

OFF SYSTEM BRIDGE INSPECTION REPORT Educational

COUNTY City of St. Louis BRIDGE NO. 600.02 ROUTE Washington Dr.

4 City/Town St. Louis 9 Location: S      T      R     

6 Features Intersected River Des Peres Lagoon

STRUCTURE DATA

29 ADT on Str. 0029 30 Year 84

32 Approach Rdwy. Width W/Sh'ld 36 34 Skew 0

36 Traf. Safety Feat. 0 Br. Rail 0 Trans. 0 App. Gr. Rail 0 App. Rail T     

41 Open To Traffic  Load Posted  Closed  Posted Loading     

49 Str. Length 40 51 Br. Width 36 52 Dk. Wid. 38

53 Vertical Clear. Over Deck Unlimited (Curb-Curb) Posted Clear.      (Out-Out)

57 Wearing Surface: Type Asphalt Thickness     

CONDITION

58 Deck Good

59 Superstructure large holes in web of outside  
Structural Members beams, most of flange gone  
Bearings: Flat Plate ( ) Encased (X) Rocker ( )  
Tar Paper ( ) None ( ) Other ( )

Expansion Type: Finger ( ) Plate (X) Felt ( ) Open ( ) None (X)  
Preformed ( ) Elastomeric ( ) Other ( )  
Type Paint Unknown

50 Substructure minor cracking of abutment  
Piers deteriorated

51 Channel and Channel Protection       
Bank Protection: Riprap ( ) Rock Blanket ( ) Grouted Rock ( )  
None (X) Other ( )     

52 Culvert & Retaining Walls     

55 Approach Rdwy. Condition     

APPRAISAL

57 Structural Condition substantial loss of section

58 Deck Geometry     

59 Under Clearances - Vert. & Lateral     

71 Waterway Adequacy     

RR X'ing ( ) Road X'ing ( ) Stream X'ing (X) All weather X'ing (X) LW X'ing ( )

72 Approach Roadway Alignment     

RATING (9-0)				
1981	1982	1984	19	19
7	7	7		
4	3	3		

7	6	5		
---	---	---	--	--

8	8	8		
---	---	---	--	--

N	N	N		
---	---	---	--	--

7	7	7		
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4	3	3		
---	---	---	--	--

8	8	8		
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N	N	N		
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7	7	7		
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8	8	8		
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BRIDGE SUFFICIENCY CALCULATION

BRIDGE NUMBER 600.02  
 EDUCATIONAL BRIDGE ON WASHINGTON DRIVE  
 DATE INSPECTED 05/17/84

ITEM	RATING	REDUCTION
SUPERSTRUCTURE	3	40
RATED BRIDGE CAPACITY	0	60.0048
TOTAL REDUTION (55 MAX)		55
STRUCTURAL ADEQUACY AND SAFETY		
DECK CONDIDITON	7	0
STRUCTURAL CONDIDITON	3	4
DECK GEOMETRY	8	0
UNDERCLEARANCE	N	0
WATERWAY ADQUACY	7	0
APPROACH ROADWAY	8	0
ROADWAY WIDTH	36	
ADT	5000	
NUMBER OF LANES	2	
APPROACH WIDTH	36	
REDUTION FOR ADT/LANE		0
ROAD IS NOT A DEFENSE HIGHWAY		
VERTICAL CLEARANCE	9999	0
TOTAL REDUTION (30 MAX)		4
SERVICABILITY AND FUNCTIONAL OBSOLESENC=		
DETOUR LENGTH	1	1.22596
ROADWAY SECTION NUMBER	0	0
ESSENTIALITY FOR PUBLIC USE		13.774
SUFFICIENCY RATING		39.774

Inspected By D.B., R.B. Inspection Date 04-27-81

REMARKS Inventory rating H0.0 per M.H.T.D., 1979.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Inspected By Kuss, Bachmann Inspection Date 06-28-82

REMARKS ADJ-7000 80  
81 count estimated  
Bridge should be replaced  
\_\_\_\_\_  
\_\_\_\_\_

Inspected By Kalhorn, Bachmann Inspection Date May 17, 1984

REMARKS Bridge should be replaced  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Inspected By \_\_\_\_\_ Inspection Date \_\_\_\_\_

REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Inspected By \_\_\_\_\_ Inspection Date \_\_\_\_\_

REMARKS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Franklin Bridge Rehabilitation

Forest Park

St. Louis, Missouri

Preliminary Engineering Report

Prepared for:

City of St. Louis  
Board of Public Service  
305 City Hall  
St. Louis, Missouri 63103

Submitted by:

Zurheide-Herrmann, Inc.  
Consulting Engineers  
4333w Clayton Avenue  
St. Louis, Missouri 63110

May 25, 1984

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## INTRODUCTION

### Authorization

Zurheide-Herrmann, Inc. has been retained by the City of St. Louis Board of Public Services to provide engineering services relative to the rehabilitation of Franklin Bridge in Forest Park. This engineering report presents the findings of preliminary engineering studies conducted by Zurheide-Herrmann, Inc. and proposed measures by which to restore the structure. The work was authorized by Ordinance 57412.

### Scope of Work

The scope of work included all work required for the City of St. Louis to receive a construction bid on the subject bridge in accordance with the Federal-Aid Highway Off-System Replacement and Rehabilitation Program - 1984.

### Project Description

Franklin Bridge is located in the northern half of Forest Park on Wells Drive near the Steinberg Skating Rink. The structure is a single span, spandrel-filled arch constructed of concrete with soil and rubble fill. No records could be found relative to its design or construction. Reportedly, it was built in the late 1800's or early 1900's.

The structure is approximately 90.5-feet long and 30-feet wide between railings. It does not have pedestrian walkways. A concrete barrel arch spans about 50-feet between abutments. It is approximately 8-inches thick and is reinforced by 11 steel I-beam ribs spaced at 3-feet on centers. The abutments and a portion of the

barrel arch are located below the waterline. The spandrel side walls and short wing walls at each end retain the soil and rubble fill which supports an asphalt pavement.

The sides of the bridge were covered with a thick coat of red colored plaster. Areas were molded or formed to construct decorative reliefs. Presently, the bridge has limestone masonry railings which are obviously of more recent construction than the rest of the bridge. Research indicates that the original railing could have been of the concrete spindle type or a solid barrier.

### Project Objectives

Franklin Bridge is a historical structure and part of the architectural heritage of St. Louis. Long term deterioration of both its structural and architectural features has prompted this current project, which has two objectives. First, the bridge is to be rehabilitated in accordance with the requirements of the Federal-Aid Highway Off-System Replacement and Rehabilitation Program - 1984. Secondly, the bridge is to be restored as nearly as possible to its original appearance.

### Summary

The superstructure and above grade portions of the abutments were visually inspected. Also reviewed, was a geotechnical report on soil and foundation conditions at the site prepared by Shannon and Wilson, Inc., Geotechnical Consultants retained by the City of St. Louis. It was determined that the superstructure has deteriorated to a condition which precludes economical repair. The abutments were judged to be stable and there is a possibility that they could be salvaged. That determination, however, could only be made after a review of information gained by means of extensive

excavation work and partial demolition of the superstructure. The present load carrying capacity of the structure can not be calculated with any degree of certainty but it has carried normal traffic for many years without showing signs of load induced distress. In our opinion, total replacement of the structure is warranted. Furthermore, it is recommended that consideration be given to including pedestrian walkways in any new design.

## BRIDGE INSPECTION

The bridge was inspected to determine the current condition of structural components and possible future weaknesses. The major features are discussed below.

### Superstructure

The bridge was found to be in a very deteriorated condition. The sidewalks of the bridge and the wing walls were cracked and eroded. Large chunks of concrete, several inches in thickness, had fallen from the structure. Some areas of concrete were found to be so friable that the material could be raked loose and crushed by hand. It was evident that roadway runoff had penetrated the structure and repeated freeze-thaw cycles had done irreparable damage.

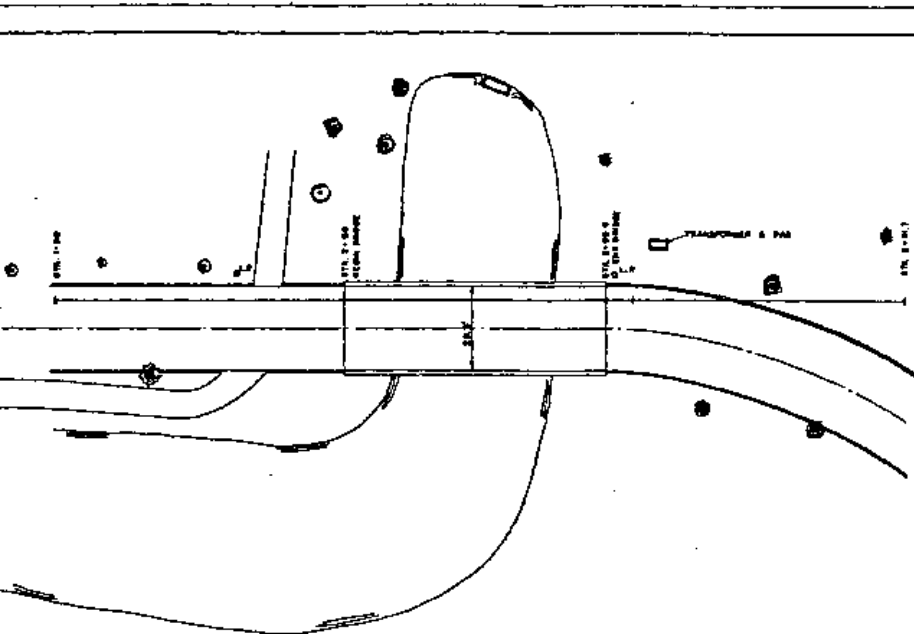
It is estimated that approximately a third of the barrel arch is below the water line. The exposed surfaces were examined. Except for surface deterioration, the concrete appeared to be sound and free of unusual cracks. At the east edge of the structure, a large section of concrete had fallen away exposing one of the steel ribs. The rib was severely corroded. Only the bottom flanges of the other steel ribs were visible and the extent of corrosion could not be determined. It is anticipated, however, that severe corrosion has occurred near the water line.

### Substructure

The abutments were judged to be stable. No signs of differential settlement were observed. The wing walls, however, have rotated and cracked.

### SURVEYS

Surveys were conducted to determine the bridge location, roadway profile and alignment, and the topographic features of the area. A preliminary drawing has been prepared and is presented herein.

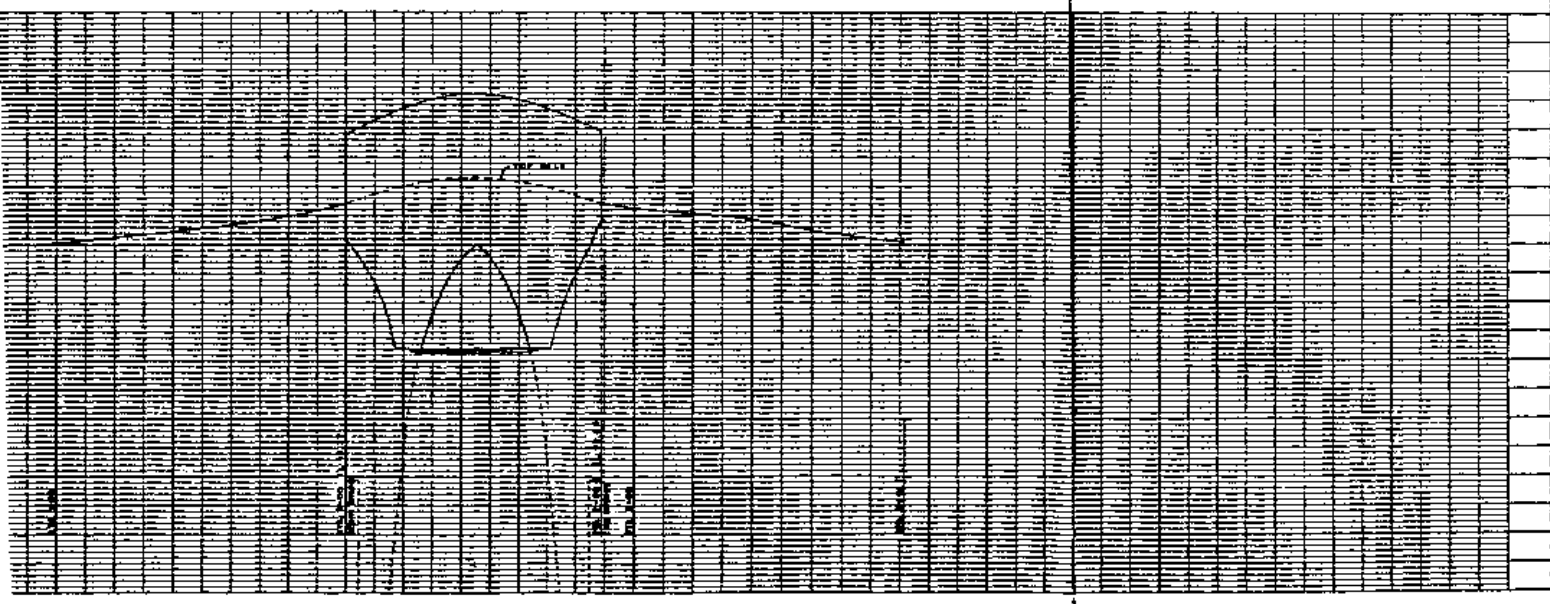


REVISIONS		PLAN & PROFILE	
NO.	DESCRIPTION	DATE	

Prepared by A.P.M. Checked by A.S.B. Drawn by T.A.S.	<b>CITY OF ST. LOUIS, MISSOURI</b> DEPARTMENT OF THE PRESIDENT BOARD OF PUBLIC SERVICE  <b>REHABILITATION</b> <b>FRANKLIN BRIDGE</b>  <b>FOREST PARK</b>	DATE 5/23-24 SHEET 2 OF 3
<b>KUHNKE-HERRMANN, INC.</b> ENGINEERS ARCHITECTS SAINT LOUIS, MISSOURI		P.B.E.

Note: 11.00 EL. 4824 N.E. CORNER OF TRANSFORMER PAD  
 11.00 EL. 4824 S.E. CORNER OF BRIDGE



PROFILE 1 PLAN, PROFILE 2 & 3 SEE SHEETS 1 & 2

Frank

### DESIGN CRITERIA

The standards which are to govern any new design include:

1. Bridge Manual for the Federal-Aid Highway Off-System Bridge Replacement and Rehabilitation Program.
2. Standard Specifications for Highway Bridges as adopted by AASHTO.
3. Geometric Design Guide for Local Roads and Streets.
4. Missouri Standard Specifications.
5. Missouri Standard Plans for Highway Construction.

### PROPOSED CONSTRUCTION

It is recommended that the existing bridge be totally replaced. Alternate designs have not yet been developed, but it may be possible to devise a plan which would allow the existing abutments to be left in place. It is recommended that since the existing roadway is only thirty (30) feet wide, pedestrian walkways be included in any new design.

Rehabilitation of Lafayette Bridge

Forest Park

St. Louis, Missouri

Preliminary Engineering Report

Prepared for:

City of St. Louis  
Board of Public Service  
305 City Hall  
St. Louis, Missouri 63103

Submitted by:

Zurheide-Herrmann, Inc.  
Consulting Engineers  
4333w Clayton Avenue  
St. Louis, Missouri 63110

May 25, 1984

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## INTRODUCTION

### Authorization

Zurheide-Herrmann, Inc. has been retained by the City of St. Louis Board of Public Services to provide engineering services relative to the rehabilitation of Lafayette Bridge in Forest Park. This engineering report presents the findings of preliminary engineering studies conducted by Zurheide-Herrmann, Inc. and proposed measures by which to restore the structure. The work was authorized by Ordinance 57412.

### Scope of Work

The scope of work included all work required for the City of St. Louis to receive a construction bid on the subject bridge in accordance with the Federal-Aid Highway Off-System Replacement and Rehabilitation Program -1984.

### Project Description

Lafayette Bridge is located in the northern half of Forest Park on Grand Drive near the Government Drive intersection. The structure is a single span open steel arched framework supported on stone masonry abutments. It spans a leg of the River Des Peres Lagoon. The City of St. Louis provided a number of design and steel fabrication drawings to Zurheide-Herrmann, Inc. They were dated 1935. The design drawing indicated that the stone masonry abutments were existing and were to be slightly modified to accept the new steel superstructure. Details of the abutments were not given. The loadings used in design were not recorded.

The structure is approximately 94-feet long and 41-feet wide. It carries a two lane roadway, 36-feet wide and a pedestrian walkway on each side. Four steel arches span 72-feet between abutments.

Spandrel columns rise from the arches to support longitudinal steel girders which, in turn, support transverse steel stringers. The deck is constructed of 3-inch deep steel I-bar grating which spans about 5'-9" between stringers. The grating is filled with concrete and topped with an asphalt wear course. The pedestrian walkways are located about 6-inches above the roadway and are guarded by ornamental steel railings. The railings terminate at decorative cast-iron pylons. The 1935 design drawing indicated that the pylons were existing features to be reused in the new bridge construction.

The arches are fabricated of curved, wide-flange members. Pinned hinge connections are located at each arch end and apex. The arches are laterally braced with closely spaced angle cross frames oriented vertically and continuous angle x-bracing oriented tangent to the arch curvature. The stone abutments are oriented perpendicular to the roadway. Their below grade size and configuration is unknown. They were modified in 1935 to receive the arches and were capped with new concrete U-type wing wall which retain the approach fill material. Separate concrete wing wall extensions were also added at each corner. They intersect the abutments and are oriented parallel to the roadway alignment. An inspection revealed that the walls were rectangular sections constructed without footings. The depth of approach fill retained by these walls varies from 0 to 4-feet.

### Project Objectives

Lafayette Bridge is a historical structure and part of the architectural heritage of St. Louis. Long term deterioration of both its structural and architectural features has prompted this current project, which has two objectives. First, the bridge is to be rehabilitated in accordance with the requirements of the Federal-Aid Highway Off-System Replacement and Rehabilitation Program - 1984. Secondly, the bridge is to be restored as nearly as possible to its original appearance.

## Summary

The superstructure and above grade portions of the abutments were visually inspected. It was determined that both the superstructure and abutments have sustained extensive deterioration and that major rehabilitation work is required. Recommended renovation work includes the following major items:

1. Replacement of the stone abutments above the arch spring line,
2. Replacement of the concrete wing walls which cap the abutments and the wing wall extensions which parallel the roadway,
3. Replacement of the deck and pedestrian walkways,
4. Replacement of 30 of the 42 transverse stringer beams, and
5. Cleaning and painting of the steel framework and railings.

The stringer beams have corroded as the result of long term exposure to roadway drainage. Their load carrying capacity has been impaired and in some instances the deck is in fact being carried by the vertical cross bracing system. Structural redundancy has permitted the bridge to function without showing outward signs of distress. Following, is a detailed description of present conditions.

## BRIDGE INSPECTION

The bridge was inspected to determine the current condition of structural components and possible future weaknesses. The major features are discussed below.

### Approaches

The condition of the approach pavement was good. There was some unevenness adjacent to the wing wall extensions on the south end due to subsidence of the approach fill. The side slopes were excessively steep and eroded. Concrete has been dumped at the south east corner in an effort to stabilize the embankment.

### Wing Walls

The U-type concrete wing walls which cap the stone abutments were in good condition with the exception of minor surface deterioration. The concrete wing wall extensions have sustained varying amounts of deterioration; at the south end, some portions have completely disintegrated.

### Abutments

The limestone abutments were constructed with massive lower sections which transfer the arch reactions to the subgrade and, with thin upper stem walls which retain the approach fill material. The lower sections showed no signs of movement or structural inadequacy. Mortar joints were deteriorated but judged to be repairable by means of tuckpointing. The upper stem walls, however, were found to be in a very deteriorated and weakened condition. Many stones were loose and friable, some were missing. At locations where stones were missing, the wall was found to be only a single wythe in thickness. Repeated freeze-thaw cycles have destroyed the integrity of the walls. Complete replacement was judged to be necessary.

## Deck

Approximately one third of the steel I-bar deck system has been damaged on the underside by corrosion. Corrosion has also attacked the supporting stringers beams. In our opinion, economical repair of the supporting beams requires that the deck be removed.

## Steel Superstructure

The arches, spandrel columns and longitudinal girders were found to be in a good condition requiring only minor repairs, cleaning and painting. 30 of the 42 transverse stringer beams, however, were severely damaged by corrosion due to long term exposure to roadway drainage. Their load carrying capacity has been impaired and in some instances, the deck is in fact being carried by the vertical cross bracing system. Structural redundancy has allowed the bridge to function without showing outward signs of distress.

## Bearings

The steel arches were supported on pinned hinge connections. The bearing points were located a short distance above the water line. No signs of distress were observed, however, there was some corrosion. The hinged connections were judged to be secure and capable of functioning properly. Minor repair will be required.

## Expansion Joints

Expansion joints were located at each end of the deck. The joints were open and allowed roadway runoff to drain onto the transverse stringers located tangent to the abutments.

### Pedestrian Walkways

The condition of the raised pedestrian walkways was good. The juncture between the walkway and deck, however, was constructed in such a fashion that roadway runoff could drain onto the supporting steel stringers. A continuous steel plate which closed the vertical separation on each side of the deck between the roadway and walkway was severely corroded.

### Railings

The steel railings were found to be secure and in a good condition. Pieces were missing, however, from the cast-iron end post but, repair will be possible. At a minimum the railings require cleaning and painting.

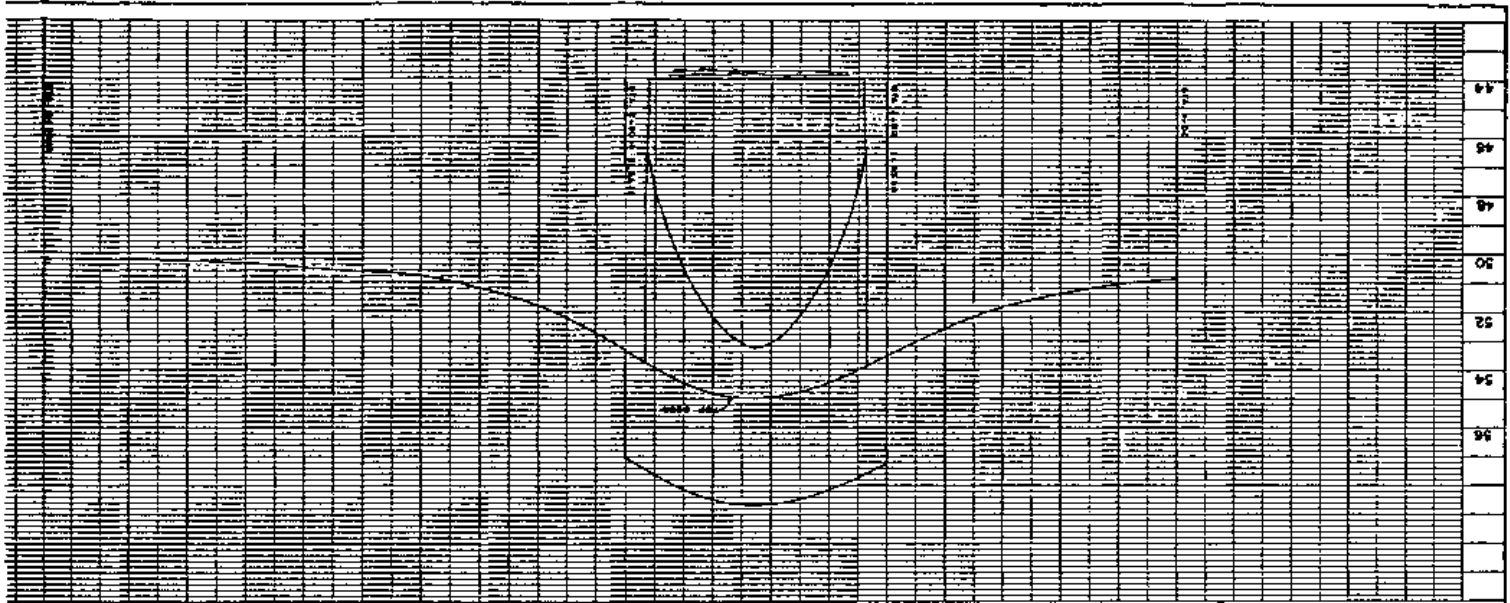
### Encroachments

A single electrical conduit was attached to the bridge. Otherwise, the structure was free of utilities, sewer pipes or other encroachments.

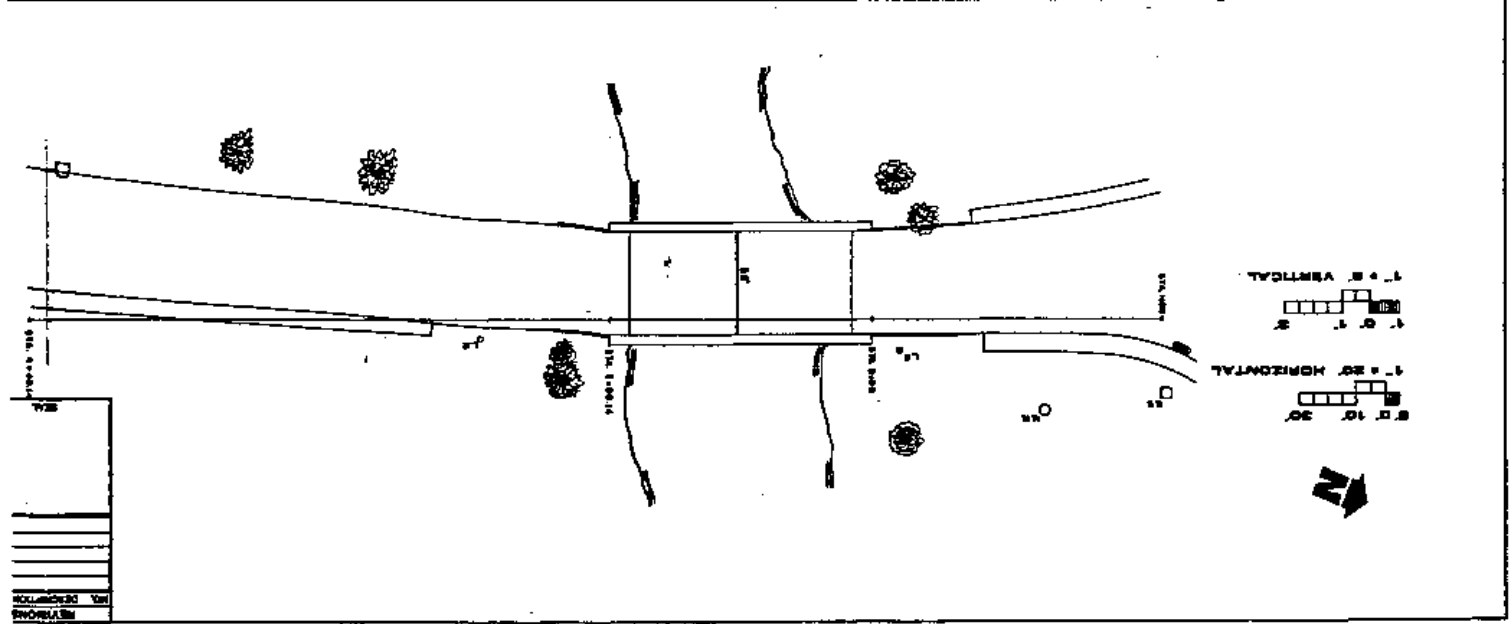
## SURVEYS

Surveys were conducted to determine the bridge location, roadway profile and alignment, and the topographic features of the area. A preliminary drawing has been prepared and is presented herein.

AN INDEPENDENT ENGINEERING FIRM  
SERVING THE PLANNING INDUSTRY



PROJECT	
NO.	
DATE	
BY	
FOR	



PLAN	
NO.	
DATE	
BY	
FOR	

REVISIONS	
NO.	DESCRIPTION

### Load Capacity Rating

Construction details of the stone abutments and the loadings for which the structure was designed are not known. The steel superstructure was constructed about 50 years ago and since that time has carried normal traffic without showing distress. A physical inspection has revealed deterioration due to corrosion. The structural integrity of the bridge can be restored by replacement of corroded members and correction of other relatively minor deficiencies described in this report. In our opinion, a detailed stress analysis is not warranted to demonstrate its capacity to safely carry normal traffic.

## DESIGN CRITERIA

The standards which governed the renovation work include:

1. Bridge Manual for the Federal-Aid Highway Off-System Bridge Replacement and Rehabilitation Program.
2. Standard Specifications for Highway Bridges as adopted by AASHTO.
3. Geometric Design Guide for Local Roads and Streets.
4. Missouri Standard Specifications.
5. Missouri Standard Plans for Highway Construction.

## PROPOSED RENOVATION WORK

Eight major items of renovation work are recommended.  
They are:

1. Remove and replace wing walls and the upper stem walls of the stone abutments.
2. Tuckpoint the stone abutments as required below the level of arch bearing.
3. Remove and replace the bridge deck and pedestrian walkways.
4. Remove and replace 30 of the 42 transverse stringer beams.
5. Repair arch bearing points.
6. Prepare and paint superstructure and railings.
7. Rebuild approaches and replace pavement.
8. Repair eroded side slopes.

The deteriorated condition of the upper stem walls warrants their replacement. It is recommended that the new walls be of concrete construction. The lower portions of the abutments were judged to be adequate for reuse.

# City of St. Louis

## DEPARTMENT OF THE PRESIDENT

BOARD OF PUBLIC SERVICE

305 CITY HALL

ST. LOUIS, MISSOURI 63103

(314) 622-3535



VINCENT C. SCHOEMEHL, JR.  
MAYOR

MARTIN P. WALSH, JR., P.E.  
PRESIDENT

April 27, 1984

Mr. Frank Kriz, District Engineer  
Missouri Highway & Transportation Department  
329 South Kirkwood Road  
Kirkwood, MO 63122

RE: Off System Bridge Replacement and  
Rehabilitation Program

Dear Mr. Kriz:

The Manufactures Bridge in Forest Park has a sufficiency rating of 51.8 which is slightly higher than a rating of 50.0 to allow the bridge to be reconstructed. Rehabilitation instead of reconstruction for this structure is not feasible.

To rehabilitate the bridge instead of constructing a new bridge would not be economically feasible for the following reasons.

1. The concrete deck needs replacement.
2. The steel beams are deteriorated and the beams lower flange no longer exist. The beams have to be replaced.
3. The type of foundation of the center piers and the abutments are unknown.
4. The wingwalls and sections of the existing abutments have to be removed to allow for the abutment to be extended for the proposed sidewalks.
5. The bridge and abutments were probably constructed seventy-five years ago, 1905-1910.
6. The beam seat in the abutment needs to be reconstructed. We think the stone piers were placed to take the beam load off of the abutment beam seats.
7. The only part of the structure remaining would be the center section of the abutment, which would have a reconstructed beam seat and a foundation of unknown design.

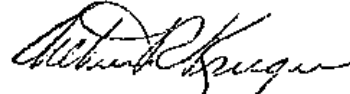
continued

Page Two

The Inventory Rating (item 66) for this bridge on the printout, dated March 1983, is about two times too high for this structure and should be reduced.

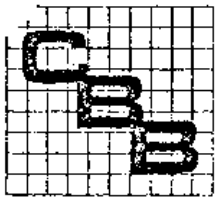
We request permission to reconstruct this bridge instead of spending the same amount of funds and have a bad section of abutment.

Yours truly,



Arthur R. Kruger, Chief Engineer  
Special Assignments Division

ARK:dd



Crawford, Bunte, Brammeier

Consulting Engineers

P.O. Box 28727 St. Louis, Missouri 63146

314-878-6644

June 8, 1984

City of St. Louis  
Department of the President  
Board of Public Service  
305 City Hall  
St. Louis, Missouri 63103

Attention: Mr. Arthur R. Kruger

RE: Manufacturers Bridge  
Forest Park

Dear Mr. Kruger:

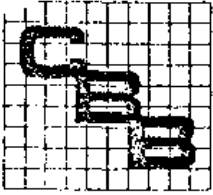
Per your request, we have prepared a cost estimate for the above referenced bridge which is attached to this letter.

Prior to preparing the enclosed cost estimate, we made a visual investigation of the existing structure to determine the feasibility of rehabilitation. Our investigation revealed the following:

1. The exterior superstructure beams are corroded to the point of near collapse.
2. The interior beams are also in poor condition with either missing or non-functional diaphragms.
3. The existing two-span bridge is supported on three rows of independent stone piers. Many of these stone piers are deteriorating badly with cracks, loose or missing mortar in the joints and missing stones.
4. The abutment concrete back wall does not appear to be an integral part of the system, and appears to have been constructed as a retaining wall independent of the bridge structural system, therefore, not carrying any of the bridge gravity loads.

In order to consider rehabilitation of the bridge, a field investigation must be performed to determine the type, condition and configuration of the existing foundation system. This investigation would also determine if the concrete walls are either a part of the structural system or independent retaining walls. The cost for this investigation was added as a separate cost in the estimate.

A George L. Crawford and Assoc. Inc. Company



City of St. Louis  
June 8, 1984  
Page 2

Should the field investigation reveal the concrete backwall to be a retaining wall, as we suspect, the wall must be removed in order to construct an abutment. In this event, the only possible use of the existing bridge would be existing piles under the stone piers if in fact there are any.

In our opinion, rehabilitation of the existing bridge should not be pursued since such a small part of the existing structure, if feasible at all, could be reused.

I have enclosed several photographs of the existing bridge for your use.

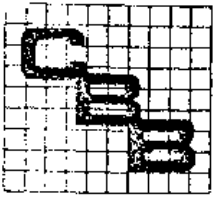
Should you have any questions or comments, please feel free to call.

Sincerely,

  
John J. Wegescheide, P.E.

JJW:dm

Enclosures



PRELIMINARY COST ESTIMATE

MANUFACTURERS BRIDGE

FOREST PARK

	<u>Reconstruction</u>	<u>Rehabilitation</u>
Removal	\$ 25,000	\$ 25,000
Deck	15,300	15,300
Railings	6,500	6,500
Beams	20,700	20,700
Sidewalks	3,200	3,200
Abutments	Piling	19,250
	Walls	10,500
	Seats	3,000
Miscellaneous	2,000	2,000
Investigation	---	7,600**
	<u>\$105,450</u>	<u>\$106,300</u>
15% O.H. & P.	<u>15,820</u>	<u>15,945</u>
Total	\$121,270	\$122,245

\* Assuming at lease one useable pile under each existing stone pier at abutment.

\*\* Additional geotechnical and investigation costs to determine useability of any part of existing abutment and piers.

EUGENE J. FELDHAUSEN, *Chairman*  
Suite 430  
10920 Ambassador Dr.  
Kansas City 64153

MISSOURI  
HIGHWAY AND TRANSPORTATION COMMISSION

ROBERT N. HUNTER, *Chief Engineer*

BRUCE A. RING, *Chief Counsel*

L. V. McLAUGHLIN, *Ass't. Chief Engine.*

MARI ANN WINTERS, *Secretary*

P. O. Box 270  
Jefferson City, Missouri 65102  
Telephone (314) 751-2551



329 South Kirkwood Road  
Kirkwood, Missouri 63122

August 27, 1984

Surveys and Plans: Off-System Bridge Program  
City of St. Louis  
Manufactures Bridge Over  
River Des Peres Lagoon in Forest  
Park  
Project BRO-115(7)  
General

Mr. Martin P. Walsh, Jr. P.E. President  
Board of Public Service  
305 City Hall  
Tucker and Market Streets  
St. Louis, Missouri 63103

Dear Mr. Walsh:

We have reviewed your comparative estimates regarding rehabilitation versus replacement and wish to inform you that the April 25 reinspection results were such that the noted structure now has a sufficiency rating of 47.5 and is therefore eligible for replacement.

Yours very truly,

  
FRANK G. KRIS  
District Engineer

RECEIVED  
AUG 28 1984  
OFFICE OF THE  
PRESIDENT, B.P.S.

Rehabilitation of Old Stable Bridge

Forest Park

St. Louis, MO

Preliminary Engineering Report

Prepared for:

City of St. Louis  
Board of Public Service  
305 City Hall  
St. Louis, Missouri 63103

Submitted by:

Zurheide-Herrmann, Inc.  
Consulting Engineers  
4333w Clayton Avenue  
St. Louis, Missouri 63110

May 25, 1984

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## INTRODUCTION

### Authorization

Zurheide-Herrmann, Inc. has been retained by the City of St. Louis Board of Public Service to provide engineering services relative to the rehabilitation of Old Stable Bridge in Forest Park. This engineering report presents the findings of preliminary engineering studies conducted by Zurheide-Herrmann, Inc. and proposed measures by which to restore the structure. The work was authorized by Ordinance 57412.

### Scope of Work

The scope of work included all work required for the City of St. Louis to receive a construction bid on the subject bridge in accordance with the Federal-Aid Highway Off-System Replacement and Rehabilitation Program - 1984.

### Project Description

Old Stable Bridge is located in the northern half of Forest Park on Municipal Opera Drive. The structure is a single span concrete T-beam bridge. It was constructed in 1922 and spans a leg of the River Des Peres Lagoon. The City of St. Louis provided Zurheide-Herrmann, Inc. with a number of design drawings. These are presented in the Appendix to this report. The loadings used in design are unknown.

The structure is 110-feet long and 56-feet, 2-inches wide. It carries a two lane roadway, 40-feet wide and a pedestrian walkway on each side. Eight concrete girders cast monolithically with a 9-inch thick deck span 44-feet between abutments. The interior girders are of nearly uniform depth but for architectural reasons, the edge girders were shaped to resemble low rise archs.

The 9-inch structural deck is covered by an unreinforced concrete base slab and an asphalt wear course. Transverse drainage was achieved by tapering the concrete base to crown the roadway centerline. Longitudinal drainage each way from the centerline of the span was achieved by cambering the top side of the girders.

The girders bear on heavy, gravity-type abutments which are oriented perpendicular to the roadway. The drawings indicate the abutments are founded on hard-pan material at an elevation approximately 22.28 feet below the roadway high point.

Wing walls retain the approach fill material and asphalt roadway. They intersect the abutments and are oriented parallel to the alignment of the roadway. The drawings indicate the walls are founded on shallow stepped spread footings.

Elaborate concrete railings, which terminate at massive pylons, line the roadway. They are a combination of precast and cast-in-place elements. The railings are anchored to a large beam-like member cast on top of the deck.

### Project Objectives

Old Stable Bridge is an historical structure and part of the architectural heritage of St. Louis. Long term deterioration of both its structural and architectural features has prompted this current project, which has two objectives. First, the bridge is to be rehabilitated in accordance with the requirements of the Federal-Aid Highway Off-System Replacement and Rehabilitation Program - 1984. Secondly, the bridge is to be restored as nearly as possible to its original appearance.

## Summary

The superstructure and above grade portions of the abutments were visually inspected. The girders, abutments and wing walls were found to need only minor repairs. The deck, however, has deteriorated due to the effects of water penetration. Scattered areas of spalled concrete and efflorescence were found on the underside of the deck and, in a few areas corroded reinforcing bars were exposed. In addition to the deck deterioration, both pedestrian walkways are severely deteriorated and the approach fill material has settled slightly causing unevenness in the pavement.

Recommended renovation work would include the following major items:

1. Construction of a new structural deck over top of the existing;
2. Construction of new walkways and handrails;
3. Resurfacing of sidewalls; and
4. Patching of the girders.

Following is a detailed description of present conditions and a discussion of the recommended renovation work.

## BRIDGE INSPECTION

The bridge was inspected to determine the current condition of structural components and possible future weaknesses. The major features are discussed below.

### Approach Pavement

The condition of the asphalt approach pavement was poor. Unevenness was caused by slight settlement of approach fill material.

### Wing Walls

With the exception of surface deterioration, the condition of the wing walls which paralleled the roadway was judged to be good. There was no noticeable movement of the walls relative to the rest of the bridge.

### Abutments

Most of the abutment construction was concealed from view. No signs were detected of structural distress or significant movement. Contrary to the design drawings, the abutments were not cast as single monolithic units. Rather, the abutments were first cast to an elevation which varied from approximately 8 to 30 inches below the underside of the girders. A leveling course was later cast to form a bearing surface for the girders. This technique resulted in the construction of two cold joints. During the inspection, water was observed seeping through the joints. Heavy efflorescence deposits were found along the joints. Some deterioration has occurred and patching is required.

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The girders and underside of the deck were inspected. Scattered areas of spalled concrete and efflorescence were found. In some areas of the deck, corroded reinforcing bars were exposed to view or rust stains indicated the presence of corrosion. In no instance, were the principal tension bars of the girders visible but, in a few places, cover material had spalled away leaving stirrups exposed. The damage to the girders was judged to be of minor importance. An estimated 16 percent of the girder surface area needs to be patched. The damage to the deck, however, was judged to be serious. Approximately 40% of the deck area has sustained some degree of spalling and 35 percent of the area was judged to have sustained damage severe enough to warrant replacement.

Contrary to the design drawings, a construction joint was installed at the center of the deck, parallel to the girder. Efflorescence and spalling indicated long term leakage through the joint. Heavy efflorescence and spalling was also found in deck areas located beneath the edges of the roadway. Apparently, there has been a steady migration of water through the deck.

### Pedestrian Walkways

The pedestrian walkways were severely deteriorated and require total replacement. Some segments have been removed and replaced with asphalt. Their condition allows water to easily penetrate to the supporting concrete deck.

### Railings

The railings have experienced some surface deterioration and cracking. They are mounted on massive beam-like elements which rest on top of the deck. These components have

sustained very severe deterioration and must be replaced. Therefore, the handrails must also be replaced. It would not be economically feasible to attempt a salvage of the railings.

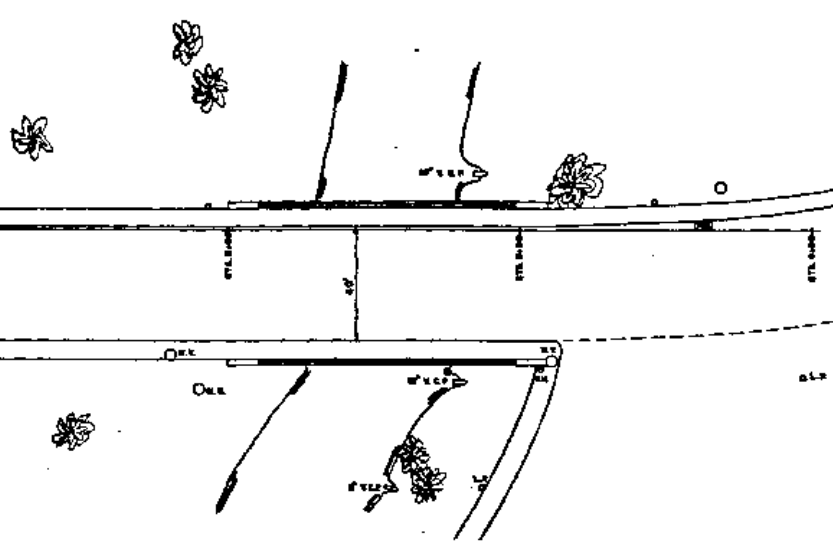
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A 12-inch diameter cast-iron sewer line is hung from the underside of the deck on the south side. The line was shown on the original design drawings. It appears to have been abandoned.

Other utilities, manholes and drain pipes are shown on the plan and profile sheet presented in Part III of this report.

## SURVEYS

Surveys were conducted to determine the bridge location, roadway profile and alignment, and the topographic features of the area. A preliminary drawing has been prepared and is presented herein.



REVISIONS			PLAN & PROFILE		
NO.	DESCRIPTION	DATE	APPROVED BY	CITY OF ST. LOUIS, MISSOURI	DAY
				DEPARTMENT OF THE PRESIDENT	
				BOARD OF PUBLIC SERVICE	
				REHABILITATION	1
				OLD STABLE BRIDGE	OF
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				FILE	

SEE 58 1/2 IN OPEN ON FIRE HYDRANT  
SOUTH EAST CORNER OF BRIDGE

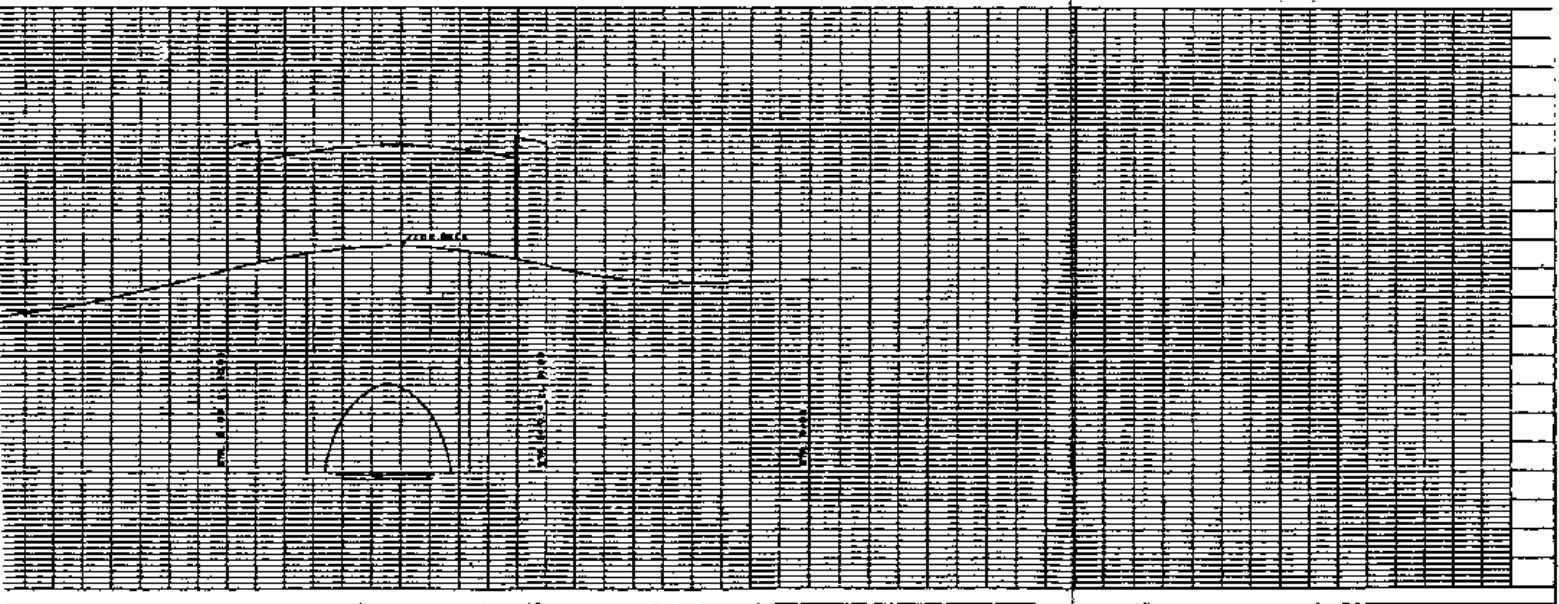


PLATE 1 PLAN & PROFILE OF OLD STABLE BRIDGE

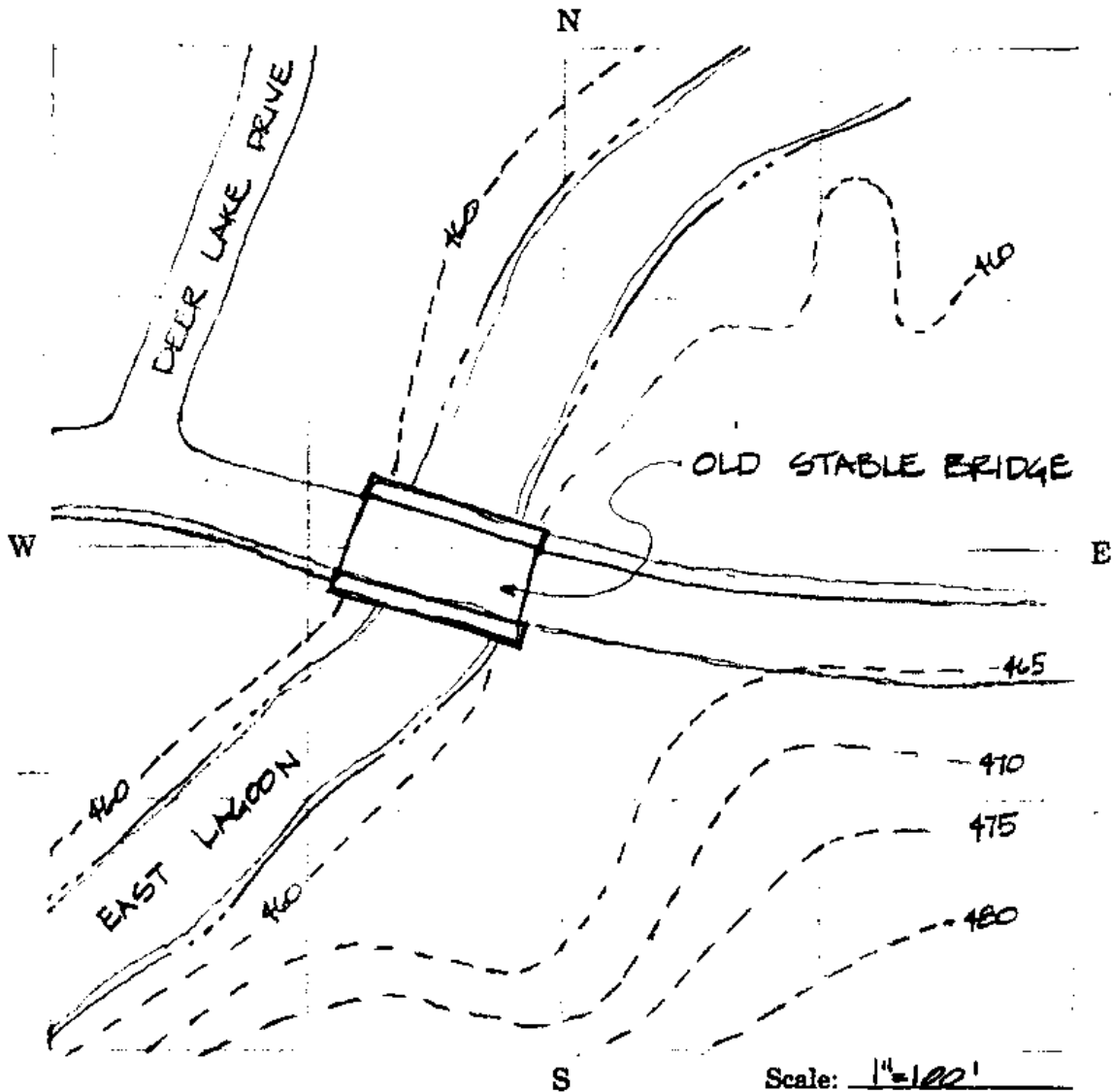
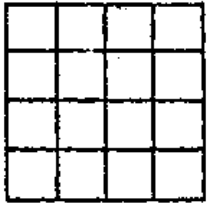
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The loading for which the structure was designed is not known. The bridge was constructed in 1922 and since that time has carried normal traffic without showing distress. A physical inspection has revealed the girders and abutments to be structurally sound, except for minor deterioration, which can be repaired. In our opinion, a detailed stress analysis is not warranted to demonstrate its capacity to safely carry normal traffic.

# SKETCH MAP

Indicate the chief topographical features, such as streams and elevations. Also indicate houses and roads. Indicate the site location by enclosing the site area with dotted line. Note scale of map and portion of section included in sketch map. Include drawings, photographs, etc.

Indicate part of section included in sketch map.



**THIS IS PROBABLY THE ONE MOST IMPORTANT PART OF THIS DATA FORM.**

*Please Attach a copy of a topographic map with the site marked on it.*

Rehabilitation of Old Stable Bridge

Forest Park

St. Louis, MO

Preliminary Engineering Report

Prepared for:

City of St. Louis  
Board of Public Service  
305 City Hall  
St. Louis, Missouri 63103

Submitted by:

Zurheide-Herrmann, Inc.  
Consulting Engineers  
4333w Clayton Avenue  
St. Louis, Missouri 63110

May 25, 1984

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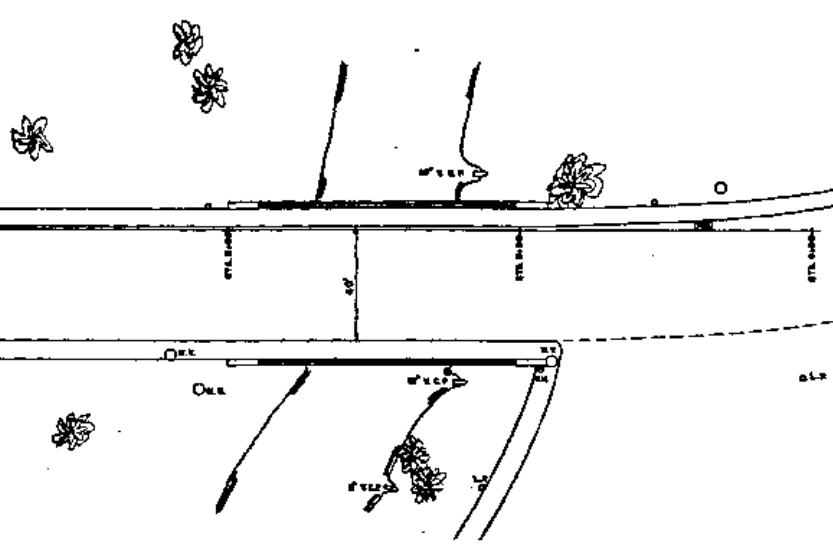
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			A.P.E.	DEPARTMENT OF THE PRESIDENT	6/25/
			M.C.L.	BOARD OF PUBLIC SERVICE	1922
			T.A.B.	REHABILITATION	1
				OLD STABLE BRIDGE	OF
				FOREST PARK	3
				BURKHERTZ-HERRMANN, INC. ENGINEERS ARCHITECTS SAINT LOUIS, MISSOURI	FILE

SEE 58 " IN OPEN ON FIRE HYDRANT  
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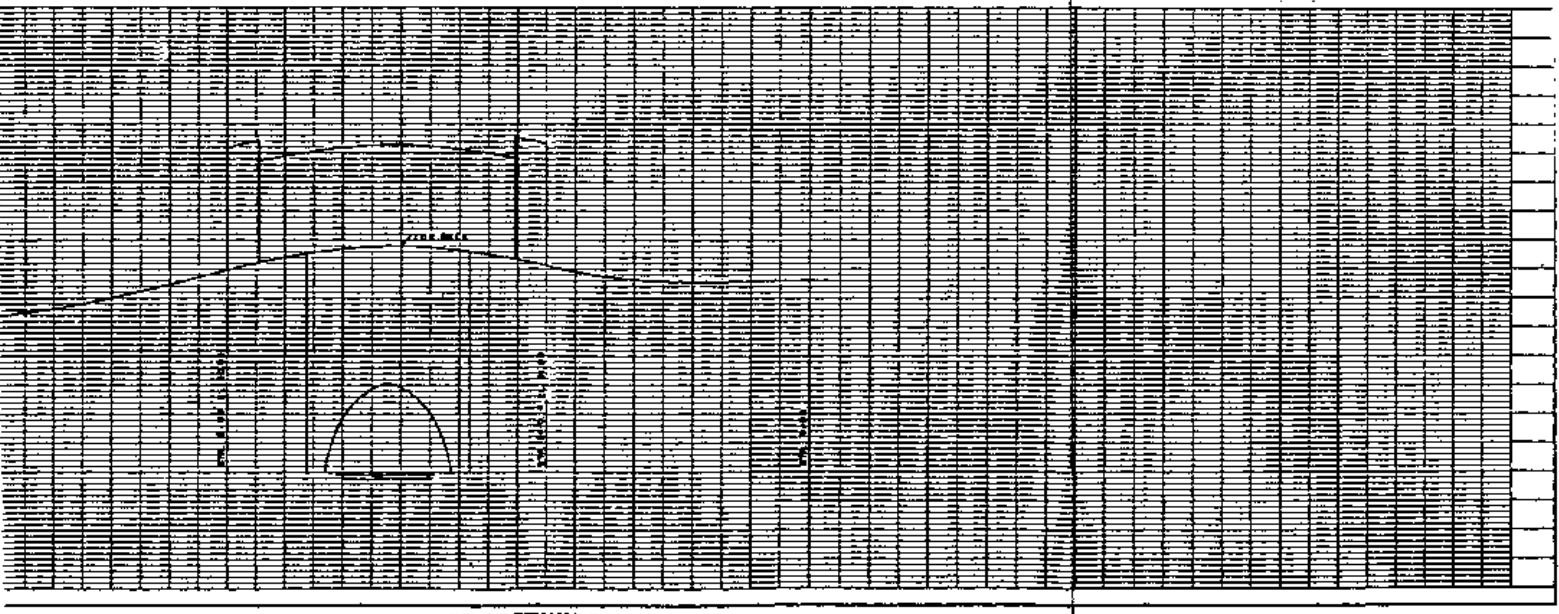


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The standards which governed the renovation work include:

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## PROPOSED RENOVATION WORK

Seven major items of renovation are recommended. They are:

1. Expose backside of each abutment and seal to prevent migration of water through construction joints.
2. Remove all existing construction above the top surface of the structural deck and construct a new deck over top of existing.
3. Construct new raised walkways with water tight joints at deck intersection.
4. Construct new handrail.
5. Chip away deteriorated concrete and resurface sidewalks of bridge and wingwalls.
6. Chip and patch deteriorated areas on girders.
7. Rebuild approach fill and install new asphalt pavement.

Sealing of the abutments is necessary to stop further deterioration of the concrete which directly supports the ends of the girders. Although the damage to date was not judged to be structurally significant, further deterioration may cause problems. Alternately, the joints may be sealed from the front side of the abutments by an injection process but, further research would be required before this can be recommended.

It would be necessary to fully expose the upper surface of the deck and core sample questionable areas in order to make a precise determination of the deck's condition. In our opinion, the

deterioration which was detected on the underside is sufficient to warrant replacement of the deck. It is not necessary, however, that the deck be removed. The present deck is overlaid with a course of plain concrete which varies in thickness from 0 to 6-inches plus a 2-3/4 inch layer of asphalt. It is possible and recommended that a new structural slab be cast directly over the existing. New walkways could be cast at their present elevation and proper edge gutters could be constructed. There would be little or no change in the net dead weight of the superstructure.

The appearance of the bridge can be restored by chipping away the deteriorated concrete and patching. All exposed concrete would have to be resurfaced to achieve uniformity in color and texture.

The girders can be repaired by chipping away the deteriorated concrete and patching. The principal tension reinforcement has not been exposed and there is no indication that it has been damaged. Several stirrups have been exposed but reinforcement is possible. It is estimated that approximately 16 percent of girder surface area requires patching.