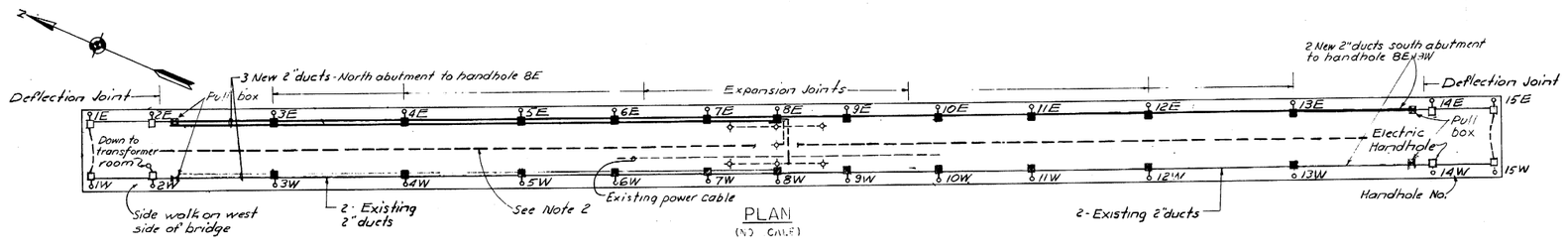
SCALE | SPEC. NO.
DRAWING NUMBER
SHEET

CORPS OF ENGINEERS — U. S. ARMY

FIG. 29

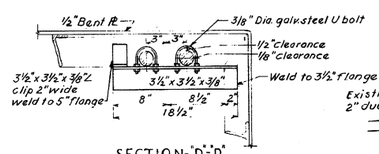


ELEVATION
SCALE: 1"=100'

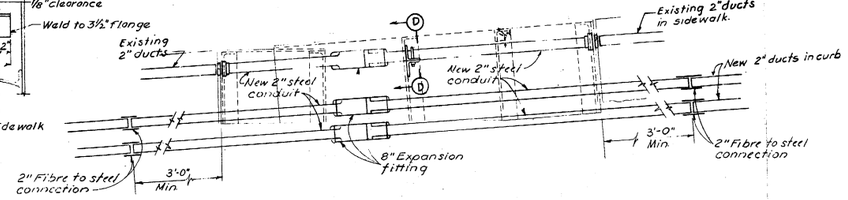


PLAN
(NO SCALE)

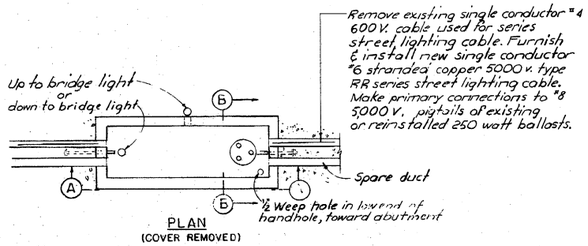
TYPICAL SECTION
EXISTING WEST SIDE ELECTRICAL DUCTS
NO SCALE



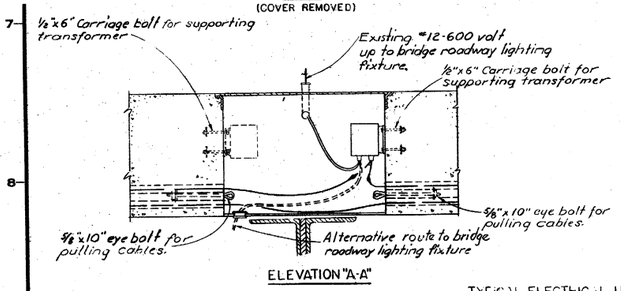
SECTION-"D"-"D"
SCALE: 1½"=1'-0"
(Curb side shown, sidewalk side similar.)



SECTION-ELECTRICAL DUCTS AT CURB & SIDEWALK EXPANSION JOINTS

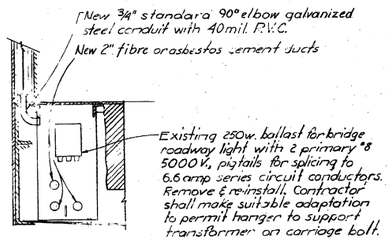


PLAN
(COVER REMOVED)

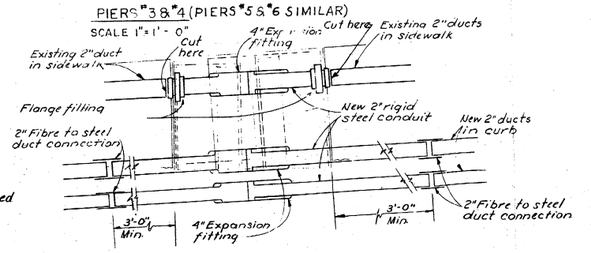


ELEVATION "A-A"

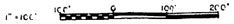
TYPICAL ELECTRICAL FIXTURE
EAST SIDE CURE
NO SCALE

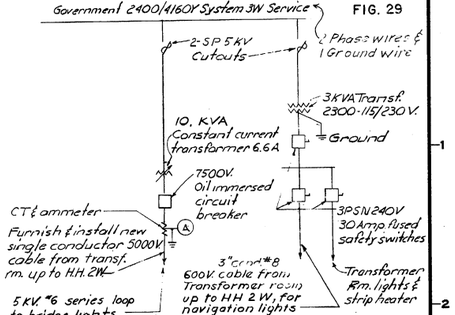


SECTION "B-B"



SECTION-ELECTRICAL DUCTS AT CURB & SIDEWALK
EXPANSION JOINTS SPAN NO. 1
SCALE 1½"=1'-0"





ONE LINE DIAGRAM

(All above equipment & wiring is located in North Pylon Transformer Room & is existing except as otherwise indicated.)

LEGEND		
NEW	EXISTING	DESCRIPTION
	○	Bridge roadway light
	◇	Obstruction & Navigation lights
■	□	Electric handhole
———	———	Ducts
- - - - -	- - - - -	Wires or cables run other than in ducts & below bridge floors

1. Contractor may obtain necessary temporary construction power for concrete saws, wire brushes, etc. & for supplementary construction lighting from Govt. Electric Service Line on the north side of Canal, or from Cape & Vineyard Electric Co. on the south. Contractor shall furnish all equipment & cables & make suitable arrangements.

2. Contractor shall make temporary installation of approximately 2500' of single conductor "6 5000 volt series street lighting cable to permit operation of bridge roadway lighting on eastside only or on west side only as required by renovation program. Conductor may be installed overhead, or under bridge floor.

3. All rigid steel conduit and fittings shall be galvanized and where indicated shall have a 40 mil PVC jacket.

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY	DR. BY	CK. BY

SUBMITTED:
CHIEF, SECTION
APPROVAL RECOMMENDED:
CHIEF, BRANCH
REVIEWED:
PROJECT
APPROVAL RECOMMENDED:
CHIEF, PROJECT BRANCH

MAJOR REHABILITATION PROJECT
CAPE COD CANAL BRIDGES
BOURNE HIGHWAY BRIDGE
ELECTRICAL
PLANS, SECTIONS AND ELEVATIONS

BOURNE MASSACHUSETTS

APPROVED DATE
CHIEF, ENGINEERING DIVISION

SCALE
SPEC. NO.
DRAWING NUMBER
SHEET