Supplemental Design Memorandum

Flood Control Modifications
to the

Leon C. Simon
and
Gentilly Boulevard Bridges
Over the London Avenue Canal

Prepared for:

The Board of Commissioners
of the
Orleans Levee District
New Orleans, Louisiana

May, 1996

Prepared by:

LINFIELD, HUNTER AND JUNIUS, INC.
ENGINEERS AND ARCHITECTS
3500 North Causeway Boulevard
Suite 200
Metairie, Louisiana 70002

LHJ Job No. 92-60
OLB Job No. 24909

SUPPLEMENTAL DESIGN MEMORANDUM

FOR

FLOOD CONTROL

MODIFICATIONS TO THE LEON C. SIMON

AND GENTILLY BOULEVARD

BRIDGES OVER THE LONDON AVENUE CANAL

Prepared for :

THE BOARD OF COMMISSIONERS
OF THE
ORLEANS LEVEE DISTRICT
NEW ORLEANS, LOUISIANA

MAY 1996

Prepared by:

LINFIELD, HUNTER AND JUNIUS, INCORPORATED
CONSULTING ENGINEERS AND ARCHITECTS
3500 North Causeway Blvd.
Suite 200
Metairie, LA 70002

OLD Project No. 24909
LHJ Job No. 92-60

TABLE OF CONTENTS

TABLE OF CONTENTS (cont.'d)

APPENDIX "A" SAMPLE CALCULATIONS

LIST OF TABLES — PAGE

LIST OF FIGURES

LIST OF ILLUSTRATIONS

I. EXECUTIVE SUMMARY

A. BACKGROUND

The Flood Control Modifications to Leon C. Simon and Gentilly Boulevard Bridges over the London Avenue Outfall Canal Project is part of the Orleans Levee District's effort to increase the level of flood protection for the City of New Orleans along Lake Pontchartrain from hurricane induced tidal surges. Hydraulic Design criteria used in this report was set forth by the United States Army Corps of Engineers (USACE) in their General Design Memorandum No. 19A, "Lake Pontchartrain Louisiana and Vicinity, High Level Plan for London Avenue Outfall Canal."

The purpose of this Supplemental Design Memorandum is to identify and evaluate the most acceptable alternative available to provide hurricane flood protection to the City of New Orleans at the Leon C. Simon and Gentilly Boulevard Bridge locations. The following priorities were used in analyzing the bridge modification alternatives:

1. FLOOD CONTROL - Flood protection against both hurricane tidal flooding and urban rainfall runoff. The new bridges cannot impede the Sewerage & Water Board's ability to pump storm runoff through the canal any more than the existing bridges.

2. NEIGHBORHOOD IMPACTS - Maintain as close as possible the existing vertical geometry thereby minimizing the impact of the new bridges on the surrounding neighborhoods.

3. TRAFFIC SAFETY - Incorporate the latest AASHTO design codes to the maximum extent possible given the restraints of item 2 above.

A sealed bridge consists of precast-prestressed or conventionally reinforced rectangular concrete girders with a cast-in-place concrete deck. The sealed bridge will have watertight concrete barrier walls approximately ten feet tall along each side of the bridge. The bridge will be anchored to its supports to prevent uplift and will have no expansion joints subject to water pressure. In order to enhance the appearance of the concrete barrier walls, an artistic treatment chosen by the residents in the neighborhoods near the bridge can be incorporated into the walls.

During the course of this study, several neighborhood groups voiced their concerns over constructing raised bridges because their approach ramps would be aesthetically displeasing and have a negative impact on the real estate values of properties near the bridges.

In order to reach a consensus on which type of flood proofing would be acceptable to the City of New Orleans and the citizen's groups, The Board of Commissioners of the Orleans Levee District requested that the City of New Orleans create a special Task Force to study and make recommendations as to the type of flood protection acceptable to the City and it's residents.

The Task Forces' final recommendation is to construct new sealed bridges at the Leon C. Simon and Gentilly Boulevard London Ave. Canal crossings at the present deck elevation with minimum changes in the approaches. In order to accomplish this, waivers of AASHTO's National Highway Standards and Louisiana DOTD standards are required regarding the need to reconstruct the bridge approaches to comply with modern highway design codes. The intent of the Design Waivers is to allow the minimum change in existing approach conditions thereby causing the least aesthetic and economic impact to the surrounding property owners.

Linfield, Hunter & Junius, Inc. has prepared a separate Waiver Study Report identifying waivers required to build the sealed bridges at approximate present bridge deck elevations. A copy of our waiver study is contained in Appendix B of this Design Memorandum.

B. ALTERNATIVES STUDIED

The bridge modification alternatives studied in this Supplemental Design Memorandum are:

1. Modify the existing bridge structures to provide watertight bridge decks and watertight flood protection walls.

2. Remove the existing bridges and replace with new watertight sealed bridges at the original bridges' elevation.

3. Remove the existing bridges and replace with new raised bridges, utilizing standard precast prestressed AASHTO girders.

4. In addition to the bridge modification alternatives, the feasibility and costs of constructing floodgates across the bridge entrances is included.

C. CONCLUSIONS

1. GENTILLY BOULEVARD BRIDGE:

The existing Gentilly Boulevard Bridge, built in the 1930's, is substandard in both structural capacity and vehicular stopping sight distances making reuse of the existing structure very impractical. In addition, the congested area near the bridge makes constructing a raised bridge prohibitively expensive as a raised bridge will block access to two blocks of homes, apartments and businesses. We assume in our cost analysis for a raised bridge that these properties will be purchased and the structures removed.

Placing floodgates across Gentilly Boulevard was studied and it was found that due to the width of the roadway and the required design height of the floodgates this option is almost as expensive as building a new sealed bridge. Also, the floodgates require additional right-of-way from three property owners and the floodgates will close a portion of London Avenue on the Northwest side of Gentilly Blvd.

Removal of the existing bridge and construction of a sealed bridge at approximately the original bridge elevation is the least costly of the bridge alternatives and provides the least disruption to the neighborhood provided design waivers can be obtained. Figure No. 1 shows a photo-computer rendering of the Gentilly Boulevard Sealed Bridge.

2. LEON C. SIMON BRIDGE:

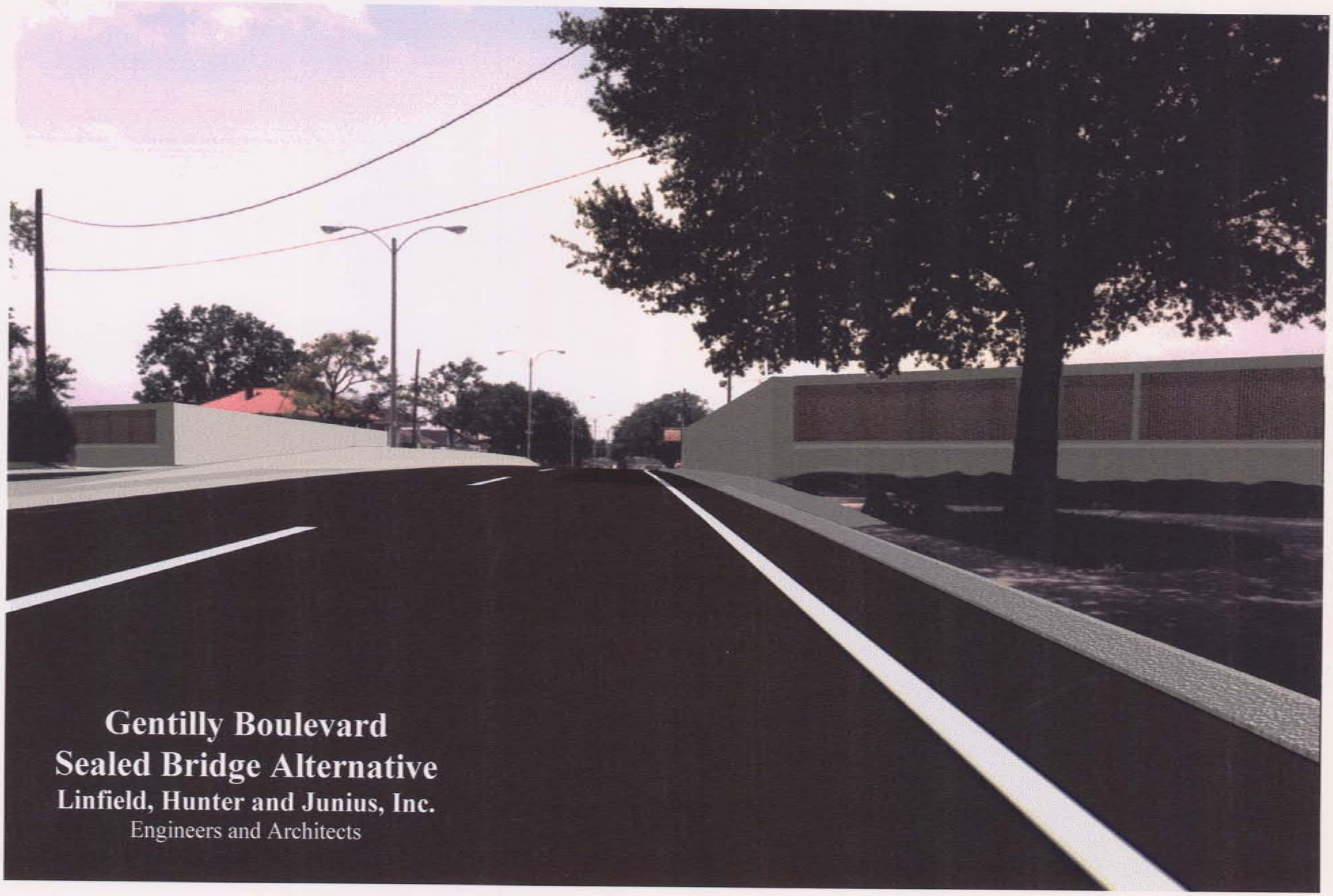
The existing Leon C. Simon Boulevard Bridge is substandard in both live load capacity and vehicular stopping sight distances making reuse of the existing structure impractical. In order to utilize the existing bridge structure the existing concrete deck will require replacement and eight new pile bents are required to anchor the bridge against buoyancy. The addition of more pile bents in the canal is not acceptable to the Sewerage and Water Board.

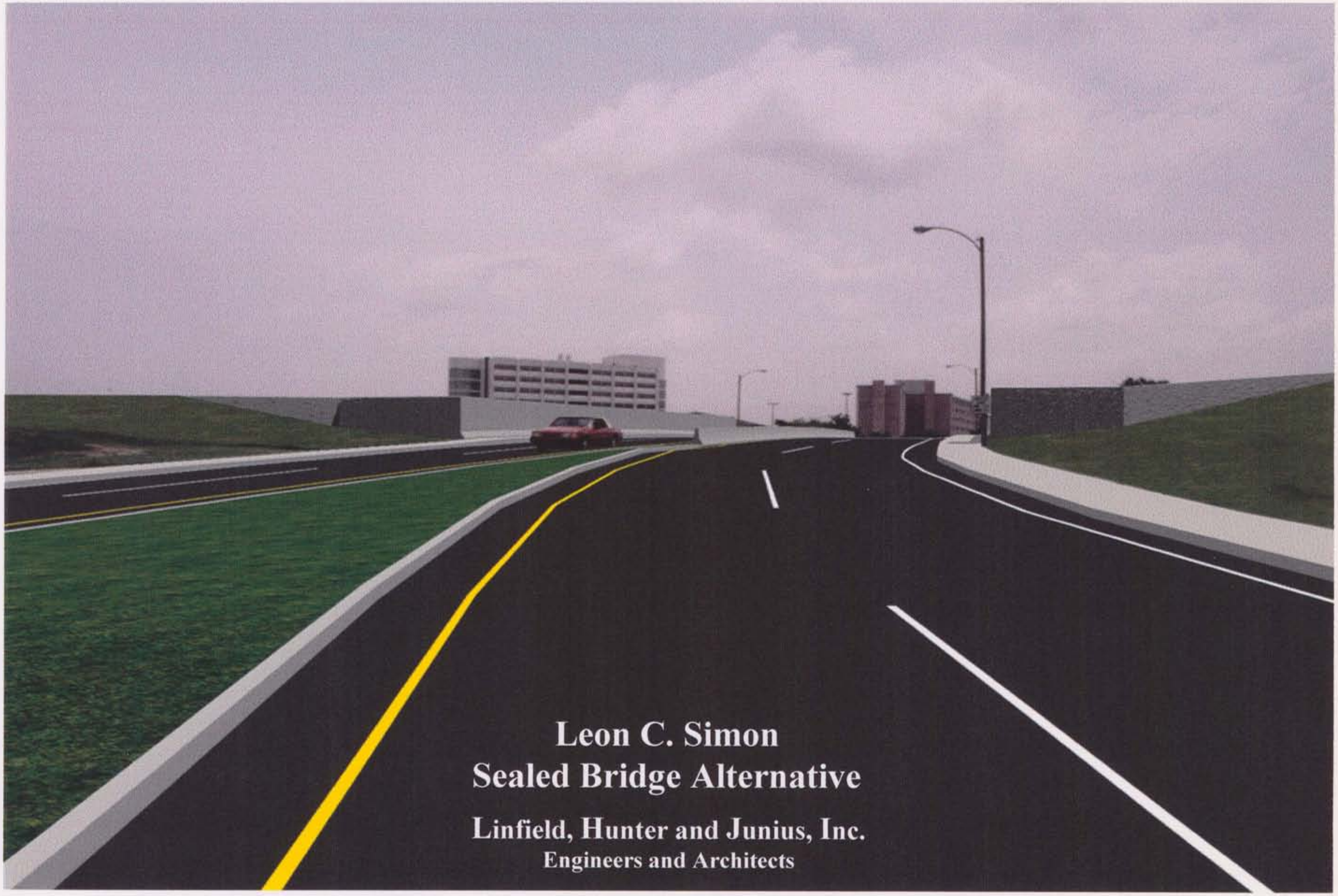
Placing floodgates across each end of the bridge is the least costly alternative studied, but requires that Leon C. Simon Blvd. be closed during high water which is unacceptable to the Mayor's Task Force.

A raised bridge corrects alignment, increases canal flow and allows the bridge to be open during hurricane events, but costs approximately $1.4 million more to construct than a sealed bridge.

A new sealed bridge constructed at the present bridge elevation will cause minimal disruption to the neighborhood, is cost effective and allows traffic flow during high water. Design waivers will be required to minimize changes to the existing bridge approaches. Figure No. 2 shows a photo-computer rendering of the Leon C. Simon Sealed Bridge.

A sealed bridge will utilize precast-prestressed or conventionally reinforced rectangular concrete girders with a cast-in-place concrete deck. (Similar to the Gentilly Boulevard sealed bridge.)


Gentilly Boulevard
Sealed Bridge Alternative
Linfield, Hunter and Junius, Inc.
Engineers and Architects


Leon C. Simon
Sealed Bridge Alternative
Linfield, Hunter and Junius, Inc.
Engineers and Architects

D. RECOMMENDATIONS

Linfield, Hunter & Junius, Inc. concurs with the Mayor's Task Force recommendation that new sealed bridges be constructed at both the Gentilly Blvd. and Leon C. Simon bridge location. Construction of new sealed bridges is the most acceptable alternative studied which satisfies the requirements set forth by the parties involved.

In summary, the new sealed bridge alternative recommended addresses the primary goals of providing cost effective hurricane protection while allowing the bridges to remain open during hurricane events, minimizing the disruption to the communities in the vicinity of the bridges and without negatively impacting the Sewerage and Water Board's capability to provide drainage to the City.

E. PROJECT COSTS

Estimated project construction costs (including a 15% contingency) for the recommended bridge alternatives are summarized below:

Gentilly Boulevard New Sealed Bridge	$2,815,000
Leon C. Simon Boulevard New Sealed Bridge	$2,945,000

F. PROJECT SCHEDULE

The preliminary design, design review, and final design for both the Gentilly Boulevard and Leon C. Simon Boulevard. Sealed Bridge recommended is estimated to take nine months, advertisement and award of construction contract - four months and actual construction time - eight months. A design and construction schedule in the form of a bar chart is shown on Figure No. 5. Design and/or construction of both bridges can be done concurrently.

II. INTRODUCTION

A. PURPOSE AND SCOPE

Linfield, Hunter and Junius, Inc. has contracted with the Orleans Levee District to provide professional engineering services for the modifications to the Leon C. Simon and Gentilly Boulevard Bridges over the London Avenue Outfall Canal. These services consist of the following:

Supplemental Design Memorandum Phase
Preparation of Construction Documents
Construction Administration

In accordance with the requirements of the contract, this Supplemental Design Memorandum presents various alternatives available to the Orleans Levee District for modifying the Leon C. Simon and Gentilly Boulevard Bridge crossings at the London Avenue Outfall Canal. Modifications to the bridge crossings is necessary in order to provide protection from hurricane tidal surges in Lake Pontchartrain. The level of hurricane protection required for this project was set forth by the USACE in their General Design Memorandum No. 19A, "Lake Pontchartrain High Level Plan, London Avenue Outfall Canal."

Modification alternatives studied in this Supplemental Design Memorandum include sealing the existing bridges, building new sealed bridges at the present bridge elevation, building new raised bridges, and building floodgates across the roadways in front of the existing bridges.

The scope of work for this Supplemental Design Memorandum includes the following:

- Attend meetings with the Owner and other interested parties.

- Coordinate with local governmental authorities having jurisdiction to approve the project.

- Provide engineering analysis to determine the most feasible method to make each bridge conform to the High Level Plan.

- Provide field surveys, including boundary, right-of-way, and topographic as may be required for the design of the project.

- Indicate generally the problems involved and the alternate solutions available to the Owner, including preliminary layouts and cost estimates for the alternatives and to present recommendations.

The problem of providing flood protection at the bridge locations is a complex problem involving the input and coordination from many public agencies and local citizens groups including:

- The Orleans Levee District
- U.S. Army Corps of Engineers
- Sewerage and Water Board of New Orleans
- Louisiana Department of Transportation and Development
- New Orleans Department of Streets
- Office of Emergency Preparedness
- London Avenue Bridge Civic Association
- Mayor's "Task Force on Outfall Bridges"
- Councilman, District D Clarence Glappion's Office
- Other Local Civic Associations

This report analyzes the sometimes contradictory requirements and wishes of the groups involved and gives recommendations as to the most feasible flood protection alternative available.

B. BACKGROUND

The Flood Control Modifications to the Leon C. Simon and Gentilly Boulevard Bridges over the London Avenue Outfall Canal Project is part of the USACE "Lake Pontchartrain High Level Protection Plan," described in Design Memorandum No. 19A for the London Avenue Outfall Canal. The purpose of the Corps Design Memorandum No. 19A was to identify the design parameters, assumptions, criteria, and essential data which will protect the City of New Orleans from a Standard Project Hurricane, (SPH). The SPH is a Class V Hurricane which approaches the New Orleans area from a direction and speed which will induce maximum tidal surges in Lake Pontchartrain.

The London Avenue Outfall Canal is one of several canals built to convey storm waters from the low lying City of New Orleans into Lake Pontchartrain (See Plate No. 1). Storm water is pumped into the London Avenue Canal from two pumping stations along the canal. The pumps at these pumping stations work against a head created by the difference in elevation of the City, which is below sea level in many locations, and the water level of Lake Pontchartrain. Hydraulic studies performed by the USACE and others indicate that during the SPH the water level in Lake Ponchartrain and the London Avenue Outfall Canal will rise to an elevation significantly higher than the City of New Orleans. Therefore, the High Level Protection Plan was adopted to protect New Orleans from flooding caused by hurricane tidal surges while allowing the Sewage and Water Board to operate their storm water pumping stations.

The High Level Protection Plan for the London Avenue Outfall Canal consists of constructing levees and floodwalls along both sides of the London Avenue Outfall Canal in order to protect the City from the anticipated tidal surges brought about by the SPH. Unfortunately, the bridges crossing the London Avenue Outfall Canal are constructed too low and essentially act as large gaps in the High Level Protection Plan floodwall system, thereby creating the necessity of developing and studying the alternatives available to provide flood protection at the bridge crossings.

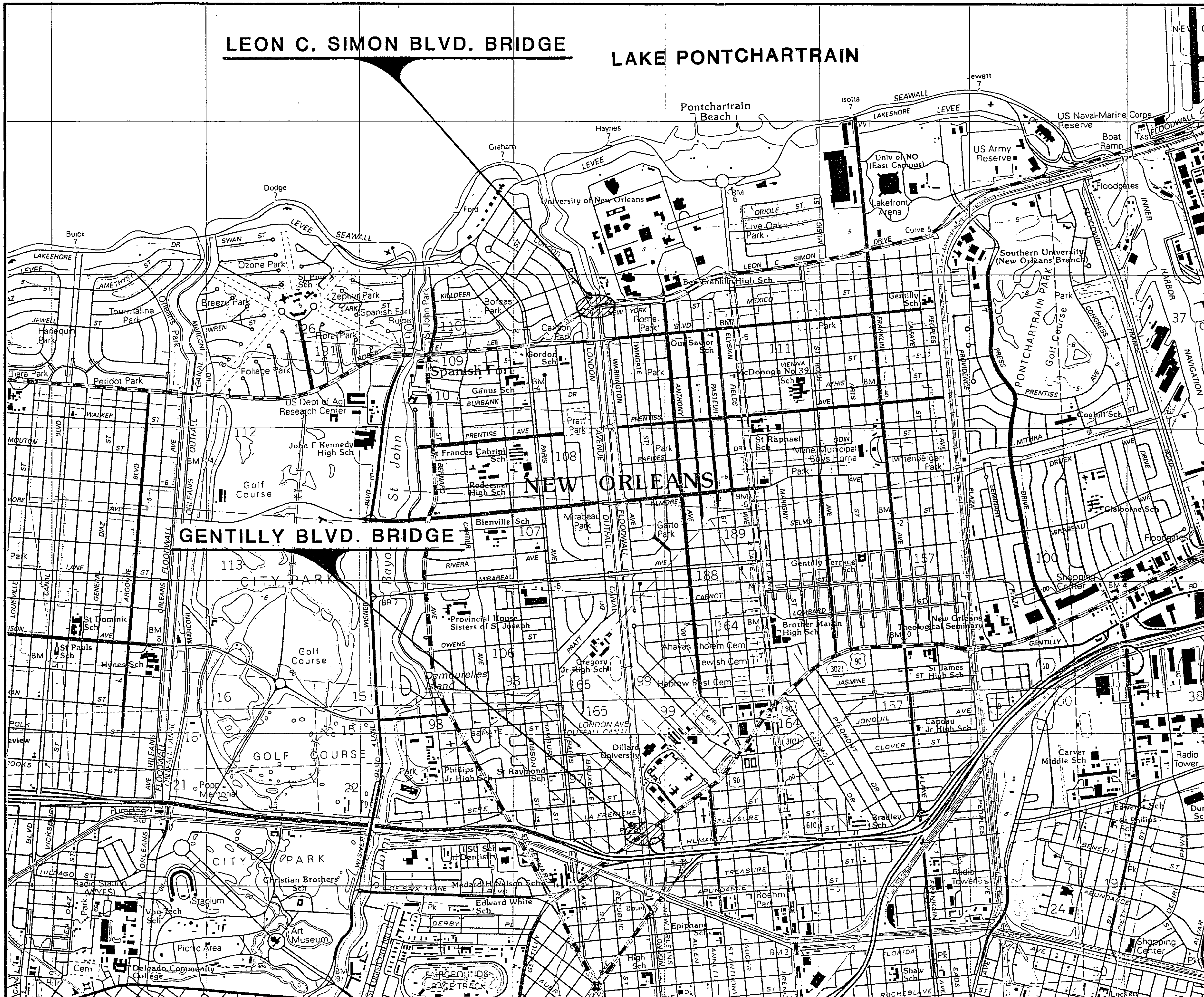
The London Avenue Outfall Canal and the Orleans Avenue Canal run in a north-south direction for approximately 2.6 miles from Lake Pontchartrain to Broad Street and City Park. The canals form barriers for residents living on either side of the canals. Several roadways cross the canals and are important transportation links for daily use as well as evacuation and emergency vehicle access prior to and during hurricanes. Gentilly Boulevard and Leon C. Simon Boulevard are two of eight roadways crossing the two canals.

A special task force composed of OLD board members, resident groups and City of New Orleans officials has studied emergency evacuation routes, resident's concerns and alternate emergency service routes in order to determine which, if any, of the canal over the London Ave. Canal crossings can be floodgated and closed during hurricanes.

The Task Force has recommended that sealed bridges should be built at the Gentilly Blvd. and Leon C. Simon Crossings over the Canal. Design waivers must be obtained so that the bridges can be built without substantially changing the existing bridge approaches.

Plans and specifications have already been prepared for the parallel levees and floodwalls along the London Avenue Outfall Canal. Construction contracts have already been awarded for the floodwall portion of the High Level Protection Plan.

All work on the parallel levee or floodwall systems along the London Avenue Outfall Canal will be completed prior to the construction of these bridges.



LINFIELD, HUNTER AND JUNIUS, INC.
ENGINEERS AND ARCHITECTS
651 RICHARD STREET NEW ORLEANS, LOUISIANA 70130

ORLEANS LEVEE DISTRICT
LONDON AVENUE OUTFALL CANAL
BRIDGE REMEDIATION SUPPLIMENTAL DESIGN MEMORANDUM

THIS SHEET	LOCATION MAP		
DRAWN BY W.A.Y.	CHECKED BY S.J.G.	APPROVED BY	CAD FILE NO.

PROJ. NO. 92-60
DATE 6/07/94
PLATE NO. 1

III. DESIGN PARAMETERS

The design parameters listed herein are taken from the various governmental agencies who have jurisdiction in approving the project plan. Construction plans and specifications will conform to USACE Standards. All elevations throughout this report are in feet, NGVD.

A. DESIGN WATER ELEVATIONS

London Avenue Canal design high water surface elevations are as follows:

Leon C. Simon Bridge	11.90 Ft.
Gentilly Boulevard Bridge	11.90 Ft.
Freeboard:	2.00 Ft.
Height of Floodwalls along London Avenue Canal	13.90 Ft. Nominal

Above data is from USACE DM No. 19A.

Note: Floodwall elevation of 14.40 ft. is based on a maximum water surface elevation of 11.90 ft. plus 2 ft. freeboard plus 0.5 ft. allowance for settlement.

B. SPECIAL DESIGN PARAMETERS

The project has several unique design parameters which are as follows:

- The modified bridges should not increase the head loss in the canal. The pumps at Pumping Stations 3 and 4 will be operating at their maximum capacity during a SPH and do not have the capacity to pump against increased head caused by constricting the flow in the canal. The bottom of any proposed alternate bridge structure can not be lower that the bridge being replaced and the number of intermediate pile bents in the canal cannot be increased.

- The modified bridges should provide a view of the canal, if possible, while crossing the bridge.

- The bridge alternatives will be sealed if their deck elevation is below the floodwall height (13.9 ft.).

C. ROADWAY AND BRIDGE DESIGN PARAMETERS

Bridges and roadways are designed to the specifications of the Louisiana Department of Transportation and Developments (LADOTD) "Bridge Manual" and "Roadway Alignment Manual", and to the American Association of State Highway and Transportation Officials (AASHTO) "Standard Specifications for Highway Bridges," and applicable Corps of Engineering Design Specifications for Hydraulic Structures and Pile Foundations.

D. MATERIAL STRENGTHS

1. Concrete for bridge decks: Class AA, f'c = 4,200 psi.
2. Concrete for intermediate piers and end walls:
   Class A, f'c = 3,800 psi.
3. Concrete for precast prestressed girders: Class P (M), f'c = 6,000 psi.
4. Concrete for precast-prestressed piles:
   Class P, f'c = 5,000 psi.
5. Structural Steel: ASTM A-36
6. Sheet piling: ASTM A378, Grade 2, Fb = 20 ksi.

E. CORPS OF ENGINEERS DESIGN SPECIFICATIONS

The following Corps of Engineers design specifications were used where applicable.

1. EM 1110-2-2105 "Design of Hydraulic Steel Structures."
2. EM 1110-2-2906 "Design of Pile Foundations."
3. EM 1110-2-2104 "Strength Design for Reinforced-Concrete Hydraulic Structures."

IV. ORGANIZATION OF REPORT

The development of this Supplemental Design Memorandum begins with a thorough study of existing conditions, including topographic surveying to locate existing utilities, elevations and the general relation of the bridges to surrounding streets and private properties, trees and other improvements. The original bridge design drawings were obtained from the City of New Orleans along with the most recent bridge inspection reports available. Canal drawings were obtained from the Sewerage and Water Board.

The report identifies the bridge modifications studied and the system of major and minor determinants used to select the best alternative.

The report analyzes the alternatives for each bridge separately and describes the advantages, disadvantages, and costs for each alternative. Engineering drawings are included to illustrate the technical aspects of the alternatives considered. A comparison of all the determinants is then made and recommendations are given.

A bar chart showing the project design and construction schedule is included. (See Figure 5.)

A section summarizing the additional information requirements which will be needed to complete the construction documents is included at the end of the report. The Appendix to the report includes sample design calculations.

V. ALTERNATIVES CONSIDERED

Several flood control modification alternatives were investigated for this project. The alternatives include:

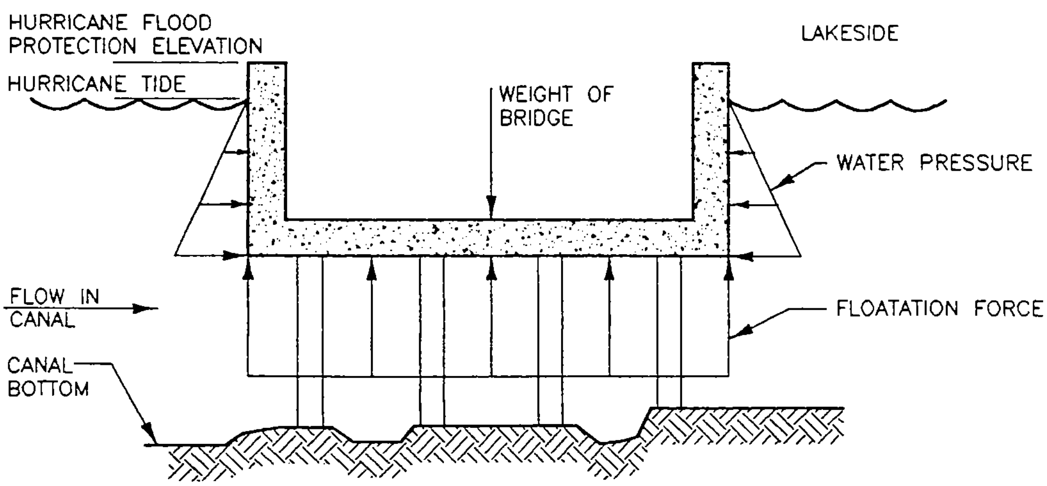
1. Seal the existing bridge structures by watertight sealing expansion and construction joints and constructing watertight barrier walls along the bridges to keep water from flowing over the bridges and into the City. This alternative includes installing additional pile bents into the canal to counteract uplift forces on the bridges.

2. Replace the existing bridges with new sealed bridges at the same elevation (these new bridges will also have sealed joints and tall barrier walls).

3. Replace the existing bridges with new raised bridges which will not require high barrier walls.

4. Construct floodgates across the roadway at each end of the bridges. The floodgates will tie into the floodwalls or levees.

The main differences between a sealed bridge and a conventional bridge are the buoyant force of the water trying to float the sealed bridge and the water pressure exerted on the barrier walls of the sealed bridge. During design high water conditions the buoyant force on the bridge exceeds the weight of the bridge and results in a net upward force. This upward force on the bridge tends to lift the bridge deck off of the bridge support piling. The upward force is resisted by tension connections between the bridge girders and pile caps and between the pile caps and the piling. Also, all construction joints are sealed to prevent water from entering the "Dry" side of the bridges. The sketch below shows a schematic drawing of a sealed bridge cross section with the design forces acting upon it.



TYPICAL FORCES ON A SUBMERGED BRIDGE

In order to evaluate the different flood control alternatives, a system of major and minor determinants is used to identify the best alternative.

The major determinants used in the selection of the alternatives are:

- flood control
- neighborhood impact (permanent impact or disruption to the neighborhood)
- traffic safety (incorporate latest design standards)
- hydraulic characteristics
- project costs
- traffic condition (open or closed to traffic during SPH)
- aesthetics (maintaining a view of the canal while crossing the bridges)
- speed and ease of construction

Minor determinants are:

- maintenance costs
- traffic and neighborhood disturbance during construction
- design/construction complexity or difficulty
- speed and ease of construction

The determinants for each alternative are described and compared in the following sections.

VI. GENTILLY BOULEVARD BRIDGE - EVALUATION OF ALTERNATIVES

A. LOCATION AND DESCRIPTION

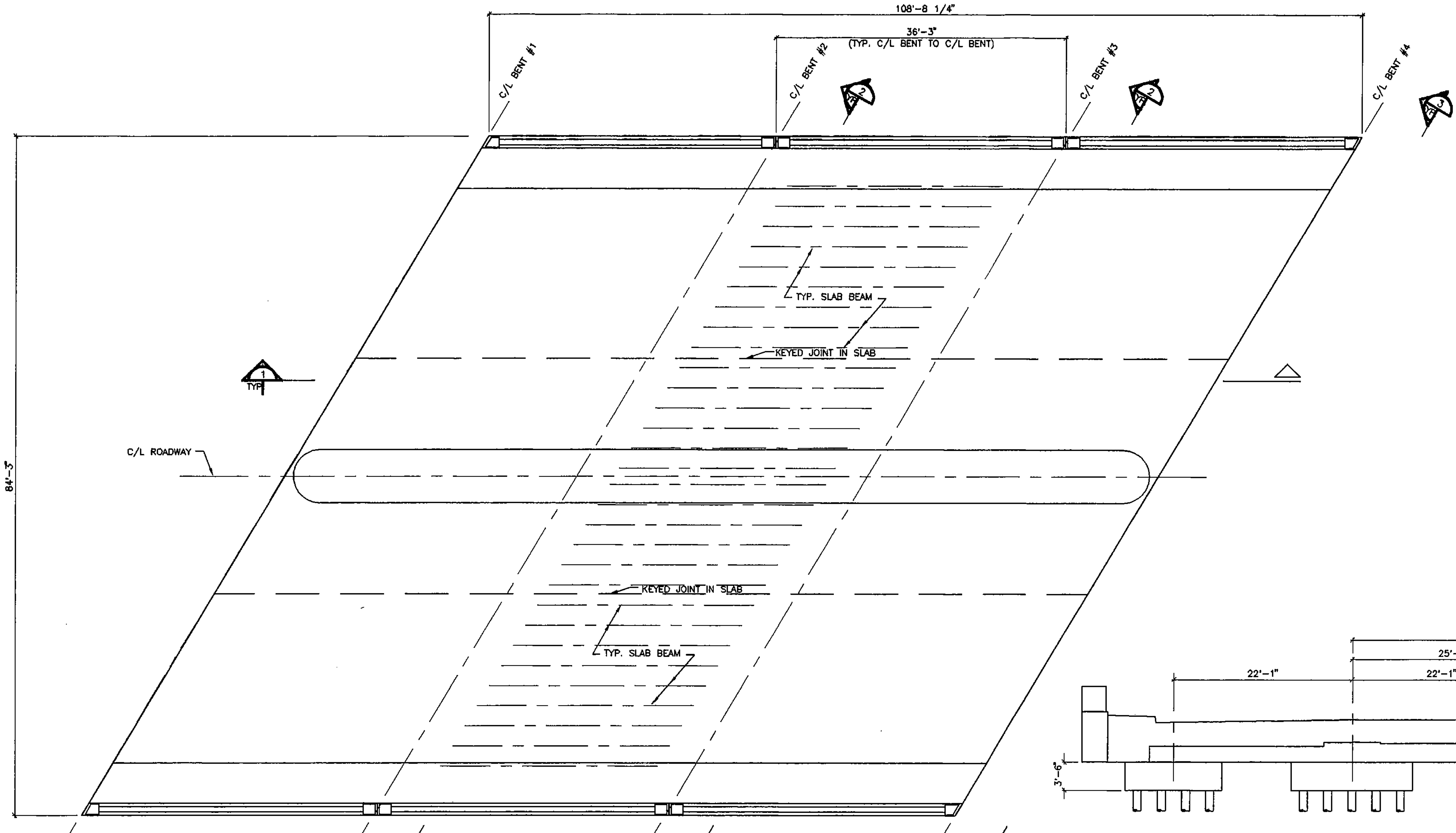
Gentilly Boulevard is a major thoroughfare in the old Gentilly section of New Orleans. Gentilly Boulevard begins at its intersection with North Broad Street and winds its way northeastward through established neighborhoods until it turns into Chef Menteur Highway at its intersection with Franklin Avenue. The Gentilly Boulevard Bridge over the London Avenue Canal is owned and maintained by the City of New Orleans.

The Gentilly Boulevard Bridge crosses the London Avenue Outfall Canal approximately 680 ft. north of Pumping Station No. 3 as depicted on Plate No. 1. Other major streets in the vicinity of the bridge are Interstate I-610 to the south, New Orleans Street to the east and Paris Avenue to the west. Dillard University is located approximately two blocks to the east of the bridge site and the Fair Grounds Race Track is located approximately 8 blocks to the west of the bridge site.

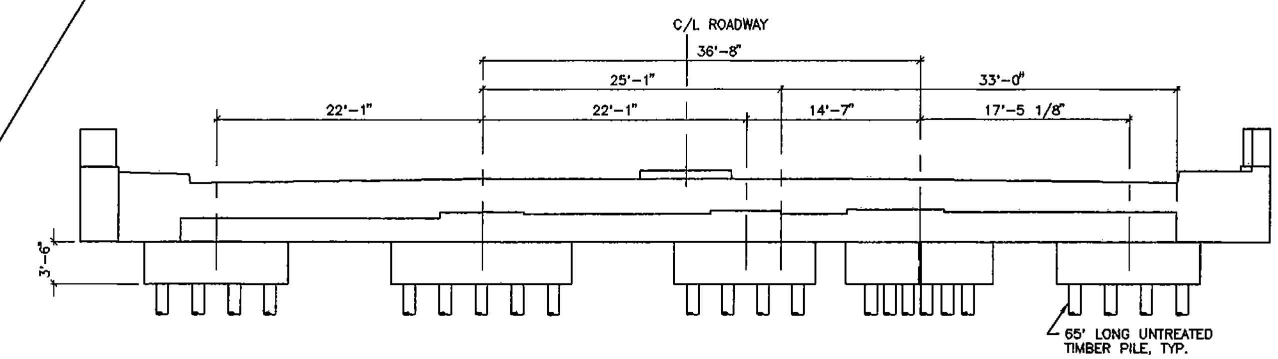
The existing bridge was built in 1936 and widened in 1939. The bridge design drawings by the LADOTD indicate that the bridge consists of three spans, each approximately 36 feet long. The spans consist of steel I-beams encased in concrete (See Plate No. 2). At each abutment and at the two intermediate supports there are steel girders to which the I-beams are attached. The bridge abutments and intermediate piers consist of cast-in-place concrete and are supported by concrete pile caps bearing on untreated timber piles.

The elevation of the existing bridge deck at the east abutment is approximately 3.2 feet, which is approximately two feet higher than the average surrounding ground elevation. The area surrounding the bridge is very congested with existing construction. There are homes and businesses built to within ten feet of the existing canal floodwalls and to within about five feet of the Gentilly Boulevard right-of-way. The properties along Gentilly Boulevard drain overland (on the surface) to the street gutter, thence to a subsurface system built below the street right-of-way. The land surrounding the bridge, being lower in elevation than the roadway gutter line, creates a drainage problem for raised bridge alternatives.

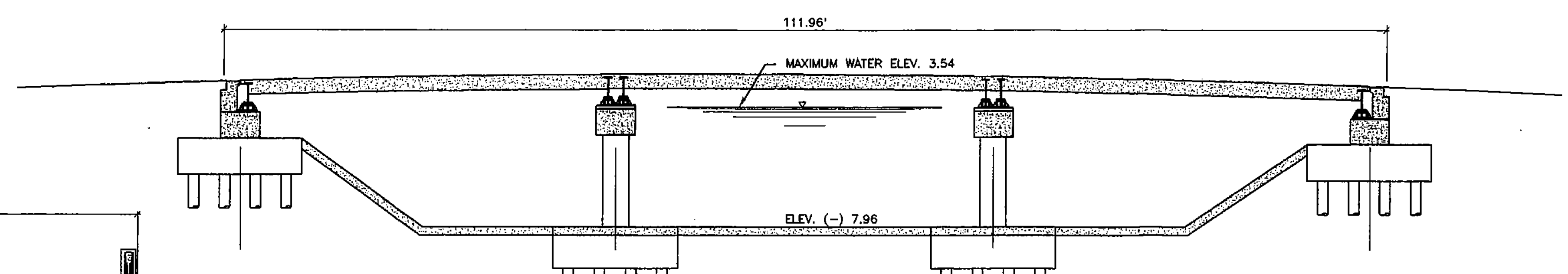
Compounding the problem of low lying properties along the street is the fact that the existing roadway approaches do not meet current LADOTD vehicular stopping sight distances for the posted speed limit. (Existing stopping sight distance meets the requirement for a 23 MPH design speed, the City's posted speed limit is 35 mph.) Sight distance is the length of roadway ahead visible to



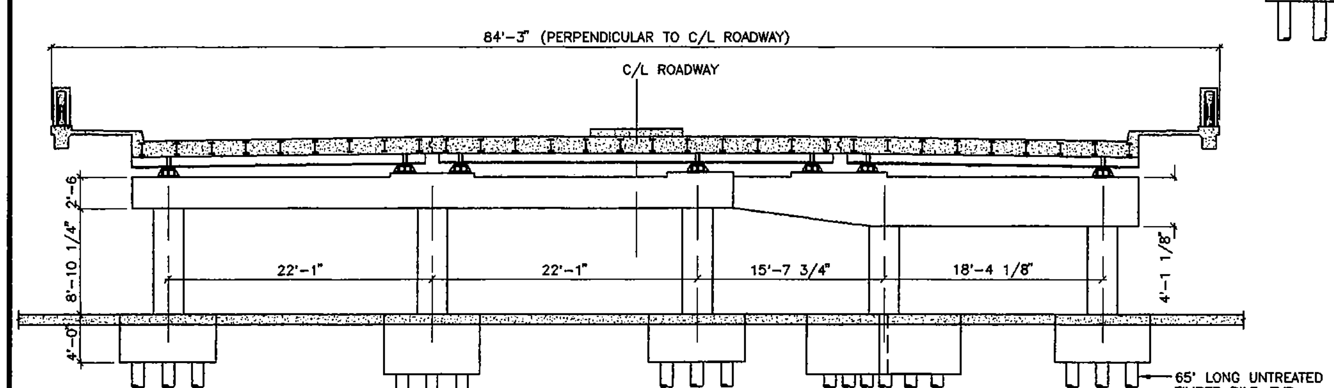
BRIDGE PLAN
1/8" = 1'-0"



3 TYP SECTION
1/8" = 1'-0"



1 TYP SECTION
1/8" = 1'-0"



2 TYP SECTION
1/8" = 1'-0"

LINFIELD, HUNTER & JUNIUS, INC.
CONSULTING ENGINEERS AND ARCHITECTS
3500 North Causeway Blvd. Suite 200
Metairie, Louisiana 70002

SEAL

REV. NO.	DATE

ORLEANS LEVEE DISTRICT
LONDON AVENUE OUTFALL CANAL
BRIDGE REMEDIATION SUPPLIMENTAL DESIGN MEMORANDUM

THIS SHEET: EXISTING GENTILLY BLVD. BRIDGE

DRAWN BY W.A.Y. | CHECKED BY A.F.G. | APPROVED BY | CAD FILE NO. 9260

PROJ. NO. 92-60
DATE 6/07/94
SHEET NO. PLATE NO.
2
OF SHEETS

the driver. The minimum sight distance available on a roadway should be sufficiently long to enable a vehicle traveling at or near the design speed to stop before reaching a stationary object in its path. Correcting the vertical sight distances coupled with raising the bridge deck elevation will cause the approach roadways to be raised higher in relation to the existing properties. Therefore, even a small increase in the bridge deck elevation will prevent the surrounding properties from draining into the street gutter and will also necessitate steep driveway slopes to access the properties closest to the canal.

Another important site condition is the existence of many large live oak trees in the street right-of-way each side of the canal. The impact to these trees will increase with the increase in bridge deck height. However, trees of this size can be relocated. The relocation of similar trees at other Orleans Levee District (OLD) sites costs from $30,000 to $50,000 or more per tree, depending on the tree size and distance moved.

B. EXISTING BRIDGE CONDITION.

The present condition of the existing bridge superstructure is considered deficient based on our visual inspection and the bridge inspection reports provided by the Louisiana DOTD dated 7/8/91 and an underwater inspection dated 1/30/92. There is very little clearance between normal water surface elevation and the bridge superstructure and the superstructure is often inundated by high tides and flood waters. The underwater inspection indicates extensive corrosion of the steel girders at the support bents.

The steel girders at the east abutment were recently replaced after their webs failed in shear due to severe corrosion. The west abutment girders and the intermediate girders remain in poor condition.

The bridge substructure shows signs of distress with cracks up to 3/8" wide in the abutments and general concrete scaling on the intermediate piers. The condition of the untreated timber piles which support the bridge is unknown.

C. MODIFICATION ALTERNATIVES

1. SEAL JOINTS AND BARRIER WALLS ON EXISTING BRIDGE

As stated, the existing bridge superstructure is in poor condition and requires extensive repairs or complete replacement. The bridge substructure is in fair to poor condition but due to its age, it is believed that it is near its useful life and will probable require extensive repairs in the near future. Also, the bridge does not meet current AASHTO and LADOTD design specifications for truck loading which makes re-using the bridge less attractive.

In addition, anchoring the bridge for buoyant forces requires additional pile bents in the canal which is unacceptable to the Sewerage and Water Board.

Therefore, modifying the existing bridge is not considered practical.

2. NEW SEALED BRIDGE AT PRESENT ELEVATION

This alternative consists of removing the existing Gentilly Boulevard Bridge deck foundation piers, and abutments and constructing a new sealed bridge at the present bridge elevation.

The proposed sealed bridge will have two 12 feet wide traffic lanes and an eight foot shoulder on each side. There will also be a six foot wide median between the travel lanes with a two foot shoulder between the median and the travel lanes. The south side of the bridge will have a six foot wide sidewalk (same as existing) and the north side of the bridge will have a 9 foot wide sidewalk. The wider sidewalk on the north side will allow minimum required sight distances for motorists turning right off of Pleasure Street onto Gentilly Boulevard.

The sealed bridge studied consists of three spans of precast concrete box girders and cast-in-place concrete deck. Intermediate piers consist of cast-in-place concrete supported on precast prestressed concrete piles. Abutments have steel sheet pile cutoff walls and precast concrete piles.

A water tight bridge barrier rail is required to keep water from passing over the sides of the bridge. The box girders and barrier rails are anchored to the abutments and intermediate piers to resist lateral and upward forces created when the water level in the canal reaches the design water level of 11.90. The top of the barrier walls will be at elevation 13.90 which includes a 2 foot freeboard. Plate No. 3 shows a typical cross section through the proposed sealed bridge.

The type of construction available for sealed bridge alternative is limited by the requirement that the new bridge structure cannot constrict the canal flow more than the existing bridge structure and the previously discussed restrictions placed on raising the bridge deck elevation due to the close proximity of existing homes and businesses to the canal.

The above restrictions eliminate the use of standard AASHTO precast-prestressed girders because their depth will either cause the bridge to be raised too high or they will cause the canal flow to be constricted if the bridge deck is kept at the existing elevation. Encased steel beam decks similar to the existing bridge decks were considered but were eliminated because of maintenance difficulty of keeping the steel girders, bearing plates and anchor bolts free of corrosion in a very corrosive environment.

Solid precast-prestressed rectangular concrete girders with a cast-in-place topping slab best meets the project requirements for the Gentilly Boulevard location. Also, due to the limited number of girders required, it may be equally cost effective to provide conventional reinforced concrete girders which can be cast by the contractor at a convenient location and brought to the site. Both structural systems appear to be suited to this bridge.

The bottom of the box girders will be set at the same approximate elevation as the bottom of the existing bridge girders in order to retain the same flow area in the canal. The thickness of the precast girder and topping slab requires that the bridge deck be raised approximately one foot higher than the existing deck. This rise in elevation along with correcting approach grades causes the driveways of the five property owners immediately adjacent to the canal to be sloped (up to approximately 8% grade) from the street curb to the property line. Area drains will be required in front of the properties to drain the low areas behind the curbs. Approach changes required by the sealed bridge are shown on Plate 4. The west approach work begins approximately 240 feet west of the west abutment and continues to the bridge. The resulting maximum change in elevation of the eastbound lane will be approximately one foot to minimize impact on the intersecting driveways. The east approach work begins approximately 400 feet eastward of the east bridge abutment and continues westward to the abutment.

The car detailing business on the northwest corner of the bridge at Pleasure Street will have a portion of its driveway reconstructed due to the required change in roadway elevation.

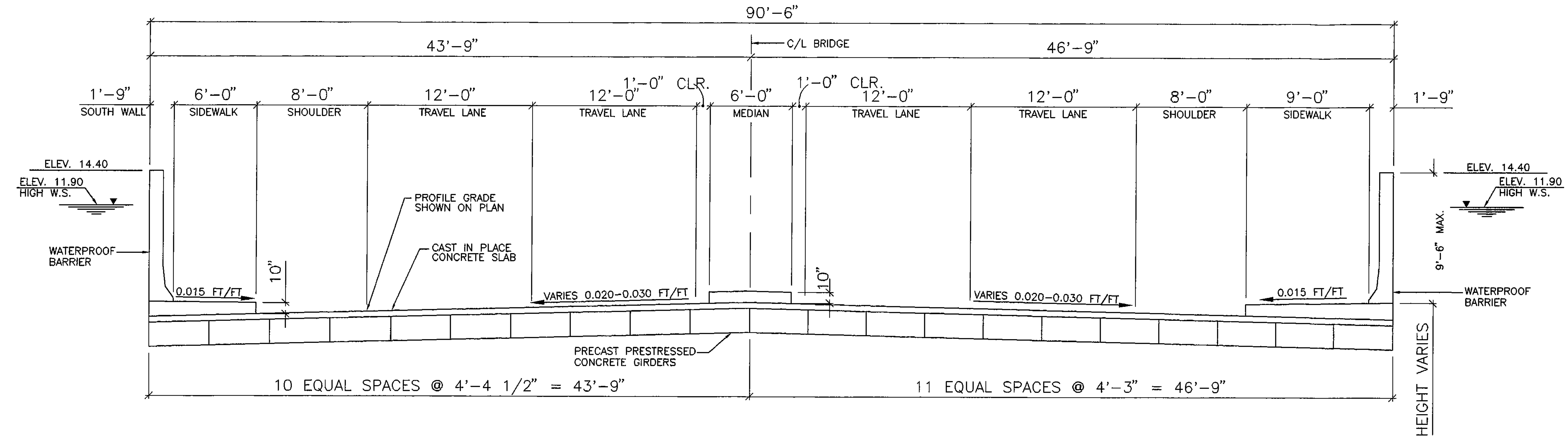
Pleasure Street will be realigned slightly to increase sight distance for vehicles turning onto Gentilly Boulevard.

Traffic safety is maintained at the sealed bridge by regrading the approaches and changing the gradient and length of the vertical curve. Stopping sight distance is changed by widening the sidewalk on the north side of the bridge and realigning Pleasure Street. This will change the design speed at the bridge from approximately 23 mph to approximately 30 mph.

Structural design considerations for the box girders include their anchorage to the intermediate piers and abutments, and designing the concrete girders so they are not over stressed when subject to the buoyant force of the water. To resist buoyancy, the box girders are cast solid and are anchored to the piers with reinforcing steel embedded in the girders and the piers which are made monolithic by the topping slab. The bridge will be designed with no expansion joints in the deck and walls subject to water pressure. Expansion and contraction of the bridge will be accomplished by allowing the abutments to move relative to the approaches. The expansion joints will be on the protected side of the abutments and will consist of neoprene strip seal joints (See Plate No. 5). The compressive stress in the precast-prestressed box girders is addressed by designing the girders such that the additional compressive stress in the bottom of the girders created by buoyancy will not exceed the AASHTO allowable compressive stress. Sample concept design calculations are included in the Appendix.

The proposed bridge deck elevation (approximate elevation is 4 feet at the highest point and 2 feet at the abutments) is relatively low compared to the top of the proposed floodwall (elevation 13.9 feet) paralleling the London Avenue Canal, therefore the top of the bridge barrier walls will be approximately 9.7 feet above the bridge deck gutter line at the abutments and slightly lower at mid span of the bridge.

The "Guidelines for Aesthetic and Landscape Treatment of the London Avenue Canal," by Terra Designs, Inc. recommends that a view of the canal from the bridge be available to pedestrians and that a recreational platform or pedestrian bridge be incorporated into the new bridge design. The report also recommends artistic treatment to the floodwalls where visible to the public.



1 **PROPOSED SEALED BRIDGE SECTION**
GENTILLY BLVD. BRIDGE SCALE: 1/4"=1'-0"

LINFIELD, HUNTER & JUNIUS, INC.
CONSULTING ENGINEERS AND ARCHITECTS
3500 North Causeway Blvd. Suite 200
Metairie, Louisiana 70002

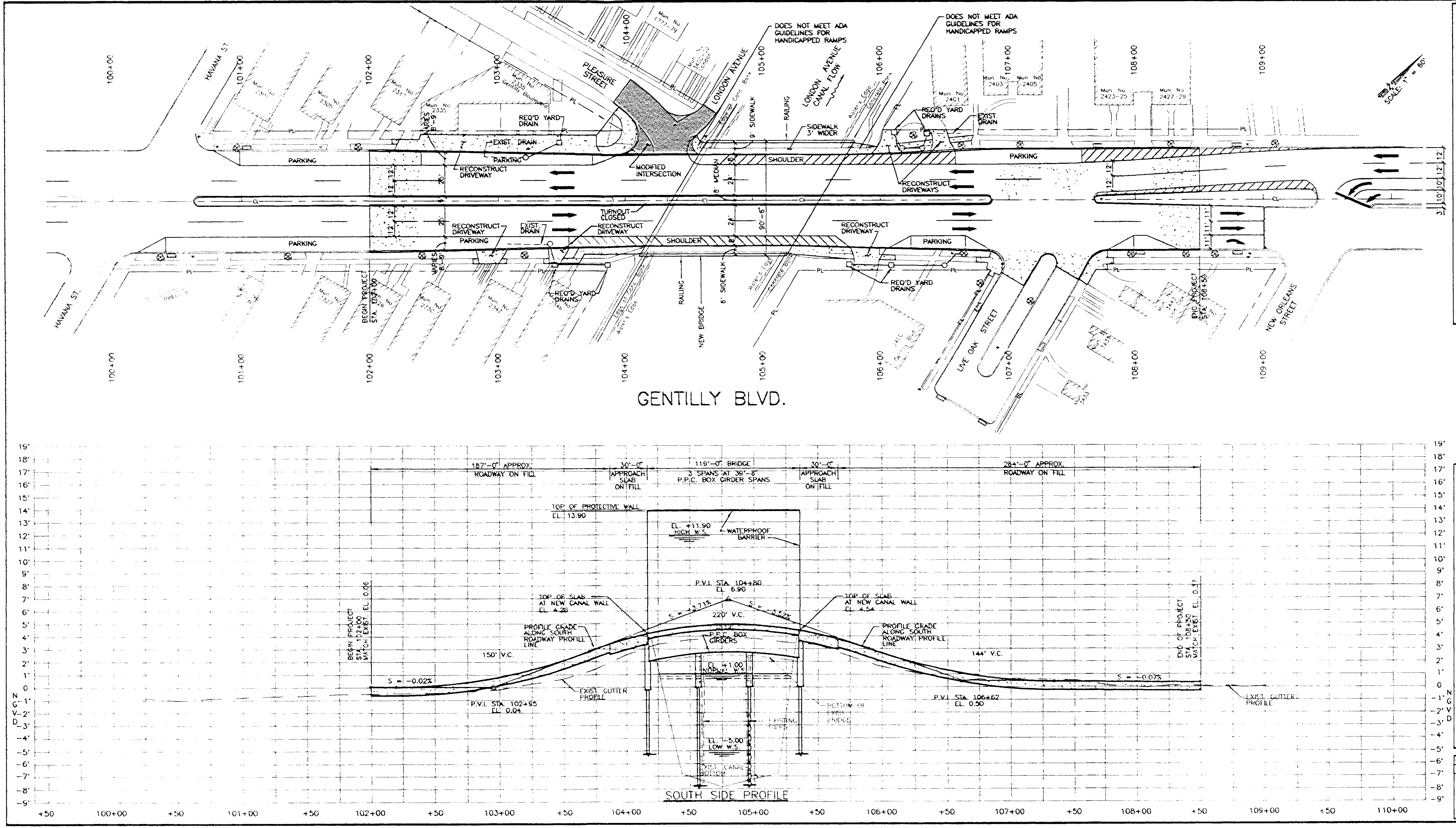
SEAL

REV. NO.	DATE

ORLEANS LEVEE DISTRICT
LONDON AVENUE OUTFALL CANAL
BRIDGE REMEDIATION SUPPLIMENTAL DESIGN MEMORANDUM

THIS SHEET: PROPOSED GENTILLY BLVD. SEALED BRIDGE
DRAWN BY: T.B.F
CHECKED BY:
APPROVED BY:
CAD FILE NO. 9260

PROJ. NO. 92-60
DATE 6/07/94
SHEET NO. PLATE 3
OF SHEETS

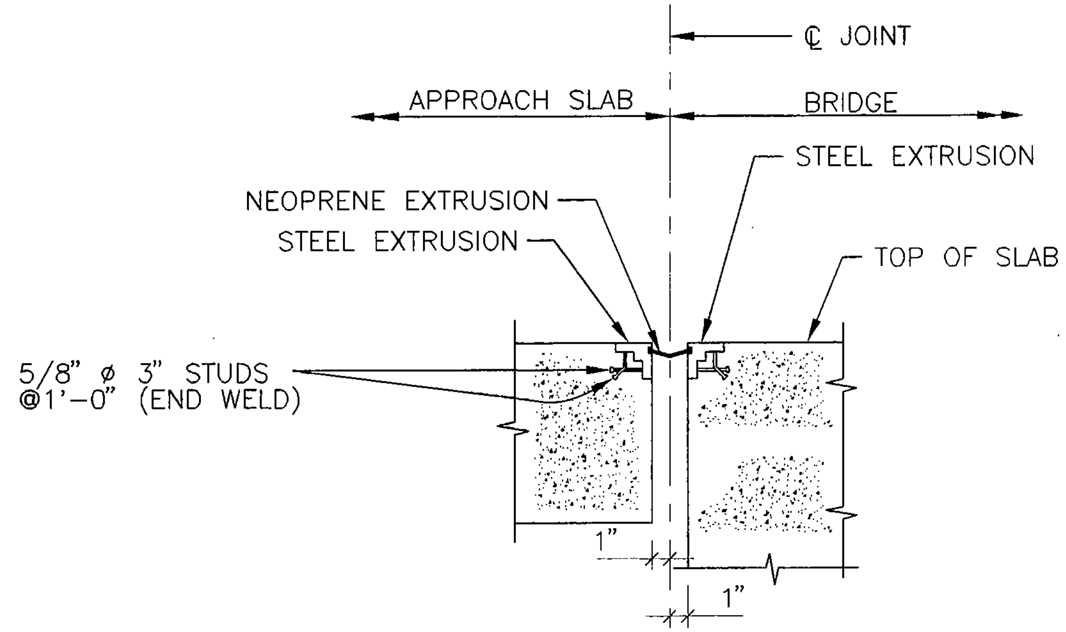


LINFIELD, HUNTER & JUNIUS, INC.
CONSULTING ENGINEERS AND ARCHITECTS
3500 North Causeway Blvd. Suite 200
Metairie, Louisiana 70002

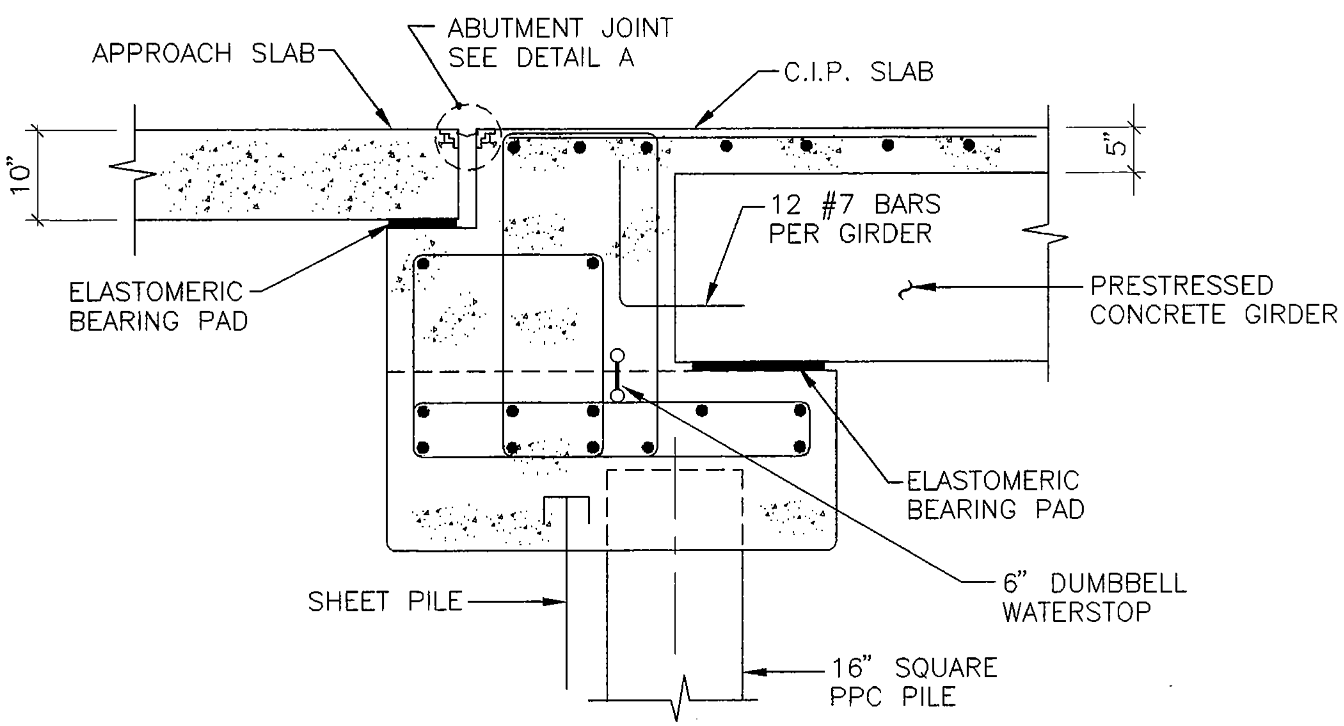
ORLEANS LEVEE DISTRICT
LONDON AVENUE OUTFALL CANAL
WAIVER STUDY REPORT

GENTILLY BLVD. SEALED BRIDGE

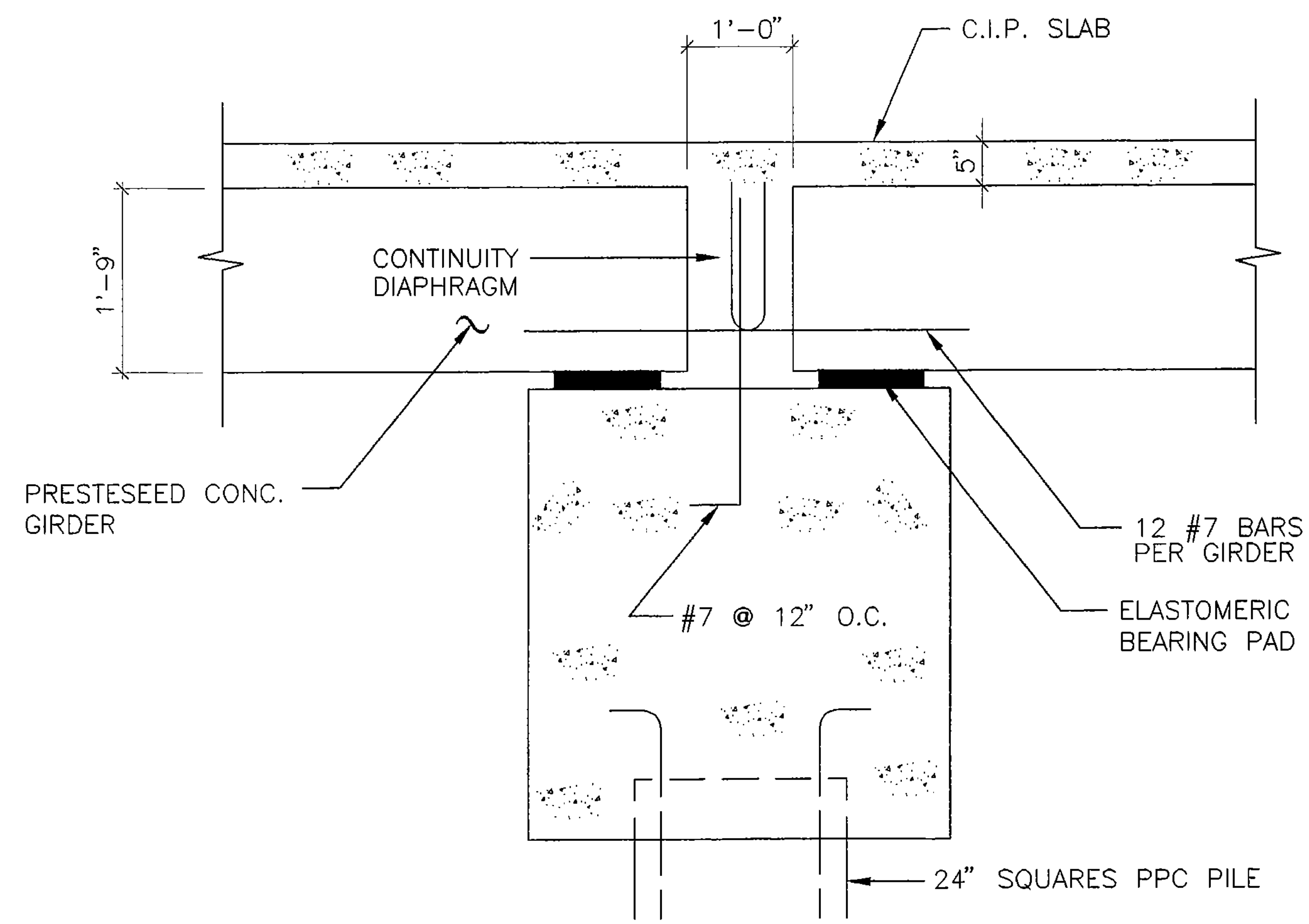
PLATE 4



DETAIL A – ABUTMENT JOINT



DETAIL 1 – ABUTMENT
GENTILLY BLVD. SEALED BRIDGE ALTERNATIVE
SCALE: 3/4" = 1'-0"



DETAIL 2 – INTERMEDIATE BENTS
GENTILLY BLVD. SEALED BRIDGE ALTERNATIVE
SCALE: 1/2" = 1'-0"

LINFIELD, HUNTER AND JUNIUS, INC.
ENGINEERS AND ARCHITECTS
651 RICHARD STREET NEW ORLEANS, LOUISIANA 70130

ORLEANS LEVEE DISTRICT
LONDON AVENUE OUTFALL CANAL
BRIDGE REMEDIATION SUPPLIMENTAL DESIGN MEMORANDUM

THIS SHEET: GEINTILLY BLVD. SEALED BRIDGE DETAILS
DRAWN BY: R.K.P. | CHECKED BY | APPROVED BY | CAD FILE NO. 9260

PROJ. NO. 92-60
DATE 6/07/94
PLATE NO. 5

The recreational platform suggested by Terra Designs will require additional piles in the canal and a floodgate at the entrance to the platform. A pedestrian bridge could be placed adjacent to the vehicular bridge but would add significant costs. The pedestrian bridge will require floodgates at each end of the bridge which will increase maintenance and OLD workload during the approach of a hurricane. Artistic treatment of the floodwalls and ends of the bridge barrier walls would be a low cost method of improving the aesthetics of the sealed bridge.

a. <u>ADVANTAGES</u>

The primary advantages of the sealed bridge alternative are:

- Relative low cost as compared to raising the bridge.
- Relatively little long term affect on the neighborhood other than realigning the intersection of London Avenue and Pleasure Streets from Gentilly Boulevard due to inadequate vehicular sight distances (See Plate No. 4). (Note: London Avenue and Pleasure Streets access to Gentilly Boulevard will be closed for the other alternatives studied).
- Bridge approaches will be modified to provide better stopping sight distances.
- The bridge will remain open during times of high water.

b. <u>DISADVANTAGES</u>

The primary disadvantages to the sealed bridge alternative are:

- The properties closest to the bridge will have their driveways removed and replaced at a steeper slope and drop inlets installed in the right-of-ways to prevent flooding. This would be true of other alternatives.
- Tall side walls prevent a view of the canal.
- Additional cost to overcome the buoy effect of the bridge.

c. <u>COSTS</u>

The engineering opinion of construction costs associated with the new sealed bridge alternative are shown on Table I. In addition to the construction costs of $2.81 million, including a $50,000 allowance for artistic treatment of the bridge barrier rails and adjacent floodwalls.

TABLE I
GENTILLY BLVD. BRIDGE
SEALED BRIDGE OPTION

ITEM DESCRIPTION	UNITS	QUANT	UNIT PRICE	TOTAL PRICE
Mobilization	LUMP SUM	1	50000	$50,000
Bridge Section				
Superstructure				
5" Top Slab (Class AA Concrete)	CU YD	167	450	$75,150
10" Sidewalk (Class AA Concrete)	CU YD	65	350	$22,750
Floodwall Barrier (Class AA Concrete)	CU YD	150	750	$112,500
Median Barrier (Jersey Type)	LIN FEET	123	35	$4,305
Substructure				
Box Girders	CU YD	700	700	$490,000
Abutments at Wall				
Class A Concrete	CU YD	200	750	$150,000
24" PPC Piles	LIN FEET	4200	55	$231,000
Sheet Piles	SQ FEET	3700	14	$51,800
Excavation	CU YD	121	12	$1,452
Temp Sheeting and Dewatering	LUMP SUM	1	100000	$100,000
Intermediate Bent				
Class A Concrete	CU YD	86	700	$60,200
24" PPC Piles	LIN FEET	2100	55	$115,500
Approach Slab				
Deck (Class AA Concrete)	CU YD	240	450	$108,000
Sidewalk (Class AA Concrete)	CU YD	20	350	$7,000
Sidewalk Barrier	LIN FEET	200	36	$7,200
Median Barrier	LIN FEET	100	35	$3,500
Roadway on Fill				
9" Concrete Pavement	SQ YD	6450	35	$225,750
8" Limestone Base	CU YD	1472	32	$47,104
Concrete Curb	LIN FEET	2934	8	$23,472
Excavation	CU YD	6622	10	$66,220
Bridge Demolition				
Deck	SQ YD	1200	100	$120,000
Substructure	CU YD	200	150	$30,000
Pull Piles	EACH	101	250	$25,250
Roadway Removal	SQ YD	6450	10	$64,500
Other Items				
Utility Modifications	LUMP SUM	1	100000	$100,000
Art Work	LUMP SUM	1	50000	$50,000
Miscellaneous	LUMP SUM	1	25000	$25,000
Tie into Floodwalls	LUMP SUM	1	50000	$50,000
Concrete Drives	SQ YD	300	40	$12,000
Concrete Sidewalks	SQ YD	600	30	$18,000
Construction Cost				$2,447,653
Contingencies (15%)				$367,148
Total Construction Cost				$2,814,801

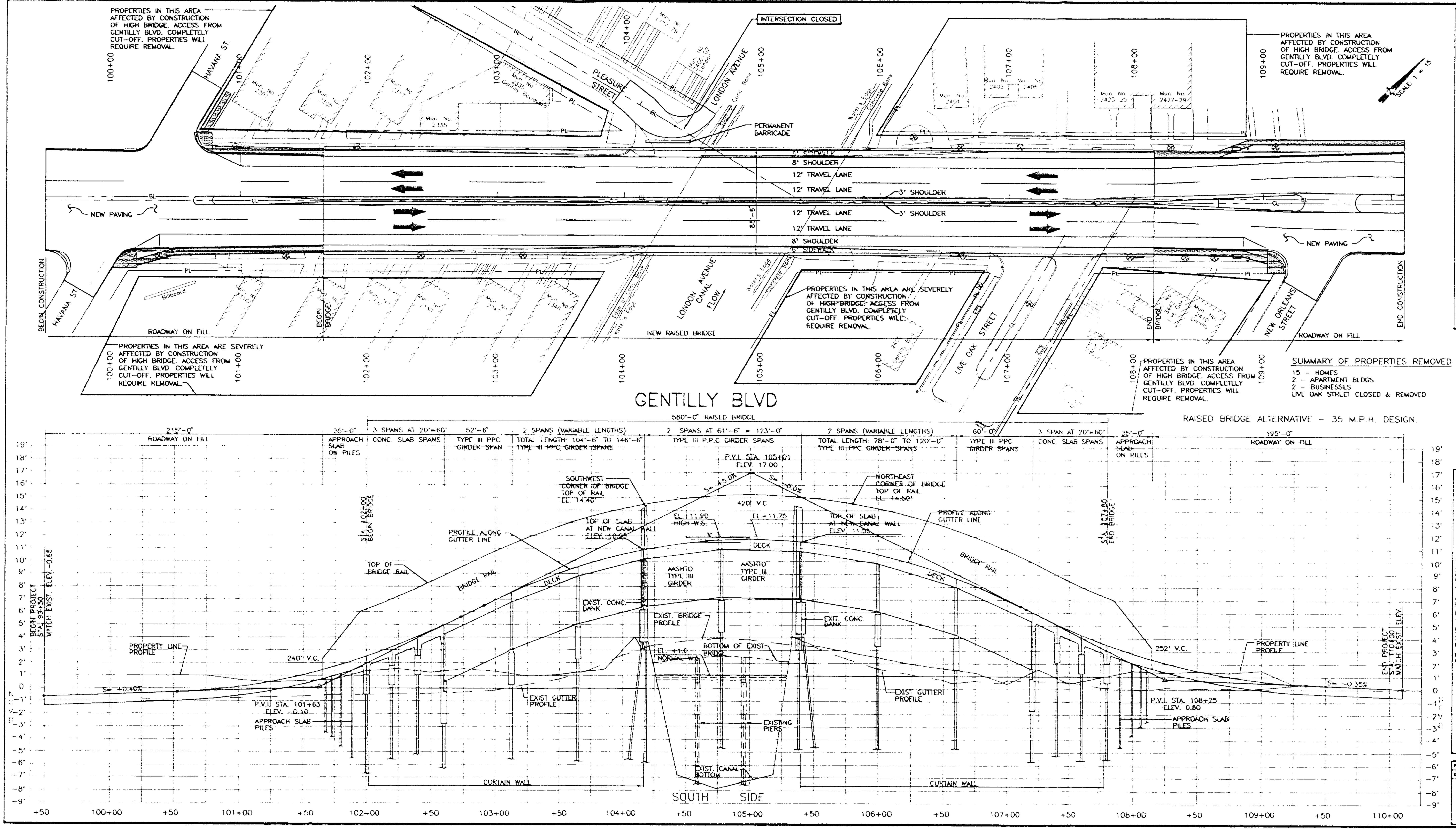
3. RAISED BRIDGE ALTERNATIVE

The raised bridge alternative for Gentilly Boulevard consists of removing the existing bridge deck, abutments and intermediate piers down to the pile caps and then constructing a new raised bridge such that the bridge barrier rails are not higher than the standard bridge rails. Raising the bridge increases the flow in the canal and limits the height so that the least possible disruption is made to the surrounding neighborhood (for a raised bridge).

The proposed raised bridge consists of two spans of standard AASHTO Type III precast prestressed girders over the London Avenue Canal and raised approaches consisting of a combination of AASHTO girders and slab spans. Plate No. 6 depicts the plan and profile of this alternative. The height of the raised bridge is set by placing the top of the bridge guard rails over the abutments at or above elevation 13.9 feet to match the proposed new floodwalls to be built parallel to the canal. The bridge guard rails are the standard 2'-8" rails and will allow a view of the canal. Placing the bridge deck as such minimizes the impact to the neighborhood while providing the required flood protection. For example, insufficient space exists for the bridge to be raised any higher unless additional streets are modified, more properties purchased and additional length of approach bridge built.

The raised bridge will require approach ramps approximately 220 feet long on either side of the bridge abutments. The bridge approaches will have curtain walls along the bottom sides to prevent access beneath the bridge.

The approaches to the raised bridge will block access to the homes and businesses adjacent to the bridge as shown on Plate No. 6. Plate No. 7 shows a cross section depicting the approach bridge elevation in relation to the existing roadway and property elevations. Plate No. 7 also shows the horizontal constraints of the site. As little as 30 feet of space exists between the existing houses and the edge of the proposed bridge, which is not sufficient space to build access drives to the properties. The properties on the north side of Gentilly Boulevard between the canal and Havana Street have access at their rear from Pleasure Street. The properties on the south side of Gentilly Boulevard between the canal and Havana Street also have at their rear from an alley. The properties on the east side of the canal do not have any means of access other than from frontage on Gentilly Boulevard. The homes and businesses on the west side of the canal could remain with access from the rear of the properties. The homes and apartments on the east side of the canal will require removal. For the purpose of this report, we assume that all the property owners will choose not to stay if vehicle access to Gentilly Boulevard is removed. Therefore, it is anticipated that all properties adjacent to the bridge approaches will be purchased and the structures thereon removed.

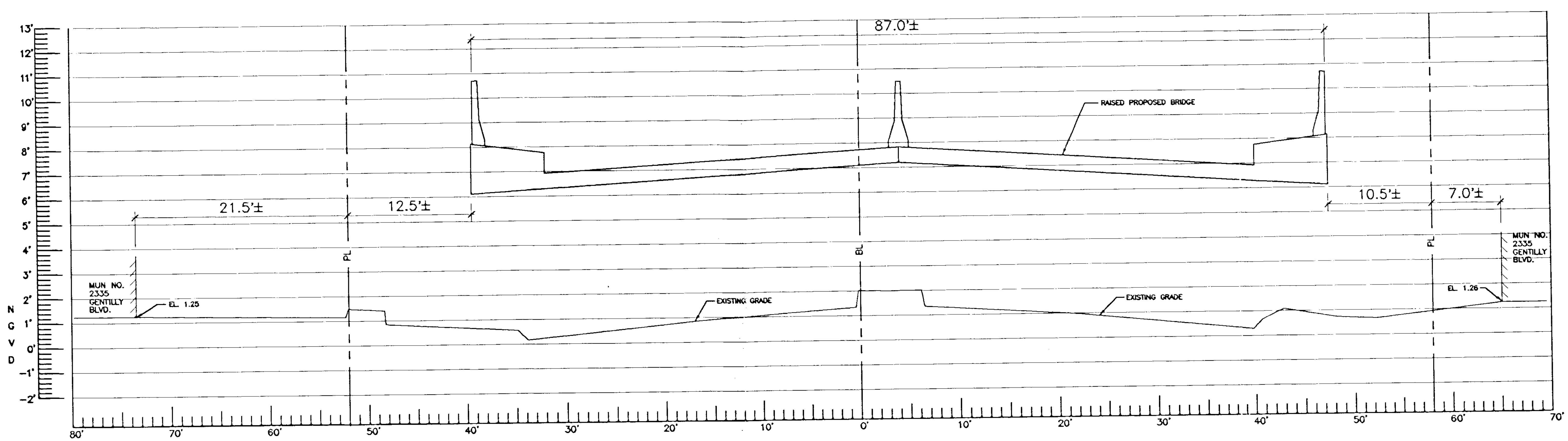


LINFIELD, HUNTER AND JUNIUS, INC.
ENGINEERS AND ARCHITECTS
651 RICHARD STREET NEW ORLEANS, LOUISIANA 70130

ORLEANS LEVEE DISTRICT
LONDON AVENUE OUTFALL CANAL
BRIDGE REMEDIATION SUPPLEMENTAL DESIGN MEMORANDUM

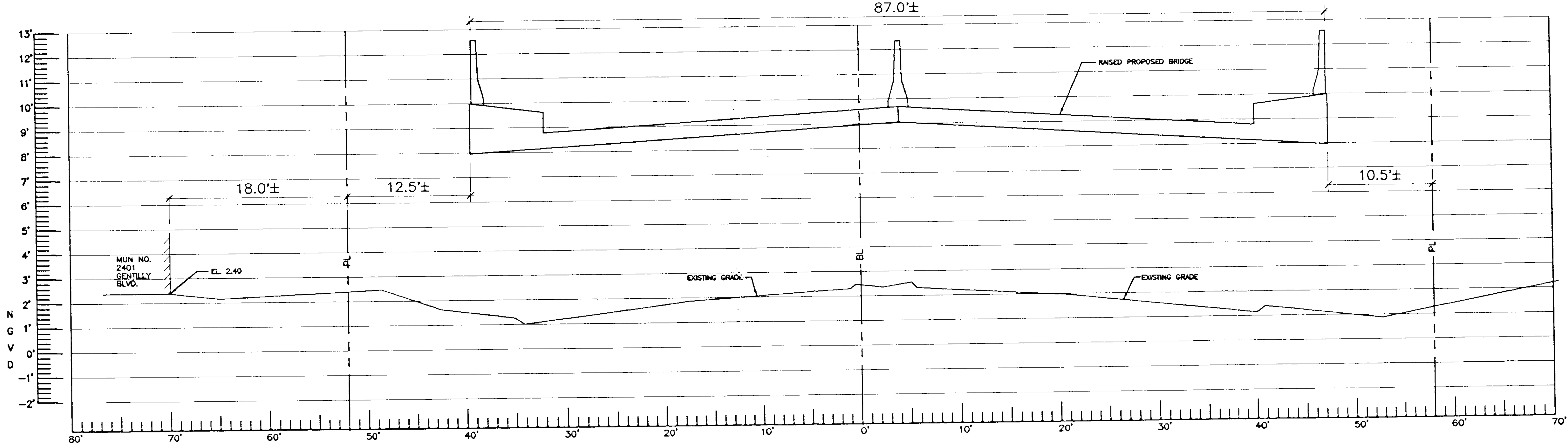
GENTILLY BLVD RAISED BRIDGE ALTERNATIVE

PLATE NO.
6



X SECTION @ STATION 103+25

LOOKING NORTHEAST SCALE: 1 = 5 HORIZ. SCALE: 1 = 2 VERT.



X SECTION @ STATION 106+25

LOOKING NORTHEAST SCALE: 1 = 5 HORIZ. SCALE: 1 = 2 VERT.

NOTE: SEE PATLE NO. 5 FOR STATION LOCATIONS

LINFIELD, HUNTER AND JUNIUS, INC.
ENGINEERS AND ARCHITECTS
651 RICHARD STREET NEW ORLEANS, LOUISIANA 70130

ORLEANS LEVEE DISTRICT
LONDON AVENUE OUTFALL CANAL
BRIDGE REMEDIATION SUPPLIMENTAL DESING MENORANDUM

GENTILLY BLVD. RAISED BRIDGE ALTERNATIVE CROSSECTIONS

PROJ. NO. 92-60
DATE 8/02/94

PLATE NO.
7

The raised bridge alternative will block access to Pleasure Street and London Avenue from Gentilly Boulevard. Live Oak Street will also be blocked and the three homes on Live Oak Street will have no street access (See Plate No. 6).

The purchase of the properties and removal of the structures will create an additional problem of maintenance of the vacant land. There will be maintenance costs for mowing grass and removing trash.

Approximately 12 large oak trees lie within the required right-of-way for the proposed raised bridge. These trees will have to be moved from the present right-of-way to the adjacent properties or other locations after the removal of the existing structures.

a. <u>ADVANTAGES</u>

The primary advantages of the raised bridge alternative are:

- Gentilly Boulevard will remain open to traffic during high water.

- Provides a good view of the canal.

- Improves hydraulics in the canal.

- Does not require high barrier walls and does not have a buoyant force on the bridge.

- Low maintenance.

- Does not require attention of OLD personnel during times of high water.

- Improved vehicular safety due to properly designed approaches.

b. <u>DISADVANTAGES</u>

The main disadvantages of the raised bridge alternative are:

- High cost.

- Severe disruption to the neighborhood (Approximately 15 homes, two businesses and 3 apartment buildings have vehicular access to Gentilly Boulevard blocked).

- The land acquired from adjacent property owners will require maintenance.

- Live Oak Street will be closed.

- Approximately 12 large live oak trees within the right-of-way will be either destroyed or relocated.

- Long lead time for this alternative due to legalities involved in buying the required properties.

- Probably will have opposition to the project which could cause a significant delay.

c. <u>COSTS</u>

The engineering opinion of construction costs for a raised bridge are shown on Table II. In addition to construction costs of $3.36 million, the cost of purchasing the properties shown on Plate No. 6 is estimated at $1.5 million. The cost of relocating the 12 live oak trees is approximately $0.6 million, bringing the total cost of the raised bridge alternative to approximately $5.46 million.

TABLE II
GENTILLY BLVD. BRIDGE
RAISED BRIDGE OPTION

ITEM DESCRIPTION	UNITS	QUANT	UNIT PRICE	TOTAL PRICE
Mobilization	LUMP SUM	1	50000	$50,000
Bridge Section				
Superstructure				
Slab (Class AA Concrete)	CU YD	1170	450	$526,500
Sidewalk (Class AA Concrete)	CU YD	305	350	$106,750
Sidewalk Barrier	LIN FEET	1400	36	$50,400
Median Barrier	LIN FEET	700	35	$24,500
Substructure				
Type III AASHTO Girders	LIN FEET	7092	60	$425,520
Abutments at Wall				
Class A Concrete	CU YD	157	700	$109,900
16" PPC Piles	LIN FEET	4200	27	$113,400
Sheet Piles	SQ FEET	3700	14	$51,800
Excavation	CU YD	121	12	$1,452
Temp Sheeting and Dewatering	LUMP SUM	1	50000	$50,000
Intermediate Bent (Girder Span)				
Class A Concrete	CU YD	268	600	$160,800
16" PPC Piles	LIN FEET	7350	27	$198,450
Intermediate Bent (Slab Span)				
Class A Concrete	CU YD	300	600	$180,000
16" PPC Piles	LIN FEET	1350	27	$36,450
Curtain Wall				
Class AA Concrete	CU YD	82	500	$41,000
Class A Concrete	CU YD	13	450	$5,850
Timber Piles	LIN FEET	2860	8	$22,880
Approach Slab				
Deck (Class AA Concrete)	CU YD	188	450	$84,600
Sidewalk (Class AA Concrete)	CU YD	37	450	$16,650
Sidewalk Barrier	LIN FEET	140	36	$5,040
Median Barrier	LIN FEET	70	35	$2,450
Fill	CU YD	1100	12	$13,200
Bridge Guardrail Ends	EACH	4	3500	$14,000
Roadway on Fill				
9" Concrete Pavement	SQ YD	3733	35	$130,655
8" Limestone Base	CU YD	855	32	$27,360
Concrete Curb	LIN FEET	1100	8	$8,800
Excavation	CU YD	4000	10	$40,000
Guard Rail (Steel)	LIN FEET			
Bridge Demolition				
Deck	SQ YD	1200	100	$120,000
Substructure	CU YD	200	150	$30,000
Pull Piles	EACH	101	250	$25,250
Roadway Removal	SQ YD	3000	10	$30,000
Other Items				
Utility Modifications	LUMP SUM	1	100000	$100,000
Miscellaneous	LUMP SUM	1	50000	$50,000
Tie into Floodwalls	LUMP SUM	1	50000	$50,000
Concrete Drives	SQ YD	200	40	$8,000
Concrete Sidewalks	SQ YD	400	30	$12,000
Construction Cost				$2,923,657
Contingencies (15%)				$438,549
Total Construction Cost				$3,362,206
Purchase and Clear Adjacent Property	LUMP SUM	1	1500000	$1,500,000
Total Cost				$4,862,206

4. FLOODGATE ALTERNATIVE.

The floodgate alternative consists of a pair sliding steel floodgates at each end of the bridge. These gates will be approximately 10.5 feet tall and 60 feet long. In the closed position, the gates meet at a removable center column in the roadway median. In the open position, the gates are hidden behind the floodwalls. The center column is stored on site behind the floodwall. The gates are split at the middle of the roadway because the roadway is too wide for a single long gate. A single gate 112 feet long was considered impractical because it would be difficult to construct and place on the site, difficult to close and more expensive than two smaller gates.

On the northwest corner of the bridge, the floodgate will take up a portion of London Avenue. London Avenue will have to be closed or the corner property on Pleasure Street bought and London Avenue re-aligned. At the southwest corner of the bridge, the gate fits into the existing right-of-way but a construction servitude is required. For the northeast and southeast gates, approximately 10 feet of additional width of right-of-way is required parallel to the canal.

The existing bridge will not be affected by the construction of the floodgates. However, the floodgate sill elevation will fix the elevation of the bridge by limiting the approach elevations, thereby preventing construction of a higher bridge at a later time unless the floodgates receive major modifications.

a. ADVANTAGES

The primary advantages of the gate alternative are:

- Relatively minor disturbance to the neighborhood during construction.
- The appearance of the gates is not a major concern because the gates will be behind the floodwall most of the time.
- The bridge will remain open to traffic during most of the floodgate construction.

b. DISADVANTAGES

The primary disadvantages of the floodgate alternative are:

- The bridge will be closed to traffic during times of high water. This will not meet the requirements of the City of New Orleans.

- The gates will be some of the largest gates in the City and will be difficult to open and close. The center post structure will be difficult to set and remove due to its size and weight. Special equipment to effect this closure will be required.

- The cost of the floodgate alternative is 96 percent of the sealed bridge alternative.

- London Avenue will be blocked by the floodgates unless additional property is obtained in order to re-align London Avenue.

- Higher maintenance costs for the OLD.

- Requires OLD personnel to close the gates.

- Fixes approach and bridge elevations at present levels unless gates are modified or removed.

c. <u>COSTS</u>

The engineering opinion of construction costs for the floodgate alternative are shown on Table III. The cost for the floodgate alternative is approximately $2.31 million. For additional right-of-way, add $100,000 to the construction cost.

TABLE III
GENTILLY BLVD. BRIDGE
FLOODGATE OPTION

ITEM DESCRIPTION	UNITS	QUANT	UNIT PRICE	TOTAL PRICE
Mobilization	LUMP SUM			
Foundation				
Excavation	CU YD	2600	12	$31,200
Piles (16" Sq PPC)	LIN FEET	12480	27	$336,960
Sheet Piling	SQ FEET	9600	14	$134,400
Concrete Sill/Ftg (Class A Concrete)	CY YD	750	600	$450,000
Tracks	LIN FEET	960	25	$24,000
Walls				
Concrete Walls (Class AA Concrete)	CU YD	143	600	$85,800
Center Post	LUMP SUM	1	75000	$75,000
Gate				
A36 Steel	LBS	235000	3	$705,000
Seals-Neoprene	LUMP SUM	1	23000	$23,000
Rollers, Locks, Inserts	LUMP SUM	1	50000	$50,000
Other Items				
Utility Modifications	LUMP SUM	1	25000	$25,000
Miscellaneous	LUMP SUM	1	20000	$20,000
London Ave. Realingment	LUMP SUM	1	50000	$50,000
Construction Cost				$2,010,360
Contingencies (15%)				$301,554
Total Construction Cost				$2,311,914

D. COMPARISON OF ALTERNATIVES

The following comparison of the advantages, disadvantages and determinants is presented to aid in the evaluation of the alternatives studied. Table IV shows a tabulation of the determinants for the Gentilly Boulevard Bridge.

Of the three viable bridge alternatives studied, the floodgate alternative allows water to flow over the existing bridge, the sealed bridge forces water under the bridge, and the raised bridge allows an increase in flow under the bridge.

The sealed low bridge has a large buoyant force acting on it during high water and requires high barrier walls and watertight construction. The raised bridge alternative also has watertight construction but the bridge deck is raised so that high barrier walls are not required on the bridge and there is no net buoyant force on the bridge.

The sealed low bridge alternative provides the required flood protection with the least permanent disturbance to the neighborhood. The raised bridge alternative severely impacts the surrounding residents and businesses by blocking access to them. The floodgate alternative requires the taking of one residence, the realignment of London Avenue at Pleasure Street and a strip of right-of-way approximately 10 feet by 50 feet parallel to the canal at the north and south quadrants of the east side of London Avenue.

The raised bridge alternative provides the best hydraulic characteristics to the canal and allows the best view of the Canal. The raised bridge alternative also has the least maintenance problems and costs.

The floodgate alternative is the least costly but will close the roadway during high water events. The existing Gentilly Boulevard bridge is in poor condition and requires replacement. The sill of floodgates will limit the elevation of the replacement bridge deck and approaches. Both the sealed and raised bridge alternatives will be usable during hurricane events.

The total estimated construction costs for implementing each alternative is tabulated below:

Alternative	Sealed Bridge	Raised Bridge	Floodgates
Cost (millions)	$2.81	$5.46	$2.41

TABLE IV
GENTILLY BLVD BRIDGE MODIFICATION ALTERNATIVES
SUMMARY OF DETERMINANTS

DETERMINANTS	EXIST. BRIDGE	NEW SEALED BRIDGE	RAISED BRIDGE	FLOODGATE	REMARKS
MAJOR DETERMINANTS					
1. PROJECT COST RATIO		1.04	2.07	1.0	FLOODGATES=I.0
2. HYDRAULIC CHARACTERISTICS					
W.S. ELEV.2.25**	0.85	0.85	0.98	0.85	% OF UNOBSTRUCTED
W.S. ELEV. 11.90	0.65	0.43	0.69	0.65	% OF UNOBSTRUCTED
3. NEIGHBORHOOD DISRUPTION		MINOR	EXTRA	SOME	PERMANENT
4. TRAFFIC CONDITION AT HIGH WATER	CLOSED	OPEN	OPEN	CLOSED	
5. APPEARANCE	POOR	FAIR	GOOD	FAIR	
MINOR DETERMINANTS					
A. TRAFFIC DISRUPTION		CLOSED	CLOSED	SOME*	
B. NEIGHBORHOOD DISTURBANCE		SMALL*	LARGE***	LITTLE*	
C. CONSTRUCTION DIFFICULTY		MOST	LITTLE	SOME	
D. DESIGN COMPLEXITY		MOST	LITTLE	SOME	
E. MAINTENANCE COST		SOME	LEAST	MOST	
F. OLB PERSONNEL AT STORM		NONE	NONE	REQUIRED	
G. EXISTING BRIDGE		REMOVE	REMOVE	UTILIZE	

*DURING CONSTRUCTION.
**ELEVATIONS ARE IN FEET-N.G.V.D.
***PERMANENT REMOVAL OF HOMES.

9260

VII. LEON C. SIMON BOULEVARD BRIDGE - EVALUATION OF ALTERNATIVES

A. LOCATION AND DESCRIPTION

Leon C. Simon Boulevard is a major thoroughfare serving the University of New Orleans, Lakefront neighborhoods and the Lakefront Airport. The Leon C. Simon Bridge is located approximately 1/4 mile from the London Avenue Canals' confluence with Lake Pontchartrain as shown on Plate No. 1. The University of New Orleans is located just northeast of the bridge.

The existing bridge structure, built in 1966, consists of a cast-in-place concrete deck on multi-span steel girders. (See Section 1, Plate No. 8.) There are four continuous spans which vary from 40 feet to 50 feet in length. The girders bear on concrete bents supported by concrete filled steel pipe piles. The existing deck and barrier walls are presently sealed to elevation 10.5 feet. The roadway elevation at the abutment is approximately 6.0 feet. The approach roadway is constructed on fill and rises to approximately six feet above the natural surrounding ground.

Unlike the existing Gentilly Boulevard Bridge site, there are no houses or other structures built close to the Leon C. Simon Bridge which have to be removed or prevent the raising of the bridge. There is an existing access road, New York Street at the southeast quadrant which will not be affected by raising the bridges. The parking lot at the northeast quadrant is built higher than the existing road and does not have an access to Leon C. Simon and therefore would not be affected by raising the bridge. The northwest and southwest quadrants are open areas which will not be affected if the bridge is raised.

B. EXISTING BRIDGE CONDITION

The Leon C. Simon Bridge is considered to be in fair condition according to our visual inspections and inspections by the LADOTD. Deficiencies found by the LADOTD inspection include: corrosion and peeling paint of the steel girders and hardware throughout the bridge; corrosive pitting of the steel piling throughout the splash zone; numerous transverse cracks ranging in size from hairline to 1/32" wide in the concrete deck and barriers.

The Leon C. Simon Bridge is currently posted for a maximum load of 25 tons for two axle trucks and 40 tons for four axle trucks. Structural analysis of the existing bridge deck and girders confirms that the bridge does not meet current live load design standards.

The topographic survey of the bridge and approaches indicates that the vertical vehicular stopping sight distances for the existing bridge do not meet current standards for the posted speed limit.

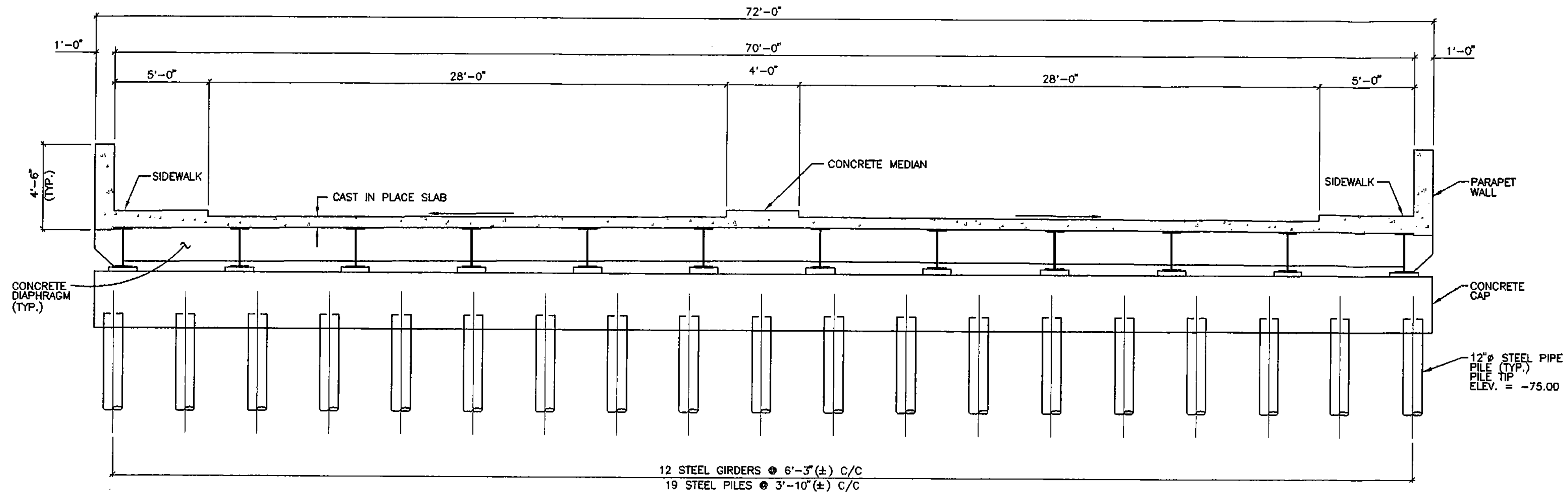
C. FLOOD PROTECTION ALTERNATIVES

1. SEAL JOINTS AND BARRIER WALLS ON EXISTING BRIDGE

Since the Leon C. Simon Bridge structure is currently deficient in its load carrying capacity, the sealed bridge alternative for this site consists of removing the existing concrete bridge deck and barrier rails, driving additional pipe piles, adding new cross beams to resist the buoyant forces on the bridge at design high water (approximate net buoyant force is 325 psf), sand blast and repaint the existing girders and piles, adding sufficient shear connectors to the existing girders, replacing the bridge deck and adding high barrier rails on each side of the bridge which tie into the levees or floodwalls parallel to the canal. Section 2 on Plate No. 8 shows a typical cross section through the modified bridge structure.

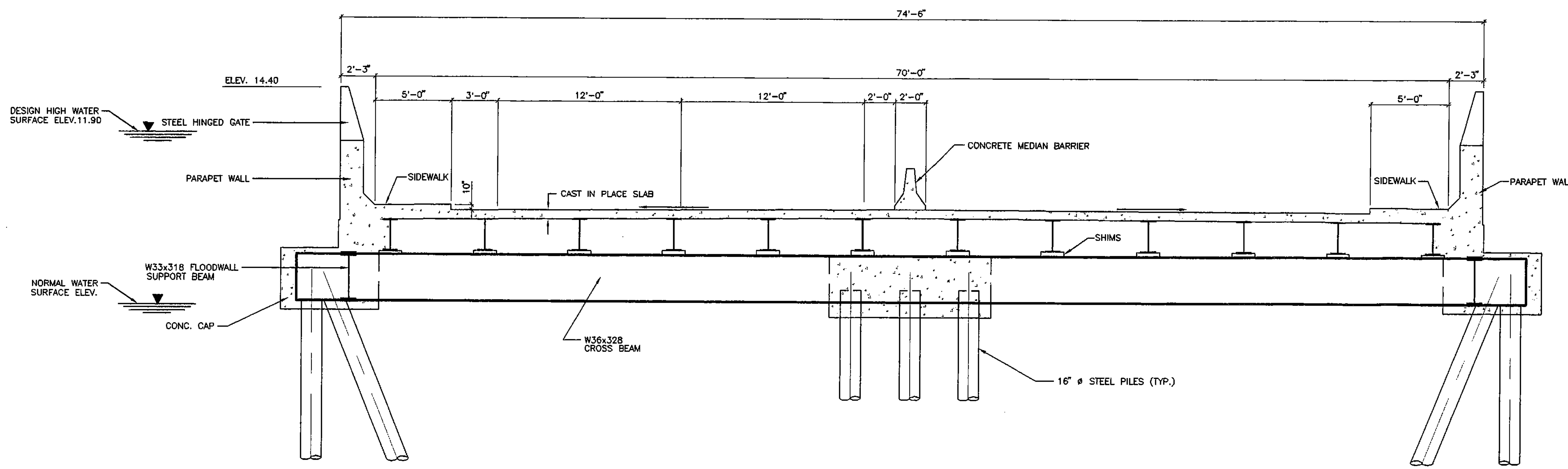
In order to resist the buoyant force created when the water rises to the design high water elevation, a buoyant force anchorage system consisting of eight new pile bents is required. The bents are located adjacent to the existing bents and abutments. The intent of the new bents is to resist uplift forces due to buoyancy and to support the new high barrier walls on each side of the bridge. The existing bridge girders carry the bridge dead and live loads. The new bents consist of W36x328 beams connected to the existing bridge girders and supported at each side of the bridge and at the center of the bridge. New steel beams are required under the high concrete barrier walls to support the weight of the walls. Steel pipe piles were selected to resist the tension forces. Because of the width of the bridge, new piles are required at the middle of the bridge, otherwise the size of the cross beams would become too large and installation of the beams would be difficult. All new and existing steel components will be coated with a non-toxic two part epoxy paint system. Plate No. 9 shows a Plan and Profile of the modified existing bridge and the location of the new and existing pile bents.

The existing approach sight distances cannot be completely corrected with this alternative because the slopes and vertical curve of the existing bridge structure cannot be changed without major reconstructing of the support bents and abutments or degrading (lowering) of the street at the base of the bridge approach. The roadway will be replaced from and including the intersection of Pratt Drive to the west abutment and from the east abutment 360 feet to the east as shown on Plate No. 9.



1 LEON C. SIMON BLVD. EXISTING BRIDGE CROSS SECTION

SCALE: 1/8" = 1'-0"



2 LEON C. SIMON BLVD. MODIFIED SEALED BRIDGE CROSS SECTION

SCALE: 1/8" = 1'-0"

LINFIELD, HUNTER & JUNIUS, INC.
CONSULTING ENGINEERS AND ARCHITECTS
3500 North Causeway Blvd. Suite 200
Metairie, Louisiana 70002

SEAL

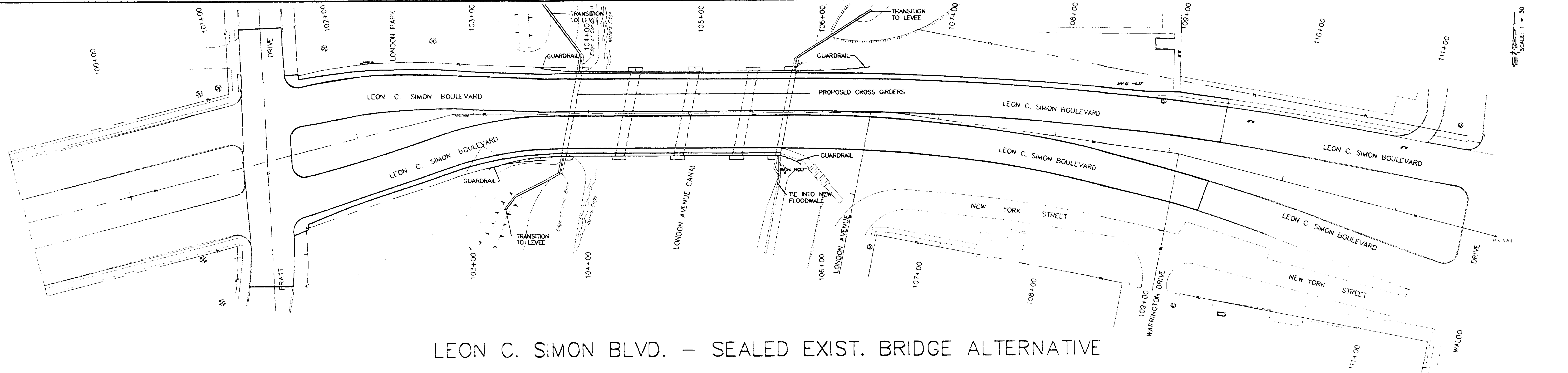
REV. NO.	DATE

ORLEANS LEVEE DISTRICT
LONDON AVENUE OUTFALL CANAL
BRIDGE REMEDIATION SUPPLIMENTAL DESIGN MEMORANDUM

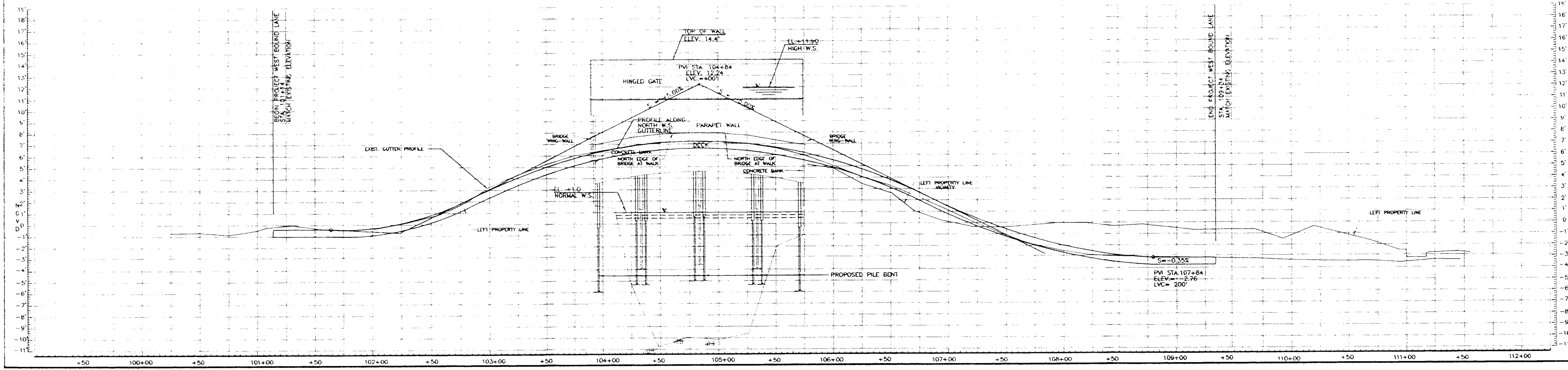
THIS SHEET
LEON C. SIMON-EXISTING & SEALED BRIDGE SECTIONS

DRAWN BY T.B.F | CHECKED BY | APPROVED BY | CAD FILE NO. 9260

PROJ. NO. 92-60
DATE 6/07/94
SHEET NO. PLATE NO. 8
OF SHEETS



LEON C. SIMON BLVD. – SEALED EXIST. BRIDGE ALTERNATIVE



LINFIELD, HUNTER AND JUNIUS, INC.
ENGINEERS AND ARCHITECTS
651 RICHARD STREET NEW ORLEANS, LOUISIANA 70130

ORLEANS LEVEE DISTRICT
LONDON AVENUE OUTFALL CANAL
BRIDGE REMEDIATION DESIGN MEMORANDUM

LEON C. SIMON-SEALED BRIDGE PLAN & PROFILE

PLATE NO. 9

The existing bridge deck is at elevation 6.0 feet at the east abutment, therefore the height of the barrier rails will be approximately 7.9 feet tall at the east abutment (13.9'- 6.0'). The barrier rails will be approximately 6.7 feet tall at the center of the bridge.

We are assuming that the existing bridge steel girders are painted with lead based paint. The blasting and painting of lead base paint will add significant costs to this alternative because of new environmental regulations dealing with the removal of lead paint.

a. <u>ADVANTAGES</u>

The primary advantages to modifying the existing bridge are:

- The permanent impact to the surrounding residences is very minimal.
- The bridge will remain open during times of high water.

b. <u>DISADVANTAGES</u>

The disadvantages of modifying the existing bridge alternative are:

- The addition of new piles required to hold down the buoyancy of the bridge will further constrict the flow of the canal.
- The required high barrier walls will block the view of the canal.
- Steel fold-down walls, if used, require higher maintenance costs and OLD personnel to lift the walls during the approach of a hurricane.
- Vehicular sight distances cannot be adequately improved to meet a 35 MPH speed limit.

c. <u>COSTS</u>

The engineering opinion of probable construction costs for sealing the existing bridge are presented in Table V. The construction costs for sealing the existing bridge is approximately $2.50 million.

TABLE V
LEON C. SIMON BLVD. BRIDGE
EXISTING SEALED BRIDGE OPTION

ITEM DESCRIPTION	UNITS	QUANT	UNIT PRICE	TOTAL PRICE
Mobilization	LUMP SUM	1	50000	$50,000
Bridge Section				
Superstructure				
5" Top Slab (Class AA Concrete)	CU YD	310	450	$139,500
10" Sidewalk (Class AA Concrete)	CU YD	60	350	$21,000
Floodwall Barrier (Class AA Concrete)	CU YD	95	700	$66,500
Median Barrier (Jersey Type)	LIN FEET	185	36	$6,660
Additional Shear Studs	EACH	3500	2	$7,000
Substructure				
Box Girders	CU YD			
Blast & Paint Existing Girders	SQ FT	16000	5	$80,000
Hazardous Material Containment and Removal	LUMP SUM	1	100000	$100,000
Crossover Beams	LB	194176	3	$582,528
Floodwall Support Beams	LB	117660	3	$352,980
Abutments at Wall				
Class A Concrete	CU YD	160	650	$104,000
16" PPC Piles	LIN FEET	4900	27	$132,300
Approach Slab				
Deck (Class AA Concrete)	CU YD	125	450	$56,250
Sidewalk (Class AA Concrete)	CU YD	25	450	$11,250
Median Barrier	LIN FEET	70	35	$2,450
Fill	CU YD	420	12	$5,040
Roadway on Fill				
9" Concrete Pavement	SQ YD	4150	35	$145,250
8" Limestone Base	CU YD	1000	32	$32,000
Concrete Curb	LIN FEET	2300	8	$18,400
Excavation	CU YD	2220	10	$22,200
Guard Rail (Steel)	LIN FEET	400	20	$8,000
Bridge Demolition				
Deck	SQ YD	1500	50	$75,000
Roadway Removal	SQ YD	2655	10	$26,550
Other Items				
Utility Modifications	LUMP SUM	1	25000	$25,000
Art Work	LUMP SUM	1	50000	$50,000
Miscellaneous	LUMP SUM	1	50000	$50,000
Construction Cost				$2,169,858
Contingencies (15%)				$325,479
Total Construction Cost				$2,495,337

2. NEW RAISED BRIDGE ALTERNATIVE

The raised bridge alternative consists of completely removing the existing bridge structure and replacing it with a raised bridge such that the bridge barrier rails are at the standard bridge guard rail height adjacent to the floodwall or levee. Placing the bridge at this height allows the raised bridge and approaches to fit between the existing cross streets without major disruption to the neighborhood and allows an unobstructed view of the canal. The raised bridge deck will be approximately five feet higher than the present bridge deck.

The raised bridge consists of three spans of AASHTO Type III prestressed-precast girders on the canal. The approach bridges consist of a combination of slab span bridges and AASHTO Type III girders. Plate No. 10 shows the Plan and Profile for the raised bridge alternative.

The alignment of the raised bridge was altered to improve horizontal sight distances. Changing the alignment requires that the bridge be built as separate bridges as shown on in plan Plate No. 10 and in section on Plate No. 11.

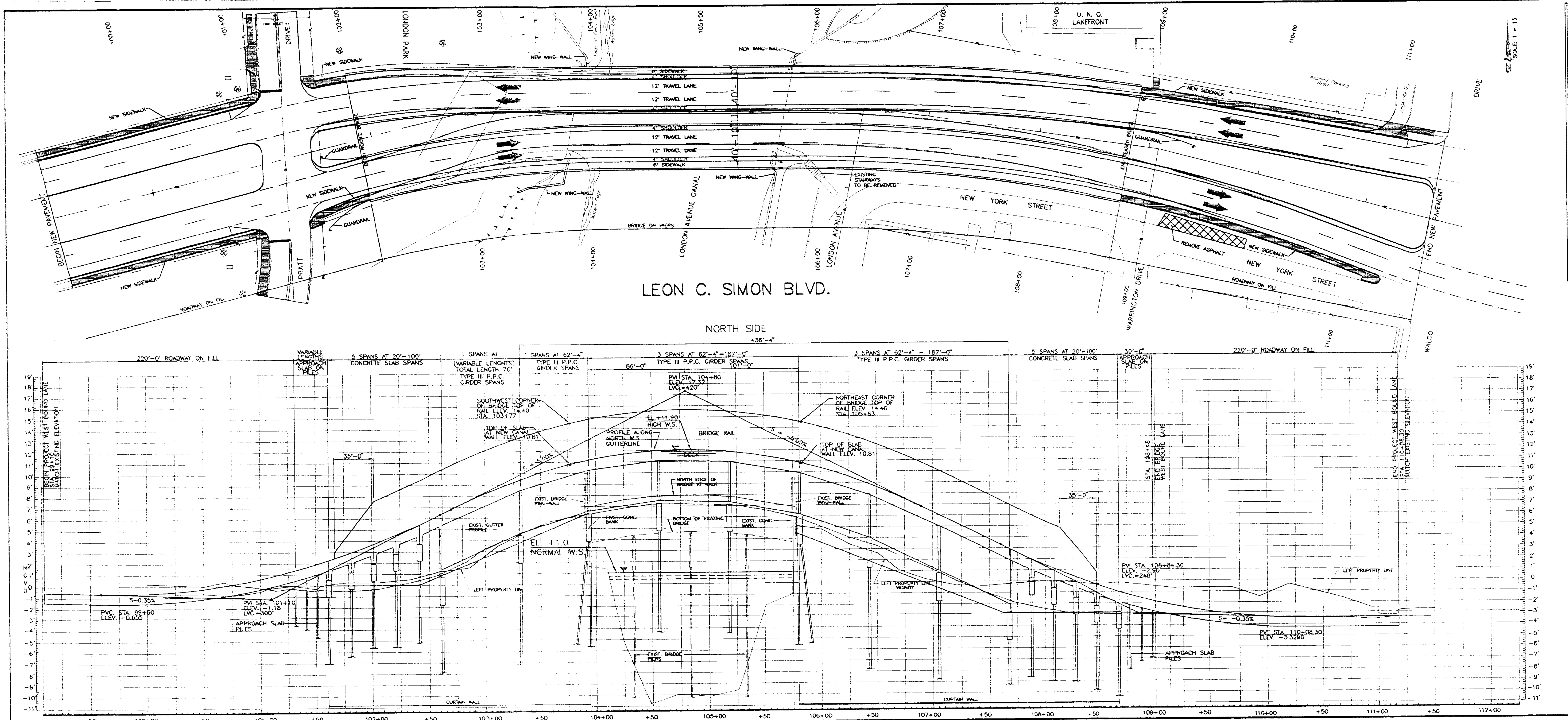
The only significant permanent impact to the neighborhood for this alternative is the raising of the intersection of Pratt Drive and Leon C. Simon approximately one foot, which causes the properties on the north and south sides of Leon C. Simon west of Pratt Drive to be slightly below the gutter line of the street. This is addressed by adding area drains to prevent ponding of water on the properties. Also, the driveway near the northwest corner of Pratt Drive will be rebuilt at a slightly steeper slope. The limits of the work in this area are shown on Plate No. 11.

It is important to note that the raised bridge could be lowered slightly to avoid raising the Pratt Drive-Leon C. Simon intersection. However, the bridge rails will have to be sealed and raised accordingly.

a. ADVANTAGES

The primary advantages to the raised bridge alternative are:

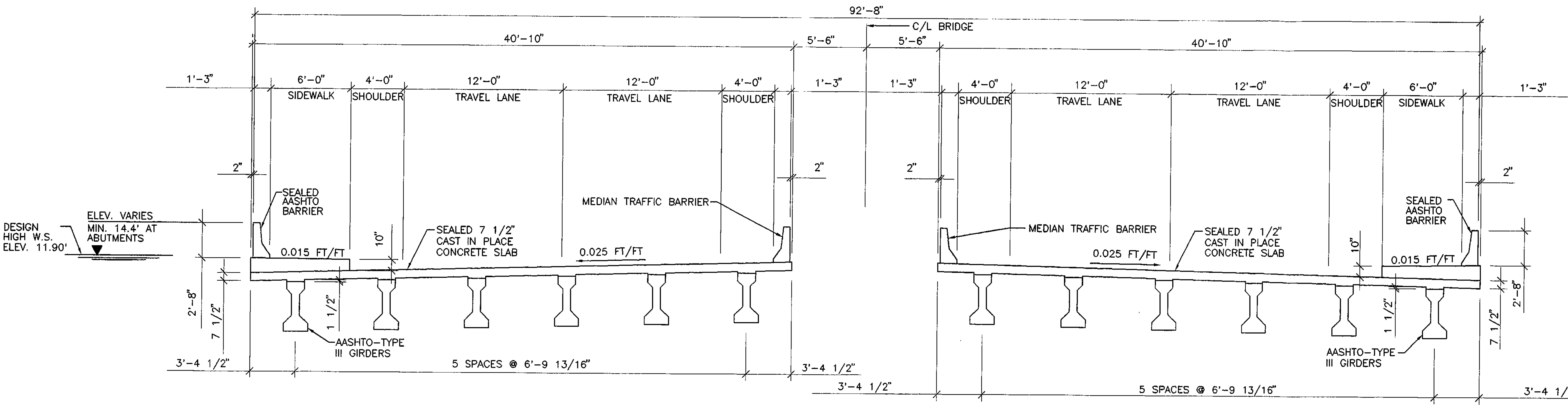
- Increased flow area in the canal.
- Improved bridge structure with a view of the canal and Lake Pontchartrain.
- Improved vertical and horizontal sight distances.
- The bridge will remain open to traffic at times of high water.



LINFIELD, HUNTER AND JUNIUS, INC.
ENGINEERS AND ARCHITECTS
651 RICHARD STREET NEW ORLEANS, LOUISIANA 70130

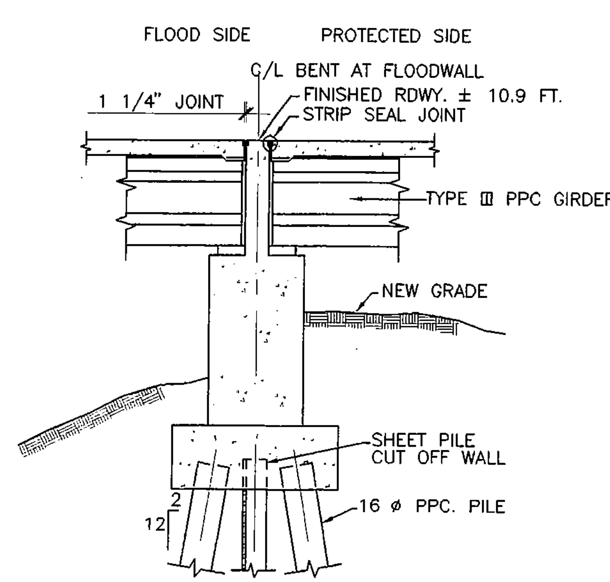
ORLEANS LEVEE DISTRICT
LONDON AVENUE OUTFALL CANAL BRIDGE
REMEDIATION SUPPLEMENTAL DESIGN MEMORANDUM
LEON C. SIMON BRIDGE-RAISED BRIDGE PLAN & PROFILE

PLATE NO.
10



1 TYPICAL BRIDGE SECTION

RAISED BRIDGE ALTERNATIVE SCALE: 1/4" =1'



LEON C. SIMON BLVD. RAISED BRIDGE
INTERMEDIATE BENT AT FLOODWALL
ELEVATION
SCALE: 3/8"=1'-0"

LINFIELD, HUNTER & JUNIUS, INC.
CONSULTING ENGINEERS AND ARCHITECTS
3500 North Causeway Blvd. Suite 200
Metairie, Louisiana 70002

SEAL

REV. NO.	DATE

ORLEANS LEVEE DISTRICT
LONDON AVENUE OUTFALL CANAL
BRIDGE REMEDIATION SUPPLIMENTAL DESIGN MEMORANDUM

THIS SHEET: LEON C. SIMON RAISED BRIDGE ALTERNATIVE - TYPICAL SECTION

DRAWN BY T.F.B | CHECKED BY S.G.J. | APPROVED BY A.F.G. | CAD FILE NO. 9260

PROJ. NO. 92-60
DATE 6/07/94
SHEET NO. PLATE NO. 11
OF SHEETS

- New low maintenance concrete structure.

- No net buoyant force on the bridge.

b. **DISADVANTAGES**

The primary disadvantage of raising the bridges are:

- Higher costs due to the construction of elevated approach spans.

- Reconstruction of the intersection of Pratt Drive and Leon C. Simon. (This can be eliminated by not raising the bridge to optimum height and providing higher bridge rails.)

c. **COSTS**

The engineering opinion of probable construction costs are tabulated in Table VI. The cost of the raised bridge alternative is approximately $3.63 million.

TABLE VI
LEON C. SIMON BLVD. BRIDGE
RAISED BRIDGE OPTION

ITEM DESCRIPTION	UNITS	QUANT	UNIT PRICE	TOTAL PRICE
Mobilization	LUMP SUM	1	50000	$50,000
Bridge Section				
Superstructure				
Slab (Class AA Concrete)	CU YD	1356	450	$610,200
Sidewalk (Class AA Concrete)	CU YD	220	350	$77,000
Sidewalk Barrier	LIN FEET	2900	36	$104,400
Median Barrier	LIN FEET	1400	35	$49,000
Substructure				
Type III AASHTO Girders	LIN FEET	6720	60	$403,200
Abutments at Wall				
Class A Concrete	CU YD	162	700	$113,400
16" PPC Piles	LIN FEET	4200	27	$113,400
Sheet Piles	SQ FEET	3800	14	$53,200
Excavation	CU YD	121	12	$1,452
Temp Sheeting and Dewatering	LUMP SUM			
Intermediate Bent (Girder Span)				
Class A Concrete	CU YD	225	650	$146,250
16" PPC Piles	LIN FEET	7350	27	$198,450
Intermediate Bent (Slab Span)				
Class A Concrete	CU YD	290	650	$188,500
16" PPC Piles	LIN FEET	1280	27	$34,560
Curtain Wall				
Class AA Concrete	CU YD	180	500	$90,000
Class A Concrete	CU YD	20	450	$9,000
Timber Piles	LIN FEET	2860	8	$22,880
Approach Slab				
Deck (Class AA Concrete)	CU YD	150	450	$67,500
Sidewalk (Class AA Concrete)	CU YD	45	450	$20,250
Sidewalk Barrier	LIN FEET	170	36	$6,120
Median Barrier	LIN FEET	100	35	$3,500
Fill	CU YD	419	12	$5,028
Bridge Guardrail Ends	EACH	4	3500	$14,000
Roadway on Fill				
9" Concrete Pavement	SQ YD	4600	35	$161,000
8" Limestone Base	CU YD	1100	32	$35,200
Concrete Curb	LIN FEET	1600	8	$12,800
Excavation	CU YD	1650	10	$16,500
Guard Rail (Steel)	LIN FEET			
Bridge Demolition				
Deck	SQ YD	1800	75	$135,000
Substructure	CU YD	200	150	$30,000
Pull Piles	EACH	120	250	$30,000
Roadway Removal	SQ YD	8500	10	$85,000
Other Items				
Utility Modifications	LUMP SUM	1	155000	$155,000
Miscellaneous	LUMP SUM	1	50000	$50,000
Tie into Floodwalls	LUMP SUM	1	60000	$60,000
Construction Cost				$3,151,790
Contingencies (15%)				$472,769
Total Construction Cost				$3,624,559

3. NEW SEALED BRIDGE

The new sealed bridge alternative consists of completely removing the existing bridge structure and replacing it with a new sealed bridge with high barrier rails. The new sealed bridge deck elevation will be at the approximate elevation as the existing bridge. The top elevation of the barrier rails will be at 13.9 feet or approximately 8.0 feet above the bridge deck at the abutments.

The proposed structural system for the new sealed bridge is similar to the sealed bridge alternative studied for the Gentilly Boulevard bridge location (see Plate 12) using precast concrete box girders with a cast-in-place bridge deck. The box girders are required so that the new bridge does not block the flow of the canal. The sealed bridge would have no joints between the abutments, expansion and contraction of the bridge would occur between the abutments and the roadway.

Referring to Plate 13, the east bound approach work begins just west of the Pratt Street intersection and continues eastward to the bridge. The street work west of the Pratt Street intersection and in the intersection is required to smooth out the intersection of the streets and will require a very minimal change in grade (elevation). Work on the west bound approach begins approximately 300 feet east of the bridge and ends at the bridge abutment. The maximum change in roadway elevation on either of the approaches is approximately 0.9 feet as indicated on the profile view of Plate 13. No private drives or drainage will be affected by the approach work and no permanent street closings are required.

Traffic safety is maintained with the sealed bridge by regrading the approaches and changing the slope gradient of the vertical curve. The horizontal alignment of the west bound lane will be altered slightly to improve the horizontal site distance as is indicated by the cross hatched area shown on Plate 13. This will change the design speed at the bridge from approximately 24 mph to approximately 35 mph.

a. ADVANTAGES

The primary advantages to building a new sealed bridge are:

- The cost is approximately 40% less than raising the bridge.
- The permanent impact to the surrounding residences is minimal.
- The bridge will remain open during times of high water.
- No additional pile bents are required for the new sealed bridge.

- Flow in the canal will not be constricted more than the present condition.

- New low maintenance concrete bridge structure.

b. **DISADVANTAGES**

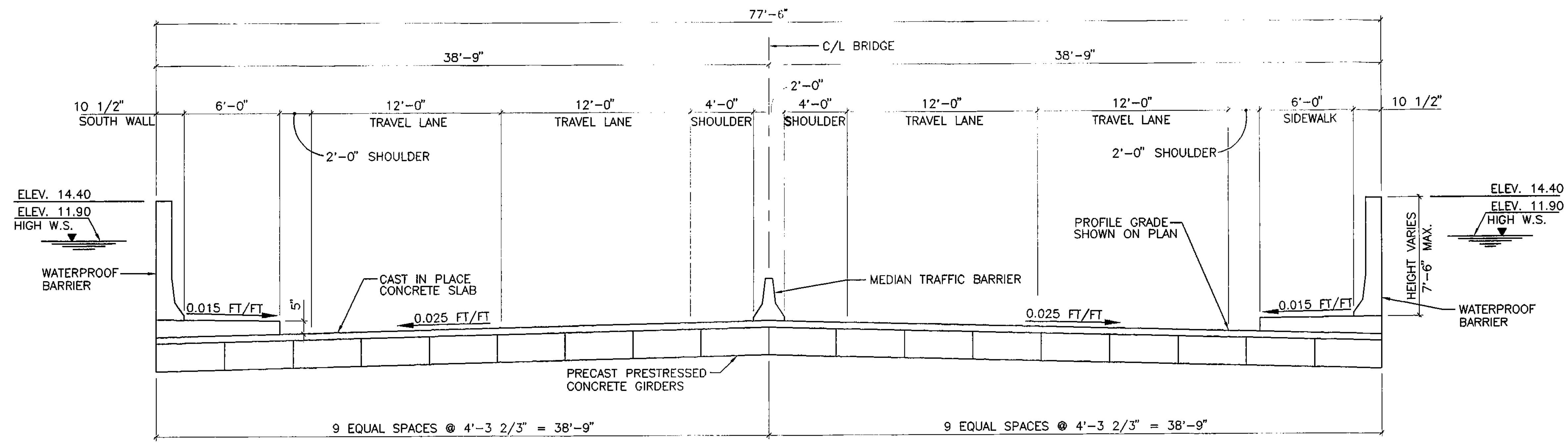
The disadvantages of a new sealed bridge alternative are:

- The required high barrier walls will block the view of the canal and surrounding green spaces.

- A design waiver will be required to maintain the 35 mph speed limit.

c. **COSTS**

The engineers opinion of probable construction costs for the sealed bridge alternative are tabulated on Table VII. The cost of the sealed bridge alternative is approximately $2.95 million. This table depicts costs for a new sealed bridge built at the same deck elevation as the existing bridge and in the same horizontal alignment. Costs will increase if the alignment is changed or if the bridge is raised.



(2) PROPOSED SEALED BRIDGE SECTION

LEON C. SIMON BRIDGE SCALE: 1/4"=1'-0"

LINFIELD, HUNTER & JUNIUS, INC.
CONSULTING ENGINEERS AND ARCHITECTS
3500 North Causeway Blvd. Suite 200
Metairie, Louisiana 70002

SEAL

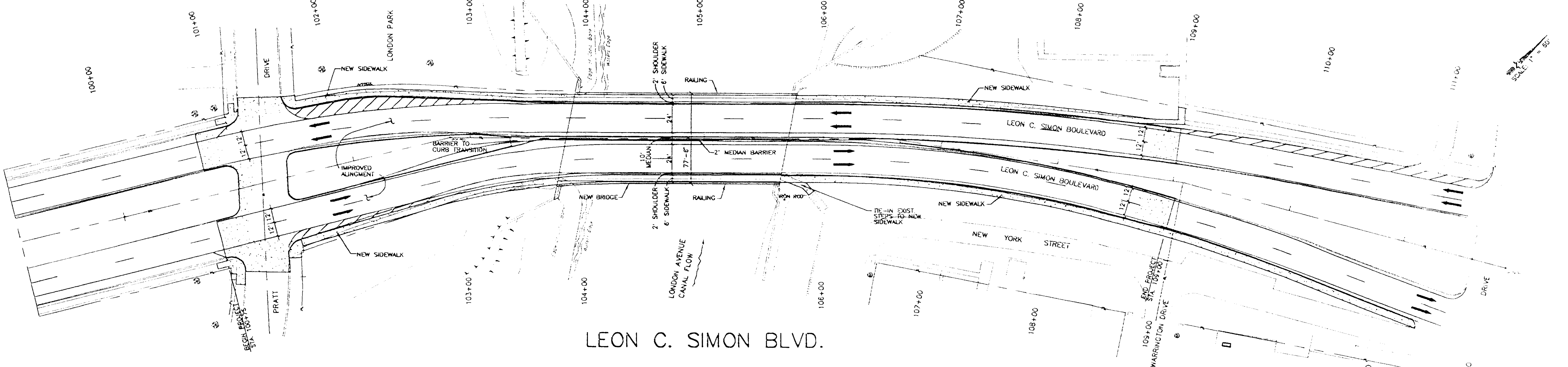
REV. NO.	DATE

ORLEANS LEVEE DISTRICT
LONDON AVENUE OUTFALL CANAL
WAIVER STUDY REPORT

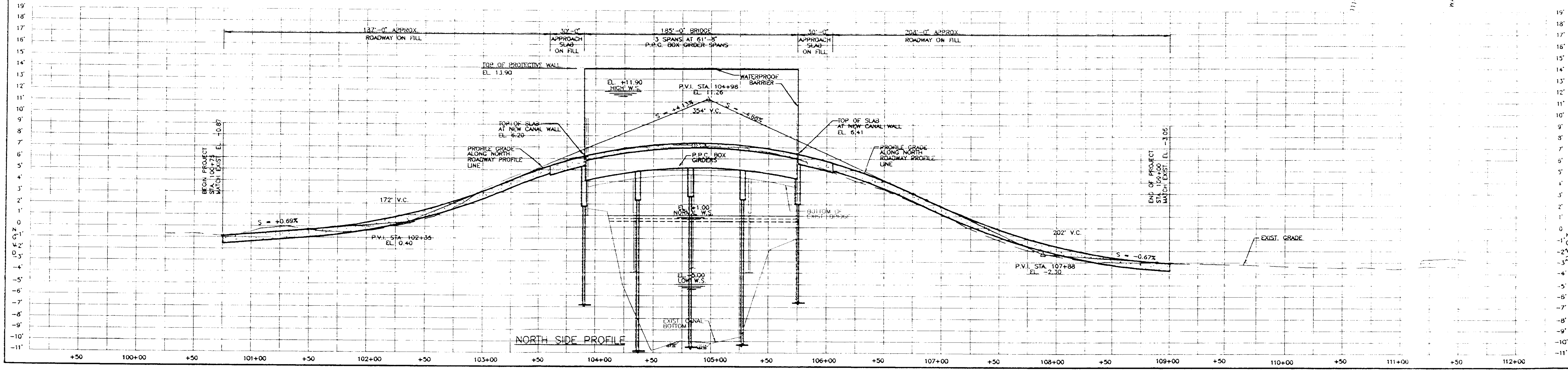
THIS SHEET: BRIDGE SECTIONS

DRAWN BY: T.B.F | CHECKED BY: | APPROVED BY: | CAD FILE NO.: 9260

PROJ. NO. 92-60
DATE 6/07/94
SHEET NO. PLATE 12
OF SHEETS



LEON C. SIMON BLVD.



LINFIELD, HUNTER & JUNIUS, INC.
CONSULTING ENGINEERS AND ARCHITECTS
3500 North Causeway Blvd. Suite 200
Metairie, Louisiana 70002

ORLEANS LEVEE DISTRICT
LONDON AVENUE OUTFALL CANAL
WAIVER STUDY REPORT

LEON C. SIMON BLVD. NEW SEALED BRIDGE

PLATE
13

TABLE VII
LEON C. SIMON BLVD BRIDGE
NEW SEALED BRIDGE OPTION
Maintain Existing Girder Bottom Elevation

ITEM DESCRIPTION	UNITS	QUANT	UNIT PRICE	TOTAL PRICE
Mobilization	LUMP SUM	1	50000	$50,000
Bridge Section				
Superstructure				
5" Top Slab (Class AA Concrete)	CU YD	225	450	$101,250
10" Sidewalk (Class AA Concrete)	CU YD	75	350	$26,250
Floodwall Barrier (Class AA Concrete)	CU YD	100	750	$75,000
Median Barrier (Jersey Type)	LIN FEET	250	35	$8,750
Substructure				
Box Girders	CU YD	1050	700	$735,000
Abutments at Wall				
Class A Concrete	CU YD	150	600	$90,000
24" PPC Piles	LIN FEET	3300	55	$181,500
Sheet Piles	SQ FEET	3800	14	$53,200
Excavation	CU YD	121	12	$1,452
Temp Sheeting and Dewatering	LUMP SUM	1	50000	$50,000
Intermediate Bent				
Class A Concrete	CU YD	100	700	$70,000
24" PPC Piles	LIN FEET	3600	55	$198,000
Approach Slab				
Deck (Class AA Concrete)	CU YD	200	450	$90,000
Sidewalk (Class AA Concrete)	CU YD	20	350	$7,000
Sidewalk Barrier	LIN FEET	200	36	$7,200
Median Barrier	LIN FEET	100	35	$3,500
Roadway on Fill				
9" Concrete Pavement	SQ YD	6450	35	$225,750
8" Limestone Base	CU YD	1472	32	$47,104
Concrete Curb	LIN FEET	2934	8	$23,472
Excavation	CU YD	6622	10	$66,220
Bridge Demolition				
Deck	SQ YD	1800	100	$180,000
Substructure	CU YD	200	150	$30,000
Pull Piles	EACH	120	250	$30,000
Other Items				
Utility Modifications	LUMP SUM	1	50000	$50,000
Art Work	LUMP SUM	1	50000	$50,000
Miscellaneous	LUMP SUM	1	50000	$50,000
Tie into Floodwalls	LUMP SUM	1	60000	$60,000
Construction Cost				$2,560,648
Contingencies (15%)				$384,097
Total Construction Cost				$2,944,745

4. FLOODGATE ALTERNATIVE

The floodgate alternative consists of constructing four sliding steel gates (two gates each side) across each end of the bridge. The gates are approximately 8.5 feet tall and 35 feet long. There will be a removable column in the roadway median where the gates meet when closed. The gates will be hidden behind a concrete floodwall when open. There is ample existing right-of-way for construction of the floodgates. However, approximately 38 feet of floodwall will be required at each quadrant of the bridge to support and hide the gate in the open position.

a. ADVANTAGES

The primary advantages to the floodgate alternative are:

- Lowest cost flood protection alternative.
- Least disturbance to nearby residents.
- Least disturbance to residents and traffic while under construction.
- The gates will be hidden behind the floodwalls until needed.
- This alternative does not impact the canal hydraulic characteristics since the existing bridge is not changed.
- Does not change view of canal from the bridge.

b. DISADVANTAGES

The primary disadvantage of the floodgate alternative are:

- The bridge will be closed to traffic during times of high water.
- Vehicular site distances and live load capacity for the bridge will remain substandard.

c. COSTS

The engineers opinion of probable construction costs for the floodgate alternative are tabulated in Table VIII. The approximate cost of the floodgate alternative is $1.22 million.

TABLE VIII
LEON C. SIMON BRIDGE
FLOODGATE OPTION

ITEM DESCRIPTION	UNITS	QUANT	UNIT PRICE	TOTAL PRICE
Mobilization	LUMP SUM	1	25000	$25,000
Foundation				
Excavation	CU YD	640	12	$7,680
Piles (16" Sq PPC)	LIN FEET	4560	27	$123,120
Sheet Piling	SQ FEET	180	14	$2,520
Concrete Sill/Ftg (Class A Concrete)	CY YD	300	600	$180,000
Tracks	LIN FEET	320	25	$8,000
Walls				
Concrete Walls (Class AA Concrete)	CU YD	75	600	$45,000
Center Post	LUMP SUM	1	75000	$75,000
Gate				
A36 Steel	LBS	181000	3	$543,000
Seals-Neoprene	LUMP SUM	1	8000	$8,000
Rollers, Locks, Inserts	LUMP SUM	1	25000	$25,000
Other Items				
Utility Modifications	LUMP SUM	1	25000	$25,000
Miscellaneous	LUMP SUM	1	20000	$20,000
Construction Cost				$1,062,320
Contingencies (15%)				$159,348
Total Construction Cost				$1,221,668

D. COMPARISON OF ALTERNATIVES (Leon C. Simon Bridge)

The following comparison of the advantages, disadvantages and determinants is presented to aid in the evaluation of the modification alternatives. Of the three alternatives studied, one alternative utilizes the existing bridge structure and forces water under the bridge; one alternative raises the bridges and improves the hydraulic characteristics of the canal, and the final alternative closes the bridges to traffic and allows water to flow over the bridge structure.

The new sealed bridge alternative provides the required flood protection for the least cost, but does not allow a view of the canal.

The sealed existing bridge alternative is more expensive than building a new sealed bridge and is not desirable because additional bents are required in the canal.

The raised bridge alternative provides the best hydraulic improvements to the canal, improves the alignment and vehicular sight distances, and allows an improved view of the canal. The disturbance to the neighborhood is slightly greater than for the sealed bridge alternative. Figure No. 4 shows a graphical comparison of the flow areas for the different alternatives at the Leon C. Simon site.

The floodgate alternative is the least costly but does not allow use of the bridge at times of high water. The hydraulic characteristics of the canal are unchanged, and the site distances at the bridge will remain sub-standard. Orleans Levee District personnel will be required to close the gates during the approach of a hurricane.

Table IX presents a tabulation of determinants for the Leon C. Simon flood protection alternatives.

The costs for each alternative are summarized below.

ALTERNATIVE	SEAL EXISTING BRIDGE	RAISED BRIDGE	NEW SEALED BRIDGE	FLOODGATES
COSTS (MILLIONS)	$2.50	$3.63	$2.95	$1.22

TABLE IX
LEON C. SIMON BRIDGE MODIFICATION ALTERNATIVES
SUMMARY OF DETERMINANTS

DETERMINANTS	EXIST. BRIDGE	SEALED BRIDGE EXISTING AND NEW		RAISED BRIDGE	FLOODGATE	REMARKS
MAJOR DETERMINANTS		EXISTING	NEW			
1. PROJECT COST RATIO		2.21	1.70	2.71	1.0	FLOODGATES=I.0
2. HYDRAULIC CHARACTERISTICS						
W.S. ELEV.2.25**	0.98	0.93		0.97	0.98	% OF UNOBSTRUCTED
W.S. ELEV. 11.90	0.63	0.53		0.72		% OF UNOBSTRUCTED
3. NEIGHBORHOOD DISRUPTION		MINOR		MINOR	NONE	
4. TRAFFIC CONDITION AT HIGH WATE	CLOSED	OPEN		OPEN	CLOSED	
5. APPEARANCE	FAIR	FAIR		GOOD	FAIR	
MINOR DETERMINANTS						
A. TRAFFIC DISRUPTION		CLOSED*		CLOSED*	SOME*	
B. NEIGHBORHOOD DISTURBANCE		LITTLE*		LARGE	LITTLE*	
C. CONSTRUCTION DIFFICULTY		SOME		LITTLE	SOME	
D. DESIGN COMPLEXITY		MOST		LITTLE	LITTLE	
E. MAINTENANCE COST		MINOR		LEAST	MOST	
F. OLB PERSONNEL AT STORM		NONE		NONE	REQUIRED	
G. EXISTING BRIDGES		UTILIZE	REMOVE	REMOVE	UTILIZE	

*DURING CONSTRUCTION
**ELEVATIONS ARE IN FEET-N.G.V.D.

9260

VIII. RECOMMENDATIONS

Based on the engineering analysis conducted in the preparation of this Supplemental Design Memorandum, the following recommendations are made to provide flood protection at the Leon C. Simon and Gentilly Boulevard Bridge crossings of the London Avenue Outfall Canal.

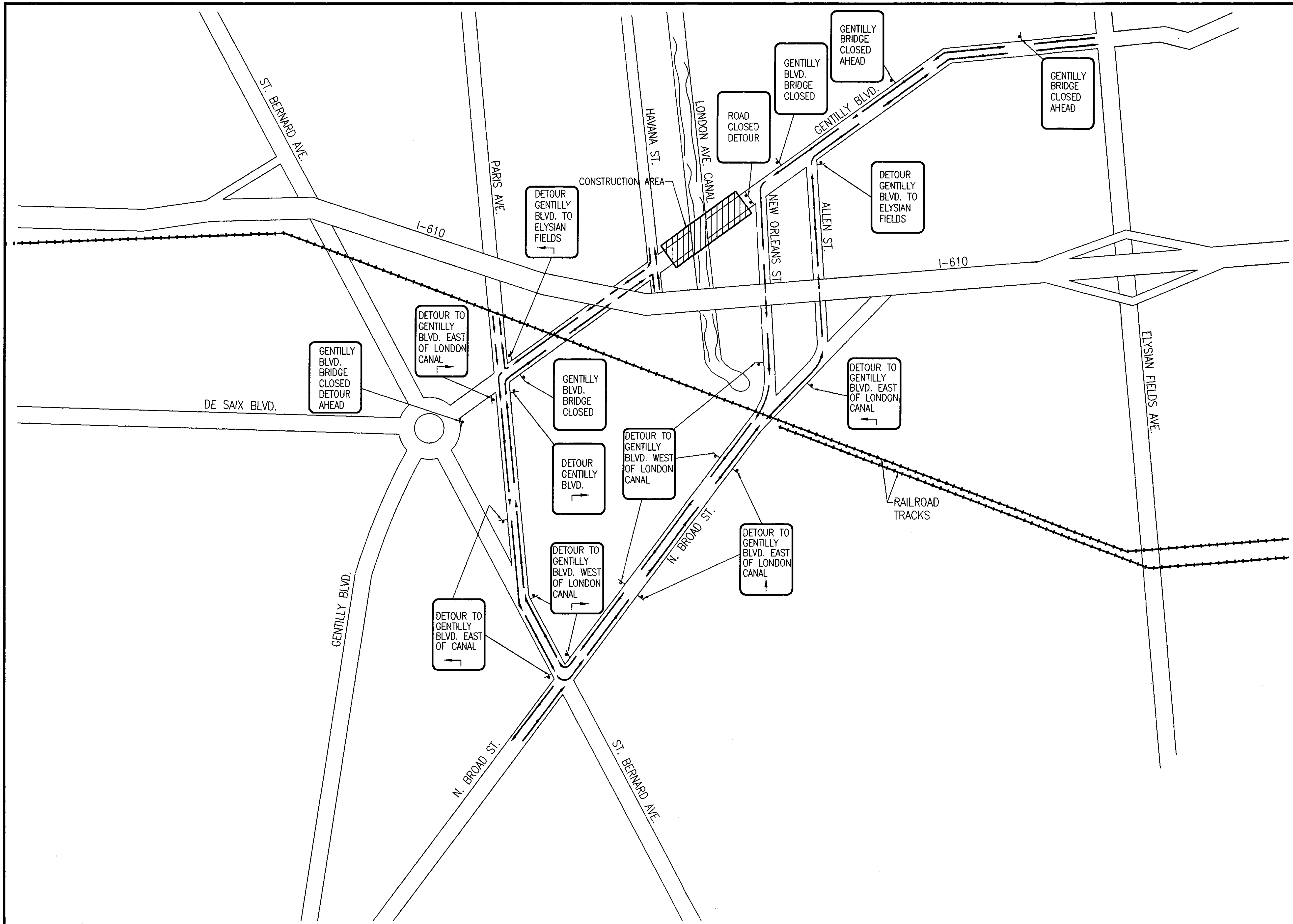
A. Gentilly Boulevard Bridge Crossing

We recommend the existing Gentilly Boulevard Bridge be removed and replaced with a sealed concrete bridge consisting of precast-prestressed girders and a cast-in-place concrete deck. Design waivers must be obtained for reduced design speed and other parameters as determined by the Waiver Study Supplement to this report dated October 31, 1995. Figure No. 1 shows a computer enhance photograph of the Gentilly Boulevard site with the recommended sealed bridge. We recommend that the bridge barrier walls and adjacent floodwalls be artistically treated by an artist selected as outlined in "Guidelines for Aesthetic and Landscape Treatment, London Avenue Canal," by Terra Designs, Inc. The engineers opinion of construction costs for the new sealed bridge is approximately $2.81 million.

It is anticipated that Gentilly Boulevard will be completely closed during construction of the new bridge. Sufficient right-of-way does not exist for a temporary detour bridge. Plate No. 14 shows a proposed detour route for traffic using Gentilly Boulevard.

The possibility of constructing the new bridges such that one lane of traffic would remain open during construction was considered. It was determined that the cost to do this will be approximately 1.5 times more than closing the bridge and constructing it all at once. Also, it was determined that the time of construction will be approximately doubled.

The Gentilly Boulevard Bridge site is congested with no open space for staging materials or construction equipment. The closest staging area which may be available to the contractor is under the I-610 bridge, approximately 400 feet south of the bridge site.



LINFIELD, HUNTER & JUNIUS, INC.
CONSULTING ENGINEERS AND ARCHITECTS
3500 North Causeway Blvd, Suite 200
Metairie, Louisiana 70002

SEAL

REV. NO.	DATE

ORLEANS LEVEE DISTRICT
LONDON AVENUE OUTFALL CANAL
BRIDGE REMEDIATION SUPPLIMENTAL DESIGN MEMORANDUM

THIS SHEET
GENTILLY BLVD. DETOUR PLAN

DRAWN BY	CHECKED BY	APPROVED BY	CAD FILE NO.
T.F.B	S.G.J.	A.F.G.	9260

PROJ. NO. 92-60
DATE 6/07/94
SHEET NO.
PLATE NO.
14
OF SHEETS

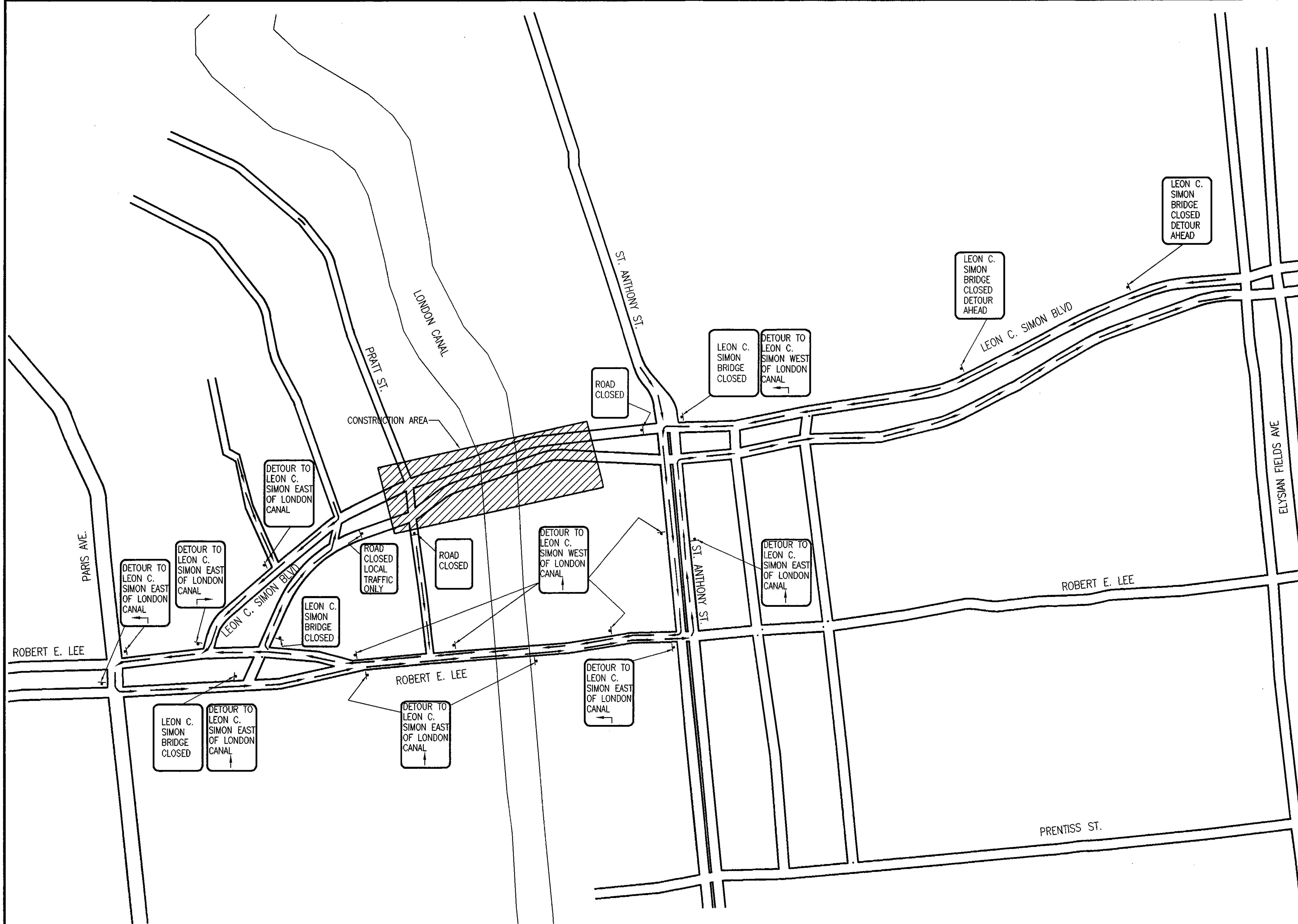
B. **<u>Leon C. Simon Boulevard Bridge Crossing.</u>**

We recommend that a new Sealed Bridge be constructed at the existing bridge elevation at the Leon C. Simon Boulevard site provided. Design waivers must be obtained for reduced design speed and other parameters as determined by the Waiver Study Supplement to this report dated October 31, 1995. The new Sealed Bridge will provide the required flood protection for the least cost of the bridge replacement alternatives studied and will have the least impact on the neighborhood. We also recommend that the barrier walls of the sealed bridge be full height concrete and incorporated some artistic treatment to help mitigate the aesthetical concerns of the neighborhood. The approximate cost for a new Sealed Bridge at Leon C. Simon Boulevard is $2.95 million.

The above cost assumes that Leon C. Simon Boulevard will be completely closed during construction. Traffic using Leon C. Simon Boulevard would be diverted to the nearby Robert E. Lee Boulevard bridge as shown on Plate No. 15. Coordination of construction contracts for these bridges will be conducted by the Orleans Levee District.

The costs for keeping the existing bridge in partial operation during construction of the new bridge is considered to be prohibitively expensive as a temporary detour bridge would add significant costs to the project.

The Leon C. Simon Boulevard bridge site has several open areas parallel to the levees which can be used by the contractor to stage his construction.



LINFIELD, HUNTER & JUNIUS, INC.
CONSULTING ENGINEERS AND ARCHITECTS
3500 North Causeway Blvd. Suite 200
Metairie, Louisiana 70002

SEAL

REV. NO.	DATE

ORLEANS LEVEE DISTRICT
LONDON AVENUE OUTFALL CANAL
BRIDGE REMEDIATION SUPPLIMENTAL DESIGN MEMORANDUM

THIS SHEET
LEON C. SIMON BRIDGE DETOUR PLAN

DRAWN BY | CHECKED BY | APPROVED BY | CAD FILE NO. 9260

PROJ. NO. 9260
DATE 6-07-94
SHEET NO.
PLATE NO. 15
OF SHEETS

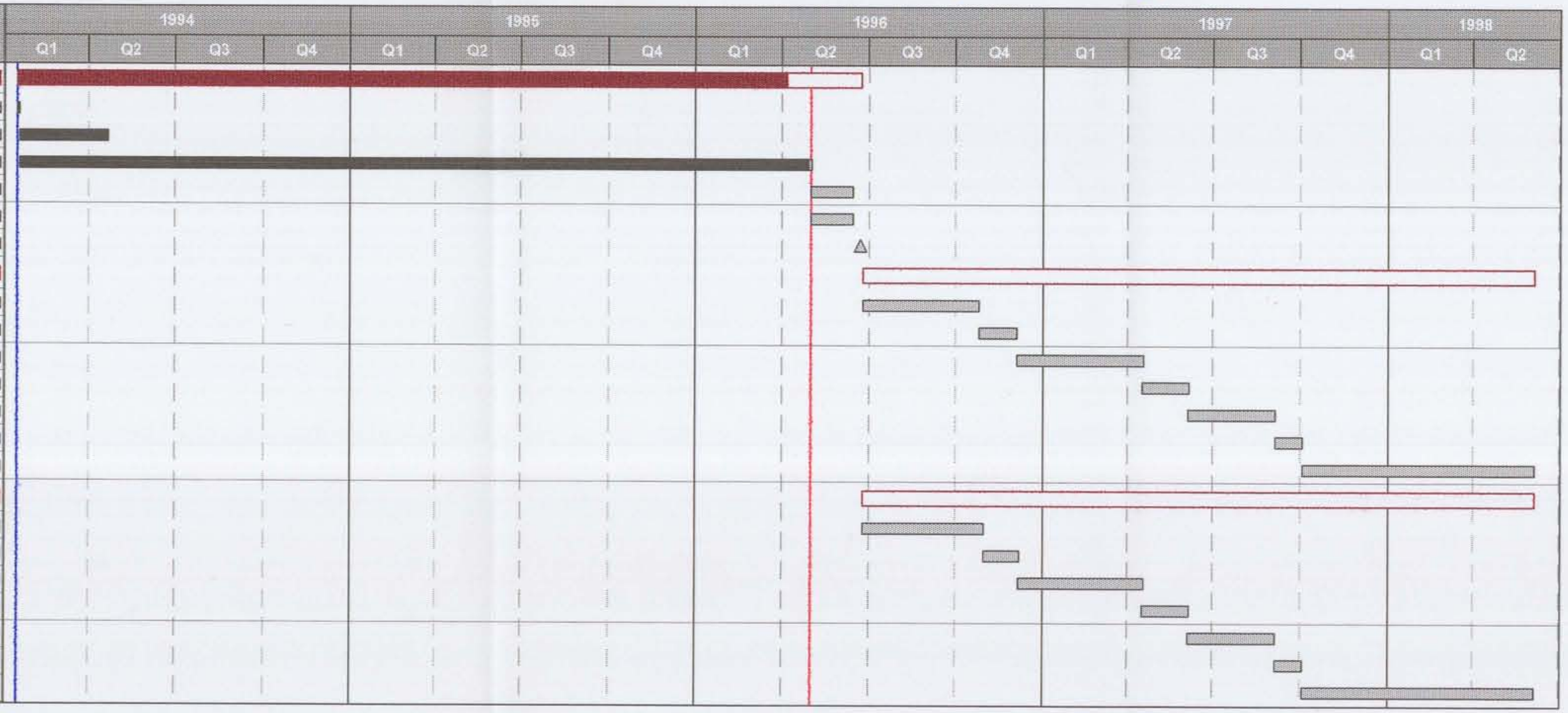
IX. SCHEDULE OF CONSTRUCTION AND DESIGN

The Schedule of Construction and Design presents a logical sequence of construction and time frame for accomplishing the recommended bridge modification alternatives. The actual dates of construction will require coordination with the construction of the other bridges and floodwalls along the London Avenue Canal.

Preliminary and final design of the construction plans, preparation of contract documents, advertising for and receipt of bids and awarding of construction contracts for the two bridges is anticipated to require thirteen (13) months. Construction work is anticipated to require approximately eight (8) months for each bridge. (See Figure 5).

Figure 3
Project Schedule
London Ave. Outfall Modifications to Leon C. Simon & Gentilly Ave. Bridges

Task Name	Start Date	End Date	Effort	Effort To Go
Study and Select Alternatives	**1/14/94**	**6/21/96**	**708d**	**31d**
Authorization & Agreement	1/14/94	1/14/94	1d	0d
Field Surveys	1/17/94	4/19/94	66d	0d
Supplemental Design Memoranda	1/17/94	4/30/96	581d	0d
Review and approval by OLB	5/1/96	6/12/96	30d	30d
Review/Approval Other Agencies	5/1/96	6/12/96	30d	30d
Notice to Proceed	6/21/96	6/21/96	0d	0d
Gentilly Blvd. Bridge	**6/24/96**	**6/3/98**	**492d**	**492d**
Preliminary Design	6/24/96	10/24/96	87d	87d
Review & Approval of Preliminary Design	10/25/96	12/3/96	26d	26d
Final Design & Specifications	12/4/96	4/16/97	93d	93d
Review & Approval of Final Design	4/17/97	6/3/97	33d	33d
Advertise for and Recieve Bids	6/4/97	9/3/97	64d	64d
Review Bids & Award Contract	9/4/97	10/2/97	21d	21d
Construct Gentilly Blvd. Bridge	10/3/97	6/3/98	168d	168d
Leon C. Simon Bridge	**6/24/96**	**6/3/98**	**492d**	**492d**
Preliminary Design	6/24/96	10/29/96	90d	90d
Review & Approval of Preliminary Design	10/30/96	12/5/96	25d	25d
Final Design & Specifications	12/6/96	4/16/97	91d	91d
Review & Approval of Final Design	4/17/97	6/3/97	33d	33d
Advertise for & Recieve Bids	6/4/97	9/3/97	64d	64d
Review Bids &Award Contract	9/4/97	10/2/97	21d	21d
Construct Leon C. Simon Bridge	10/3/97	6/3/98	168d	168d



Printed: 5/1/96
Page 1

Milestone △ Summary
Fixed Delay Slack

X. ADDITIONAL INFORMATION REQUIRED

Additional topographic survey information approximately 300 feet west of Pratt Street and 500 feet east of Waldo Drive is required for raised bridge alternative in order to design the tie-in to the existing street. Also required will be the as-built locations and elevations of the new floodwalls and levees recently completed and tie-in information to the Corps of Engineers base line for the floodwalls.

APPENDIX A

III. PRESTRESSED GIRDER DESIGN

PURPOSE:

1.) TO DETERMINE IF 21" X 52.5" P.P.C GIRDERS ARE ADEQUATE FOR DEAD LOAD & HS-20 TRUCK LOADING. THIS INCLUDES FLEXURE, SHEAR & DEFLECTION ANALYSIS. ADEQUACY FOR UPLIFT IS ALSO ANALYZED

2.) CALCULATE THE COMPRESSIVE STRESSES THAT RESULT FROM THE COMBINATION OF PRESTRESSING & UPLIFT.

TABLE OF CONTENTS

DESIGN CRITERIA

- PRESTRESSED GIRDER SPANS OF 41'. 3 SPANS TREATED AS SIMPLE SPANS. ELEV. = 4.2' @ TOP OF SLAB TOP OF WALL = 14.4'

- DESIGN FOR HS-20 TRUCK LOADING OR LANE LOADING, WHICHEVER GOVERNS. (AASHTO). ALSO 12 PSF FOR FUTURE OVERLAY

LOADING CONSIDERATIONS

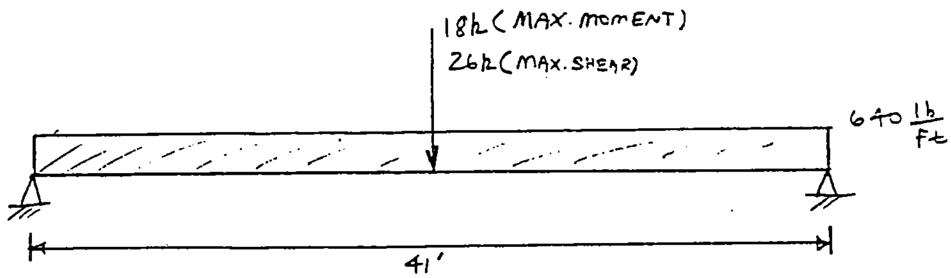
- DESIGN LOADING COMBINATIONS

  LL W/ IMPACT + DEAD

  BUOYANCY + DEAD (UPLIFT)

- LIVE LOADS

  1) LANE LOADING



MAX MOMENT = $(.640)(41')^2/8 + \frac{18(41')}{4} = 319$ Ft·k

MAX. SHEAR = $.640(41')/2 + 26/2 = 26.1$k

2) TRUCK LOADING Refer to APPENDIX A p. 643. AASHTO

MAX MOMENT = <u>467.6 Ft·k / LANE</u> = $18L + \frac{392}{L} - 280$

SHEAR = <u>55.6k / LANE</u> = $72 - 672/L$

<u>TRUCK LOADING CONTROLS</u>

3) LOAD FACTORS

a) IMPACT = $\frac{50}{L+125} = \frac{50}{41+125} = .30$

b) AASHTO LL FACTORS = 1.3 * 1.67 (GROUP I LOADING)

4) ASSUME 2 GIRDERS PER LANE. THEREFORE DISTRIBUTE MAX. MOMENT & SHEAR BETWEEN 2 GIRDERS. DIVIDE BY 2.

5) LL DISTRIBUTION FACTOR

LOAD FRACTION = S/D

$S = 4.375' =$ WIDTH OF GIRDER
$C = K(W/L) = 0.7(87.5'/41') = 1.49$

$D = (5.75 - 0.5N_L) + 0.7N_L(1 - 0.2C)^2$

$D = (5.75 - (.5*4)) + 0.7(4)(1 - (0.2*1.49))^2$

$D = 5.13$

$S/D = 4.375'/5.13 = .85$

IF 6 LANES DF = .91

6.) DESIGN LIVE LOADS

a.) INTERIOR

$M_{L+I} = 467.6\ \text{ft·k} * 1.3 * .85 * \frac{1}{2} = 258.3\ \text{ft·k}$ (276.5) (1.3 = IMPACT)

FACTORED $M_{L+I} = 258.3\ \text{ft·k} * 1.3 * 1.67 = 560.8\ \text{ft·k}$ (601 ft·k)

NOTE: DF = .91 WAS USED TO CALCULATE LOADS IN PARENTHESES.

$V_{L+I} = 55.6k * 1.3 * .85 * \frac{1}{2} = 30.7k$ (33.2) (1.3 = IMPACT)

FACTORED $V_{L+I} = 30.7 * 1.3 * 1.67 = 66.6k$ (72k)

b.) EXTERIOR

SIDEWALK LL = 60 psf * 4.375' = 262.5 lb/ft

$M_{LL} = .263(41)^2/8 = 55.3\ \text{ft·k}$

FACTORED $M_{LL} = 1.3 * 1.67 * 55.3 = 120\ \text{ft·k}$ NOTE: 152 ft·k WAS USED IN CALCULATIONS

$V_L = 262.5\frac{\text{lb}}{\text{ft}} * \frac{41'}{2} = 5.38k$

FACTORED $V_L = 1.3 * 1.67 * 5.38k = 11.7k$ NOTE: 14.7k WAS USED IN CALC.

- DEAD LOADS (LOAD FACTOR = 1.3) GROUP I AASHTO

1.) INTERIOR GIRDERS

DL = ASPHALT + SLAB + WT. GIRDER + BARRIER

$DL = (12 psF * 4.375) + (62.5 psF * 4.375') + (262.5 psF * 4.375') + 202$ lb/Ft

$DL = 52.5$ lb/Ft $+ 273.4$ lb/Ft $+ 1148$ lb/Ft $+ 202$ lb/Ft

$DL = 1675.9$ lb/Ft

$M_{DL} = 1675.9 (41^2)/8 = \underline{352.1 \text{ Ft}\cdot k}$

FACTORED MOMENT = $\underline{458 \text{ Ft}\cdot k}$

$V_{DL} = 1675.9 * \frac{41'}{2} = \underline{34.4 k}$

FACTORED $V_{DL} = \underline{45k}$

2) EXTERIOR GIRDERS

DL = SLAB + GIRDER + SIDEWALK + WALL

SIDEWALK = $150 \frac{lb}{Ft^3} * \left(\frac{10''}{12}\right) * 4.375' = 546.9$ lb/Ft

WALL = $150 \frac{lb}{Ft^3} * (13.9 - 4.20 - 1') * 1' = 1330.5$ lb/Ft

$DL = 273.4$ lb/Ft $+ 1148$ lb/Ft $+ 546.9$ lb/Ft $+ 1400.5$ lb/Ft $= 3372$ lb/Ft

$M_{DL} = 3373 (41^2)/2 = \underline{709 \text{ Ft}\cdot k}$ (745)

FACTORED $M_{DL} = \underline{922 \text{ Ft}\cdot k}$ (969)

$V_{DL} = \underline{69.1 k}$ (73)

FACTORED $V_{DL} = 1.3 * 69.1k = \underline{89.8k}$ (94.6)

THE ACTUAL DESIGN VALUES WERE SLIGHTLY HIGHER BECAUSE AN ELEV = 1.02' @ THE BOTTOM OF THE GIRDERS WAS TAKEN INTO ACCOUNT. THESE VALUES ARE IN PARENTHESES

– BUOYANCY (LOAD FACTOR = 1.3)

ASSUME WATER SURFACE ELEV = 13.9' = TOP OF WALL (WORSE CASE)

BOTTOM OF GIRDER = ELEV = 2.03'

DETERMINE NET UPLIFT

BUOYANT PRESSURE = $62.4 \frac{lb}{ft^3} \times (13.9' - 2.03') = 740.7$ psF

BUOYANCY ON GIRDER = 740.7 psF × 4.375' = 3240.5 lb/Ft ↑

DEAD LOAD DUE TO GIRDER + SLAB + (DISTRIBUTION OF WALL & SIDEWALK WEIGHT)

$DL = 1148 + 273 + \left(\frac{1330.5}{10}\right) + \left(\frac{546.9}{10}\right) = 1608.7$ lb/Ft ⇒ 367.3 psF

NET UPLIFT = 740.7 psF – 367.3 psF = 373.4 psF

MOMENT

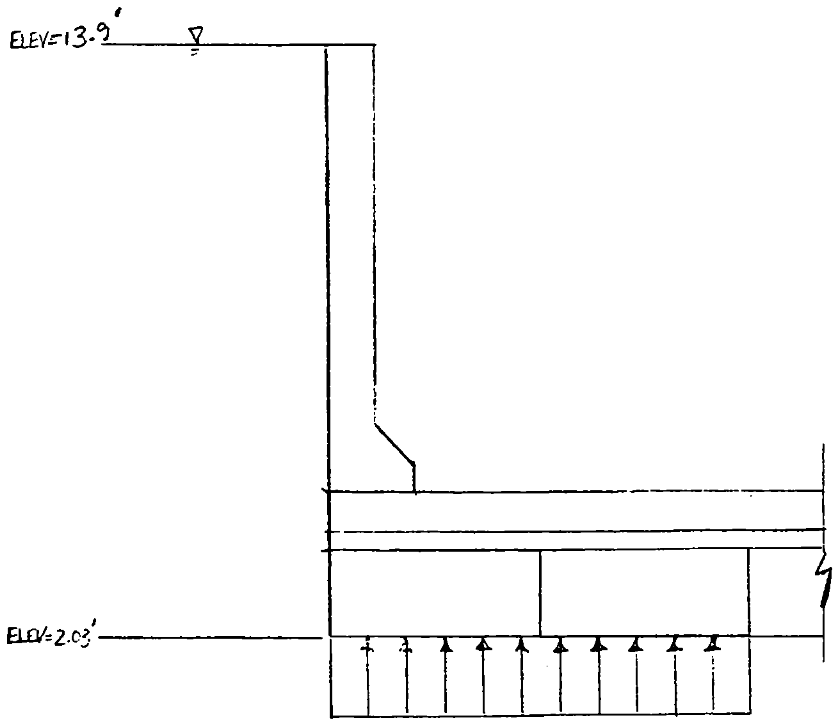
$M_{UPLIFT} = 1633.6(4.1^2)/2 = 343.3$ Ft·k

FACTORED M_{UPLIFT} = 1.3 × 343.3 Ft·k = 446.2 Ft·k

SHEAR

$V_{UPLIFT} = 1633.6$ lb/Ft × 41/2 = 33.5k

FACTORED V_{UPLIFT} = 1.3 × 33.5k = 43.5k



NET UPLIFT = 373.4 psF

JOB GENTILLY BRIDGE BY [illegible] DATE 7/12/94 JOB NUMBER 92-60
SHEET 4 OF

LINFIELD, HUNTER & JUNIUS, INC.
ENGINEERS AND ARCHITECTS

SUMMARY OF DESIGN LOADS

- INTERIOR GIRDERS

MOMENT:	SERVICE LOADS	FACTORED LOADS
M_{LL+I}	276.8	601
M_{DL}	352.9	459
M_{tot}	Σ = 629.7 ft·k	Σ = 1060 ft·k
SHEAR:	SERVICE	FACTORED
V_{LL+I}	33.2	72
V_{DL}	34.4	45
V_{TOT}	Σ = 67.6k	Σ = 117k

UPLIFT

M_{UPLIFT} = 343.3 ft·k

FACTORED M_{UPLIFT} = 446.2 ft·k

V_{UPLIFT} = 33.5k

FACTORED V_{UPLIFT} = 43.5k

- EXTERIOR GIRDERS

MOMENT:	SERVICE	FACTORED
M_{LL}	70	152
M_{DL}	745	969
M_{tot}	Σ = 815 ft·k	Σ = 1121 ft·k
SHEAR:	SERVICE	FACTORED
V_{LL}	6.8k	14.7k
V_{DL}	73k	94.6k
V_{TOT}	80k	109.3k

SHEAR DESIGN (Refer to p. 58: Naaman)

V_u = DESIGN LOAD = 117 k (INTERIOR GIRDERS CONTROL

- SHEAR STRENGTH PROVIDED BY CONCRETE

DESIGN SHEAR STRESS = $117k / 52.5" \times 23"$ = .097 ksi = v_u

WHEN $F_{pe} \geq .40 F_{pu}$ p. 205 (NAAMAN)

$V_c = 0.6\sqrt{f'_c} + 700 \frac{V_u d}{M_u}$ ← 1060 Ft·k FOR INTERIOR GIRDERS

$F_{pe} = F_{pi}$ − LOSSES

INITIAL TENSILE FORCE = 30980 lbs

f_{pi} = 30.98k / .153 in² = 202.5 ksi

LOSSES = 45 ksi p. 175 AASHTO

F_{pe} = 202.5 − 45 ksi = 157.5 ksi

158 > .40(270) = 108 ksi

$\therefore V_c = 0.6\sqrt{6000 \text{ psi}} + 700 \left(\frac{117k \times 23"}{1060 \text{ Ft}\cdot k \times 12} \right)$

V_c = 46.5 psi + 148

V_c = 194.5 psi > 97 ksi

USE #3 ☐ @ 9" SPACING $\frac{18"}{2}$

PRESTRESSED GIRDER DESIGN FOR GRAVITY LOADING

1.) Reduce AREA OF STEEL TENDONS TO MINIMUM REQ. (INCLUDE SLAB IN ANALYSIS)

2.) CHECK THE COMP. STRESS DUE TO PRESTRESSING

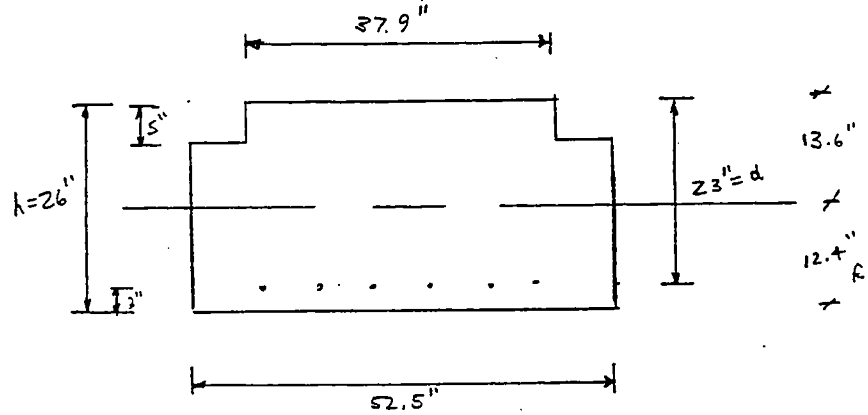
1.)

DESIGN MOMENT = 1170.5 FT·k (EXT. GIRDER CONTROLS)

f'_c SLAB = 3200 psi, N = 9 }
f'_c GIRDER = 6000 psi N = 6.5 } P. 101 (WANG) CONC TEXT.

USE $\frac{1}{2}$" ϕ GR 270 STRANDS
AREA PER STRAND = .153 in² (p. 29 Naaman)

TRANSFORM SLAB TO 6000 psi ⇒ $\frac{6.5}{9} \times 52.5" = 37.9"$



$\frac{1}{2}" = 1'$

RECTANGLE	AREA, in²	$\bar{y}$	$A\bar{y}$
①	189.5	2.5	473.8
②	1102.5	15.5	17088.8
	ΣA = 1292		ΣA$\bar{y}$ = 17562.6

$\bar{y} = 13.6"$

– DETERMINE AREA OF STRANDS REQ. (Refer to Ex. 1 p. 176 (Naaman))

Reinforcement index q

$$q(1 - 0.59q) = \frac{M_u}{\phi f'_c b d^2} = \frac{1170.5 \text{ ft·k} \times 12}{0.9(6)(52.5")(23")^2} = .094$$

$q \approx .10$

Total tensile force taken by prestressing steel.

$$F_N = (.10)(bd) f'_c = .10(52.5")(23")(6) = 724.5k$$

Req. A_{ps}

$$A_{ps_{req}} = \frac{bd\, f'_c}{F_{pu}}\left(1 - \sqrt{1 - \frac{2F_N}{bd\, f'_c}}\right) = \frac{(52.5")(23")(6)}{270\text{ ksi}}\left(1 - \sqrt{1 - \frac{2(724.5k)}{(52.5)(23")(6)}}\right)$$

$A_{ps_{req}} = 2.83 \text{ in}^2$ # STRANDS REQ = $\frac{2.83 \text{ in}^2}{.153 \text{ in}^2/\text{STR}}$ = 19 STRANDS

LINFIELD, HUNTER & JUNIUS, INC.
ENGINEERS AND ARCHITECTS

$A_{ps} = 2.9 in^2$

-TRY 19 STRANDS - CHECK FLEXURAL STRENGTH (Refer to p. 25-15 ACI 318-77)

1) App. f_{ps}

$$\omega_{pu} = \frac{A_{ps} f_{pu}}{b d f'_c} = \frac{(2.9 in^2)(270 ksi)}{(52.5'')(23'')(6)} = .11$$

f_{ps} = yield stress.

$$F_{ps} = F_{pu}(1 - 0.5 * \omega_{pu}) = 270 ksi (1 - 0.5(.11)) = 255 ksi$$

2) Reinforcement index, ω_p

$$\omega_p = \frac{A_{ps} F_p}{b d F'_c} = \frac{(2.9 in^2)(255 ksi)}{52.5''(23'')(6)} = .10$$

3) NOMINAL MOMENT STRENGTH

$$M_N = A_{ps} F_{ps}\left(d - .59 \frac{A_{ps} F_{ps}}{b F'_c}\right) = (2.9 in^2)(255 ksi)\left(23'' - .59\left(\frac{2.9 in^2 * 255}{52.5'' * 6}\right)\right)$$

$$M_N = 15984 in \cdot k = 1332 Ft \cdot k > 1120 Ft \cdot k = M_u \text{ OK.}$$

- LOWER STRANDS Don't use $\phi = .9$ to find Req A_{ps} $\phi = 1$ CH. 9 AASHTO

$$q(1 - .59q) = \frac{1120.5 Ft \cdot k * 12}{(6)(52.5'')(23'')^2} = .081$$

$q \approx 0.09$

$$F_N = (0.09)(52.5'')(23'')(6) = 652.1 k$$

$$A_{ps\,req} = \frac{(52.5'')(23)6^{ksi}}{270 ksi}\left(1 - \sqrt{1 - \frac{2(652.1)}{(52.5)(23)(6)}}\right) = 2.53 in^2$$

$$\# \text{ STRANDS REQ} = \frac{2.53 in^2}{.153} = 16.5 \text{ STRANDS} = 17 \text{ STRANDS}$$

$A_{ps} = 2.6 in^2$ 17 STRANDS

CHECK STRENGTH

$$\omega_{pu} = \frac{2.6(270 ksi)}{52.5(23)(6)} = .097$$

$$f_{ps} = 270(1 - 0.5 * .097) = 256.9 ksi$$

$a = \frac{2.6(256.9)}{.85(52.5)(2.3)(6)} = .092$

NOMINAL STRENGTH

$M_N = (2.6)(256.9)(23 - .59(\frac{(2.6 \times 256.9)}{52.5'' \times 6})) =$

$M_N = 14527 \text{ in}\cdot k = 1210.6 \text{ Ft}\cdot k > M_u = 1120.5 \text{ Ft}\cdot k$ OK.

USE 17 STRANDS $2.6 \text{ in}^2 = A_{ps}$ @ 3.09" CENTER TO CENTER.

2.) CHECK COMP. STRESS DUE TO PRESTRESSING (CHECK INTERIOR GIRDER BECAUSE IT CONTROLS WHERE UPLIFT IS OF A CONCERN)

STRESSES DUE TO PRESTRESSING AFTER LOSSES

ASSUME LOSSES = 45 ksi Table 9.16.2.2 P.175 AASHTO
INITIAL TENSILE LOAD APPLIED TO EACH STRAND = 30980 lbs Veterans Bridge

INITIAL PRESTRESS = $\frac{30980 \text{ lbs}}{.153 \text{ in}^2} = 202.5 \text{ ksi} = f_{pi}$

f_{pe} = eff. prestress = 202.5 ksi − 45 ksi = 158 ksi

P_{eff} = 158 ksi × 2.6 in² = 410.8 k

P_{eff} acts as a comp. Force on the TRANS SECT. After PRESTRESS LOSSES.

f_{c_1} = AXIAL STRESS DUE TO P_{eff} = $\frac{P_{eff}}{A_g + (N-1)A_{ps}}$ (REFER TO p. 942 WANG CONC. TEXT)

$A_g = 52.5''(21'') + (37.9'' \times 5'') = 1292 \text{ in}^2$

$N = 6.5$ FOR $f'_c = 6000$ psi
$A_{ps} = 2.6 \text{ in}^2$

$f_{c_1} = \frac{410.8 k}{1292 \text{ in}^2 + (5.5)(2.6)} = .314 \text{ ksi} = $ 314 psi BOTTOM

MOMENT DUE TO P_{eff} = 410.8 k (12.4" − 3") = 3861.5 in·k = 321.8 Ft·k

IN ORDER TO CALCULATE THE BENDING STRESS
DUE TO PRESTRESSING, I_{eff} MUST FIRST BE CALCULATED.

CHECK IF SECTION IS CRACKED P. 25-25 ACI 318-77 Eq. 25.5

1) $F_r = 7.5\sqrt{6000} = 580.9\,psi$

2) $M_{cr} = Pe + \frac{I_g}{y_b}\left(\frac{P}{A_g} + F_r\right)$

$P = A_{ps} f_{pe} = (2.6\,in^2)(158\,ksi) = 410.8\,k$

$I_{g\,SLAB} = \frac{1}{12}(37.9'')(5'')^3 = 394.8\,in^4$

$I_{g\,GIRDER} = \frac{1}{12}(52.5'')(21'')^3 = 40516.9\,in^4$

$I_{tot} = [394.8\,in^4 + (189.5\,in^2)(11.1'')^2] + [40516.9\,in^4 + (1102.5\,in^2)(1.9'')^2]$

$I_{tot} = 23743\,in^4 + 44497\,in^4 = 68240\,in^4$

$e = 12.4'' - 3'' = 9.4''$

$M_{cr} = 410.8\,k\,(9.4'') + \left(\frac{68240\,in^4}{12.4''}\right)\left(\frac{410.8\,k}{1292\,in^2} + .581\,ksi\right)$

$M_{cr} = 8809\,in\cdot k = 734\,ft\cdot k$

SERVICE LOAD ON INTERIOR GIRDERS = 629.7 ft·k $< M_{cr}$ ∴ USE $I_E = I_g$.

F_{c2} = COMP. BENDING STRESS = $\frac{(321.8\,ft\cdot k \times 12)(12.4'')}{68240\,in^4}$ = <u>702 psi</u> BOTTOM

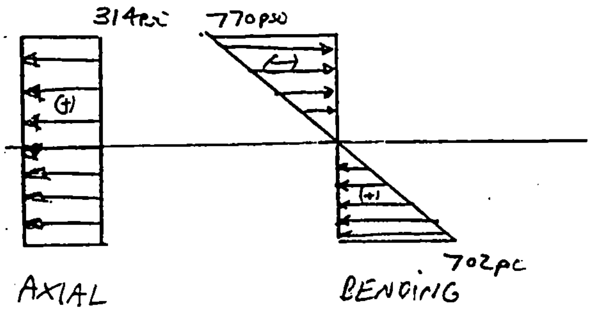
F_c = TOTAL COMP STRESS DUE TO PRESTRESSING AFTER LOSSES = 702 + 314 = <u>1016 psi</u>

LIMIT FOR COMP STRESS = $.40 f'_c = .4(6) = 2400\,psi$ p. 171 AASHTO Sec. 9.15.2.2

2400 − 1016 psi = 1384 psi IS ALLOWED FOR UPLIFT COMP. STRESS.

TENSILE BENDING STRESS = $\frac{(321.8\,ft\cdot k \times 12)(13.6'')}{68240\,in^4}$ = <u>770 psi</u>

STRESS DIAGRAM AFTER LOSSES (+) = COMP
(−) = TENSION



CHECK DEFLECTION OF GIRDER USE SERVICE LOADS + IMPACT.

LIVE LOAD DEFLECTION OF INTERIOR GIRDERS WILL CONTROL

$M_{L+I} = 276.8 \text{ Ft}\cdot k$ $\quad w_{L+I} = \frac{276.8 \times 8}{41^2} = 1.32 \frac{k}{Ft}$ see p. 1 of PRESTRESSED DESIGN

LONG TERM Δ OF EXT. GIRDERS CONTROLS

$M_D = 745 \text{ Ft}\cdot k$ $\quad W_D = \frac{745 \times 8}{41^2} = 3.55 \frac{k}{Ft}$

$M_L = 70 \text{ Ft}\cdot k$ $\quad w_L = .33 k/Ft$

1.) IMMEDIATE LL Δ OF INT. GIRDERS

USE $I_e = I_g$ because TOTAL SERVICE LOAD FOR INT. GIRDERS = 629.7 < M_{cr} = 734

$I_e = 68240 \text{ in}^4$

$\Delta_{LL+I} = \frac{5 w l^4}{384 E_c I_e} = \frac{5(1.33 k/Ft \times \frac{1}{12} \times 1000)(492'')^4}{384(4.42 \times 10^6 psi)(68240 in^4)}$

$E_c = 57000\sqrt{6000} = 4.42 \times 10^6 psi$

$\Delta_{LL+I} = .28'' < \frac{492}{800} = .62''$ O.K.

JOB GENTILLY BRIDGE BY R.W.P DATE 7/8/94 JOB NUMBER 92-6..
SHEET 11 OF

LINFIELD, HUNTER & JUNIUS, INC.
ENGINEERS AND ARCHITECTS

2) IMMEDIATE DL & LL DEFLECTIONS FOR EXTERIOR GIRDERS.

SERVICE LOAD = 815 Ft·k > M_{cr} = 734 Ft·k ∴ FIND I_e.

$$I_e = \left(\frac{M_{cr}}{M_{max}}\right)^3 I_g + \left[1 - \left(\frac{M_{cr}}{M_{max}}\right)^3\right] I_{CR} \quad \text{p. 3-68 PCI}$$

$$I_{CR} = n A_{ps} d^2 (1 - \sqrt{e})$$

$N = 6.5$
$A_{ps} = 2.6 \text{ in}^2$
$d = 23''$
$e = \frac{2.6 \text{ in}^2}{52.5'' \times 23''} = .0022$

$$I_{CR} = 6.5 (2.6 \text{ in}^2)(23'')^2 (1 - \sqrt{.0022})$$

$$I_{CR} = 8520.8 \text{ in}^4$$

$$I_e = \left(\frac{734 \text{ Ft·k}}{815 \text{ Ft·k}}\right)^3 (68240 \text{ in}^4) + \left[1 - \left(\frac{734}{815}\right)^3\right] 8520.8$$

$$I_e = 49848.8 + 2296.4 = 52145 \text{ in}^4$$

$\underline{\Delta_{DL}}$

$\omega_{DL} = 3.55 \text{ k/ft}$

$$\Delta_{DL} = 5(3.55 \text{ k/ft} \times 1000 \times \tfrac{1}{12})(492'')^4 \Big/ 384(4.42 \times 10^6 \text{ psi})(52145 \text{ in}^4)$$

$\Delta_{DL} = .98''$

$\underline{\Delta_{LL}}$ $\omega_{LL} = .33 \text{ k/ft}$

$$\Delta_{LL} = 5(.33 \times 1000 \times \tfrac{1}{12})(492'')^4 \Big/ 384(4.42 \times 10^6)(52145)$$

$\Delta_{LL} = .09''$

3) IMMEDIATE CAMBER DUE TO PRESTRESSING (EQ. 7.4 p. 7-19 ACI 312-77)

$\Delta_P = -P_o e \ell^2 / 8 E_c I_g$

P_o = INITIAL PRESTRESSING FORCE = $\frac{30980 lb}{.153 in^2} * 2.6 in^2 = 526.5k$

$\Delta_P = -526.5k(9.4'')(492'')^2 / 8 * 4.42\times10^6 psi * 68240 in^4$

$\Delta_P = -.50''$

4) LONG TERM CAMBER

$\Delta_{PL} = -.50''\left[\left(1 - \frac{P_1}{2P_o}\right)\left(C_t - \frac{P_1}{P_o}\right)\right]$

$P_1 = 45 ksi * 2.6 in^2 = 117k$

$C_t = 2.0$

$\Delta_{PL} = -.50''\left[\left(1 - \frac{117}{2 * 526.5}\right)\left(2 - \frac{117}{526.5}\right)\right]$

$\Delta_{PL} = -.50''[(.889)(1.78)]$

$\Delta_{PL} = -.79''$

5) LONG TERM DEFLECTIONS

$\Delta_{LT} = \Delta_L + \Delta_{PL} + \lambda \Delta_{DL}$

$\lambda = 2.0$ = MULTIPLYING FACTOR TO ESTIMATE LONG TERM DL DEFLECTION (p. 7-5 ACI-77)

$\Delta_{LT} = .09'' + -.79'' + 2(.98'') = 1.26''$ ← CONTROLS

$\Delta_{LT} = -.79'' + 2(.98'') = 1.17''$

CHECK LIMITS FOR LONG TERM DEFLECTION

$1.03'' = \frac{492''}{480} < 1.26'' < \frac{492''}{240} = 2.05''$ OK

DESIGN OF GIRDERS FOR UPLIFT

- DESIGN LOADS (FROM DRF)

$DL = 1606.9\ lb/Ft \downarrow$

BOUYANT PRESSURE = 740.7 psF (ASSUME WATERSURFACE @ Elev = 13.9')

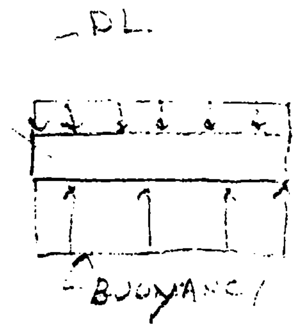
UNIFORM BOUYANCY ON GIRDER = 3240.5 lb/Ft ↑

NET UPLIFT = 1633.6 lb/Ft ↑

$V_{UPLIFT} = 43.5\,k$

$M_{UPLIFT} = 1633.6\ lb/Ft \frac{(41')^2}{2} = 343.3\ Ft{\cdot}k$

FACTORED MOMENT $343.3 \times 1.3 = 446.2\ Ft{\cdot}k$

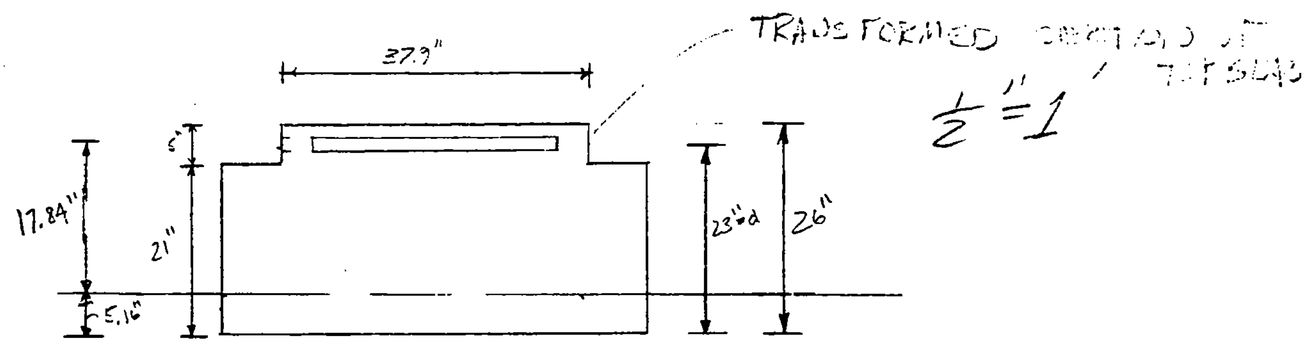


TOP SLAB STEEL TO RESIST TENSION

- DESIGN PARAMETERS

$f'_c = 6000\ psi$ $f_y = 60\ ksi$ $\phi = .90$ p. 144 AASHTO

$M_u = 446.2\ Ft{\cdot}k$ USE Rebar Ultimate STRENGTH METHOD



- Determine $A_{req.}$

$$m = \frac{F_y}{.75 f'_c} = \frac{60\ ksi}{.75\,(6)} = 13.33$$

$$\frac{M_N}{bd^2} = \frac{446.2\ Ft{\cdot}k \times 12}{(52.5")(22")^2} = .1928\ ksi = R_N$$

$$\rho_{req} = \frac{1}{13.33}\left(1-\sqrt{1-\frac{2(13.33)(.193)}{60}}\right) = .0033$$

$$A_{S req} = .0033\,(52.5'')(23'') = 3.97\ in^2$$

TRY 6-#9, $A_s = 6.0\ in^2$

Assume $d-\frac{a}{2} = .9d = 23 \times .9 = 20.7''$

$$a = \frac{A_s F_y}{b(.85 f'_c)} = \frac{A_s(60)}{52.5(.85)6} = 0.22$$

$$A_s = \frac{M_u(12)}{.9(60)\,d-\frac{a}{2}} = \frac{118.67}{d-\frac{a}{2}} = 5.19$$

$a = 1.14$

$d-\frac{a}{2} = 22.4$

$A_s = 5.23$

$a = 1.16$

$d-\frac{a}{2} = 22.42$

$A_s = 5.27$

– CHECK FLEXURAL STRENGTH

$$A_c = \frac{A_s F_y}{.75 f'_c} = \frac{(6.0\ in^2)(60\ ksi)}{.75\ (6\ ksi)} = 80\ in^2$$

$$a = \frac{80\ in^2}{52.5''} = 1.52''$$

$$a/2 = .76''$$

$\phi M_N = (.9)\,360k\,(23'' - .76'') = 7207\ in \cdot k = 540.5\ Ft \cdot k > M_u = 533.8\ Ft \cdot k$ OK

USE 6-#9 bars, $A_s = 6.0\ in^2$

DETERMINE STRESSES DUE TO UPLIFT

– FIND CENTROID OF TRANSFORMED SECTION

$A_s N = (6.0)(6.5) = 39\ in^2$

$$\tfrac{1}{2}bx^2 + A_s N x - A_s N d$$

$$26.25x^2 + 39x - 897$$

$$x = \frac{-39 \pm \sqrt{39^2 - 4(26.25)(-897)}}{2(26.25)} =$$

$$x = 5.16''$$

$$d - x = 23'' - 5.16'' = 17.84''$$

– TRANSFORMED MOMENT OF INERTIA

$$I_{tr} = \tfrac{1}{3}bx^3 + A_s n(d-x)^2$$

$$I_{tr} = \tfrac{1}{3}(52.5'')(5.16)^3 + 39(17.84'')^2$$

$$I_{tr} = 14817\ in^4$$

- CRACKING MOMENT

$$M_{cr} = 7.5\sqrt{6000}\,\frac{(68240\,in^4)}{13''} = 3050\,in\cdot k = 254\,ft\cdot k$$

UPLIFT = 343.3 ft·k > 254 ft·k ∴ CRACKED

- EFFECTIVE MOMENT OF INERTIA

$$I_e = \left(\frac{M_{cr}}{M_{max}}\right)^3 I_g + \left[1 - \left(\frac{M_{cr}}{M_{max}}\right)^3\right] I_{cr}$$

$$I_e = \left(\frac{254}{343.3}\right)^3 (62240) + \left[1 - \left(\frac{254}{343.3}\right)^3\right] 14817\,in^4$$

$$I_e = 16154 + 8816 = 36{,}454\,in^4$$

- COMPRESSIVE STRESS $= \dfrac{(343.3\,ft\cdot k \times 12)(5.16'')}{36454\,in^4} =$ 583 psi bottom

- TENSILE STRESS DUE TO UPLIFT $= \dfrac{(343.3 \times 12)(17.84'') \times 1000}{36454\,in^4} =$ 13245 psi top

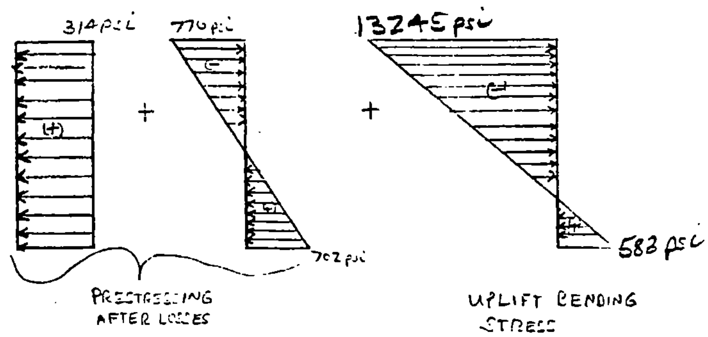
SUMMARY OF STRESSES

(+) = Comp.
(−) = TENSION

STRESSES AFTER LOSSES & UPLIFT (PSI)

	TOP	BOTTOM
AXIAL STRESS	314 psi	314 psi
BENDING STRESS DUE TO PRESTRESS	−770 psi	702 psi
BENDING STRESS DUE TO UPLIFT	−13245 psi	583 psi
TOTAL	−13701 psi	1599 psi OK
PERMISSIBLE		2400 psi

PERMISSIBLE STRESSES P.171 AASHTO
Comp: $.40 f'_c = .40(6) = 2400$ psi



CHECK STRESSES IMMEDIATELY AFTER TRANSFER.

1) STRESSES DUE TO PRESTRESS (Refer to p. 942 (CONC. TEXT – WANG)

INITIAL TENSILE FORCE = 30920 lbs

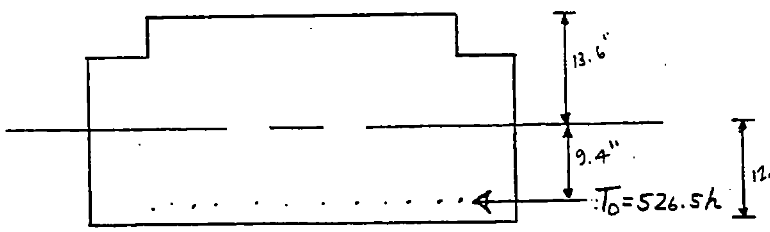
$A_{ps} = 2.6\,in^2$

$f'_c = 6000\,psi$ $\quad N = 6.5$

$d = 23''$

$$\text{INITIAL PRESTRESS} = \frac{30920\,lbs}{.152\,in^2} = 202.5\,ksi$$

$$T_o = 202.5\,ksi * 2.6\,in^2 = 526.5\,k$$



T_o ACTS AS A COMPRESSIVE FORCE ON THE TRANSFORMED SECTION IMMEDIATELY AFTER CUTTING THE WIRES.

$$f_{c_1} = \text{AXIAL STRESS} = \frac{T_o}{A_g + (N-1)A_{ps}} = \frac{526.5k}{(1292\,in^2) + (5.5)(2.6\,in^2)} = .403\,ksi$$

$$f_{c_2} = \text{COMP. BENDING STRESS} = \frac{(526.5k \times 9.4'')(12.4'')}{I_g = 68240\,in^4 \text{ p. 4}}$$

f_{c_2} = .899 ksi BOTTOM

$$f_t = \text{TENSILE BENDING STRESS} = \frac{(526.5k \times 9.4'')(13.6'')}{68240}$$

f_t = .986 ksi TOP

2) STRESSES DUE TO DEAD LOAD

DL = SLAB + GIRDER

DL = 1421.8 lb/ft p.8

$$M_{DL} = 1421.8 \frac{lb}{Ft} * \frac{41^2}{8} = 299 \text{ Ft}\cdot k$$

$$f_c = (299 \text{ Ft}\cdot k * 12)(13.6") / 68240 \text{ in}^4$$ ← BECAUSE IT IS NOT CRACKED ON INTERIOR

f_c = .715 ksi TOP

f_t = .652 ksi BOTTOM

STRESSES @ PRESTRESS TRANSFER

(+) = COMP

(-) = TENSION

	TOP	BOTTOM
AXIAL PRESTRESS	403 psi	403 psi
BENDING STRESS DUE TO PRESTRESS	-986 psi	899 psi
DL BENDING STRESS	715 psi	-652 psi
TOTAL	132 psi OK	650 psi OK
PERMISSIBLE	2400 psi	2400 psi

PERMISSIBLE STRESSES

Comp: $0.60 f'_{ci} = .6(4) = 2400$ psi

P. 171 AASHTO

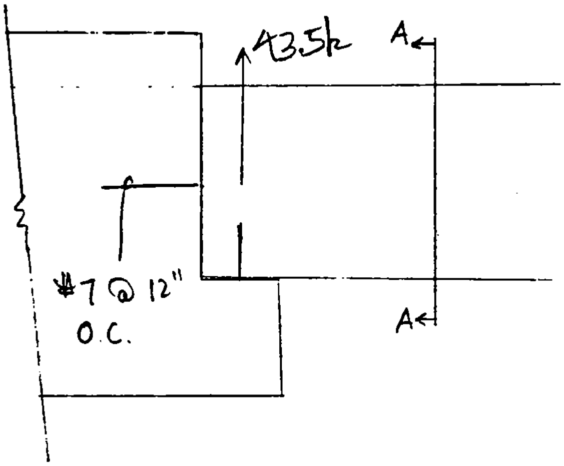
JOB GENTILLY BRIDGE BY PWB DATE 7/12/94 JOB NUMBER 72-[illegible]

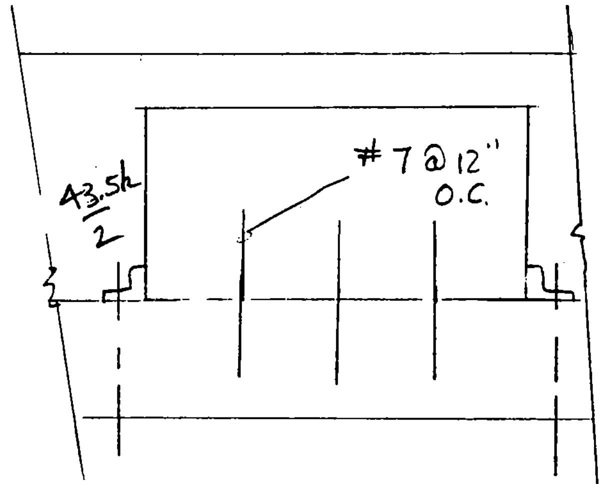
SHEET 18 OF

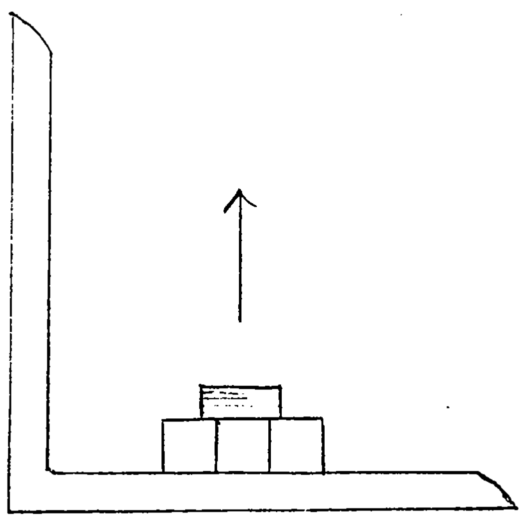
CONSIDERATION OF CONNECTION FOR UPLIFT

NET UPLIFT = 1633.6 LB/FT ↑

$V_u = wl/2 = 1633.6(41)/2 = 33.49 \times 1.3 = 43.5^k$







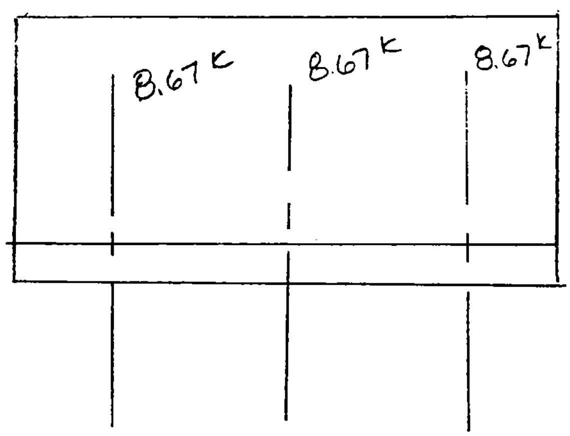
$\frac{43.5^k}{2} = 21.8^k$ / SIDE

$\frac{21.8^k}{3} = 7.27^k$ / BOLT

ALLOWABLE LOAD ON A 325 - 5/8 ϕ BOLT = 13.5^k

$13.5^k > 8.67$

ADDITIONALLY, #7 BARS @ 12" O.C. WILL BE USED TO TIE THE GIRDERS, BENTS & DIAPHRAGMS TOGETHER



JOB LONDON AVE CANAL BRIDGE STUDY BY DRF DATE 6-29-94 JOB NUMBER 92-65

SHEET 19 OF

LINFIELD, HUNTER & JUNIUS, INC.
ENGINEERS AND ARCHITECTS

CONCLUSION OF P.P.C. DESIGN

1.) FLEXURE

(BOTTOM STEEL)
21" X 52.5" P.P.C GIRDERS WITH 17 STRANDS (A_{ps} = 2.6 in^2) IS ADEQUATE

M_N = 1210.6 Ft·k > M_u = 1120.5 Ft·k

2.) SHEAR

#3 ⊔ @ 9" SPACING IS ADEQUATE

3.) DEFLECTIONS

IMMEDIATE LL Δ < $\frac{L}{800}$, LONGTERM Δ FALLS BETWEEN $\frac{L}{420}$ & $\frac{L}{240}$.

4.) UPLIFT

6-#9 BARS (A_s = 6.0 in^2) TOP STEEL ARE ADEQUATE FOR APPLIED UPLIFT

5.) STRESSES

COMP. STRESSES DUE TO PRESTRESSING & UPLIFT FALL BELOW THE AASHTO LIMITS FOR THIS DESIGN.

IV. PROTECTIVE WALLS

DESIGN OF FLOODWALL ALTERNATIVE #1 (Refer to BRIDGE SECTION FOR ILLUSTRATION)

- DESIGN PARAMETERS

WALL THICKNESS = 1'-0" f'_c = 4000 psi F_y = 60 ksi   FLEXURE ϕ = .9 p. 144 AASHTO

ASSUME WATER SURFACE ELEV = 14.4'   SHEAR ϕ = .85

TOP OF SLAB ELEV. = 4.20

WALL HEIGHT = 14.4' - (4.20) - $\frac{10''}{12}$ = 9.37'

- LOADS TO BE CONSIDERED

LOAD FACTOR = 1.3   GROUP I LOADING

1.) WATER PRESSURE

u = 62.4 pcF * 9.37' = 584.7 pcF => 584.7 * 1.3 = 760.1 psF

584.7 psF * ½ * 9.37' = 2739 $\frac{lb}{FT}$

2.) WIND LOAD

BASIC WIND SPEED V = 110 mph

IMPORTANCE FACTOR I = 1.05 CATEGORY I

VELOCITY PRESSURE EXPOSURE K_z = 1.15 TABLE 8 EXPOSURE D

EQN 3 p. 11 $q_z = 0.00256 K_z (IV)^2$ = .00256 (1.15) (1.05 * 110 mph)^2 = 39 psF ≈ 40 psF

40 psF * 1.3 = 52 psF

3.) STREAM FLOW

ASSUME V = 5 Ft/s

SF = KV^2 p. 26 AASHTO

K = 1 3/8 FOR IMPACT ON RECTANGULAR AREA

SF = (1.375)(5 Ft/s)^2 = 34 psF

34 psF * 1.3 = 44 psF

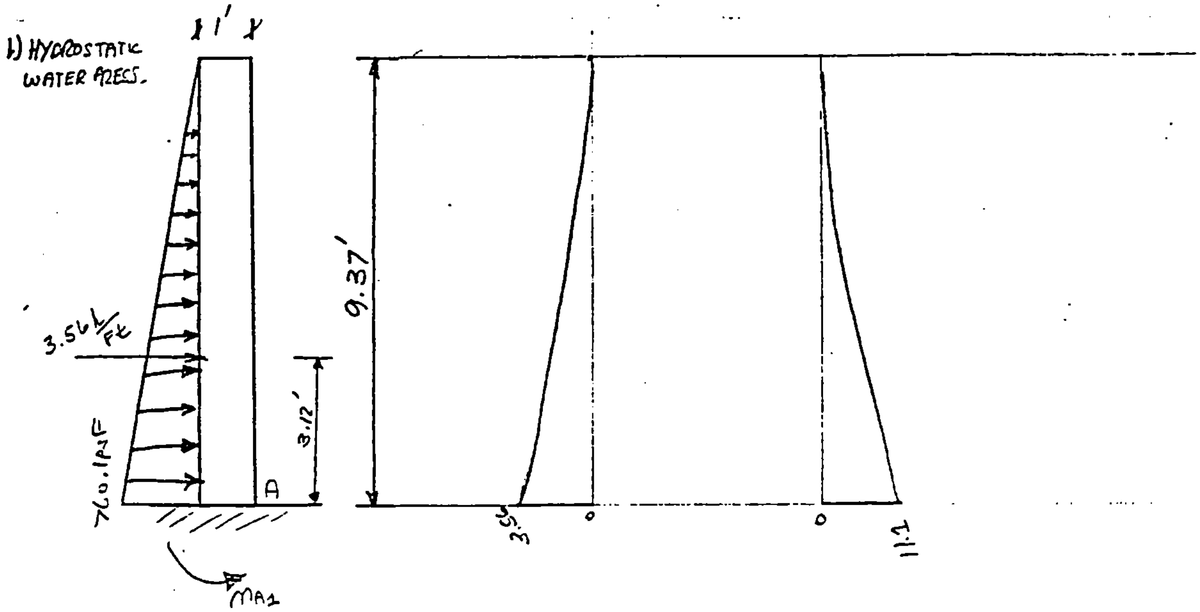
JOB GENTILLY BRIDGE   BY PWB   DATE 7/11/94   JOB NUMBER 92-60

SHEET 1 OF

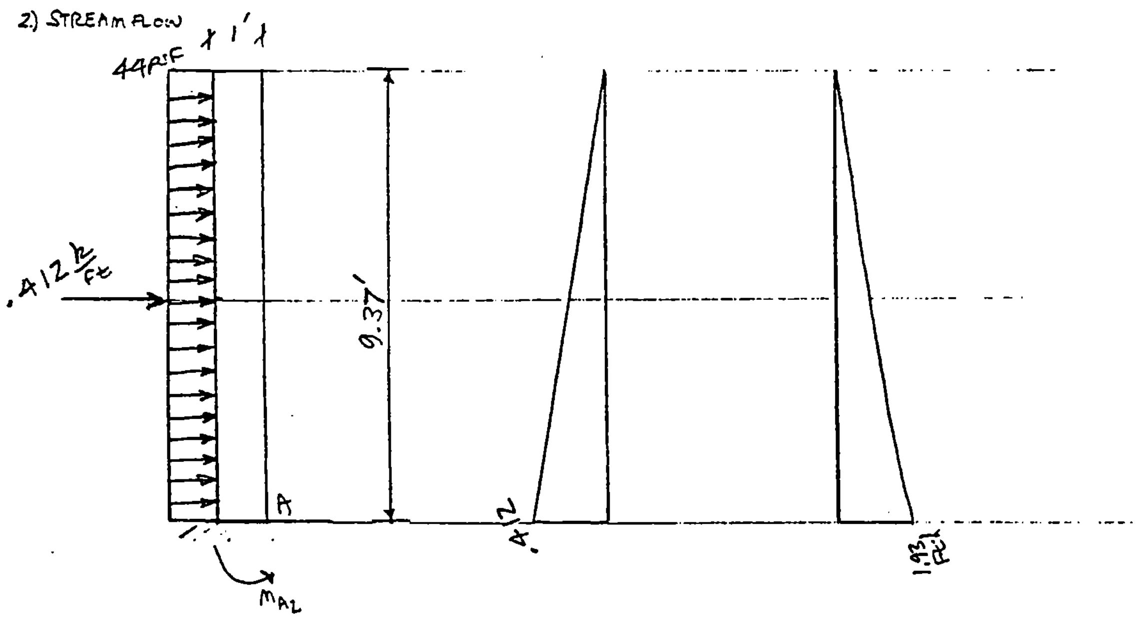
4) TRUCK IMPACT

LOAD = 10 k P. 13 AASHTO
APPLY 3' FROM BASE OF WALL

– LOADING CONFIGURATION (EXTERIOR)

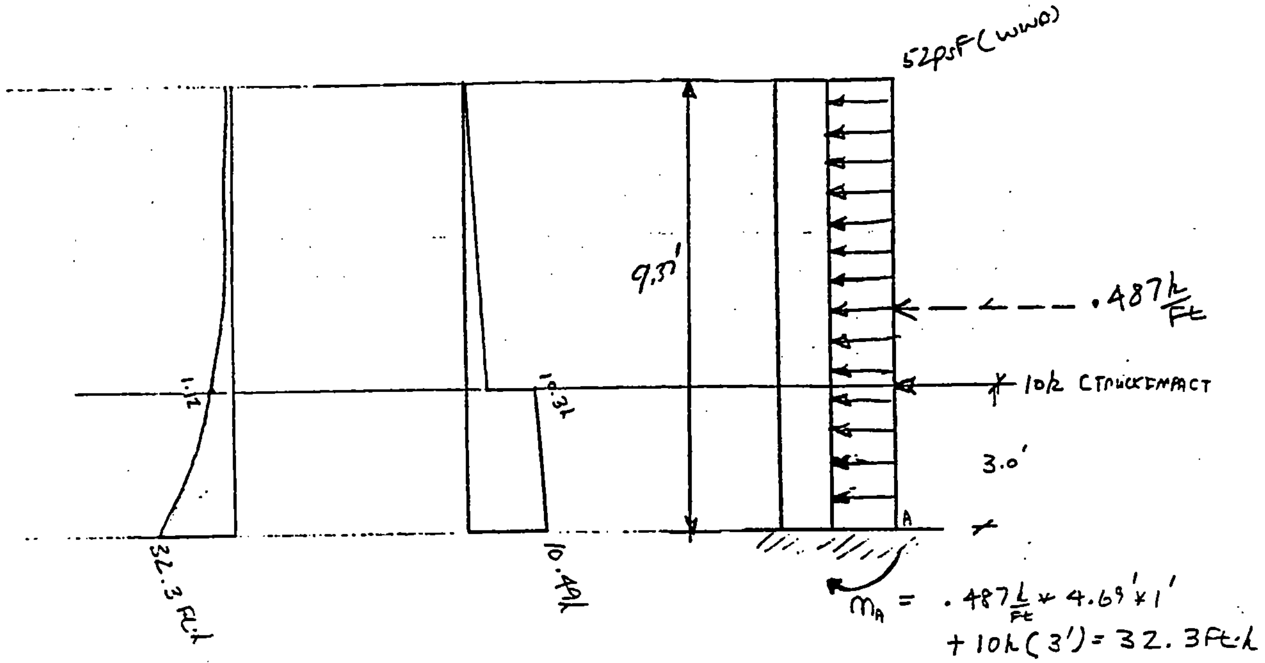


$\Sigma M_A \Rightarrow M_{A1} = 3.56\ k/ft * 3.12' * 1' = 11.1\ ft \cdot k$



$M_{A2} = .412 \frac{k}{ft} * 4.69' * 1' = 1.93 ft \cdot k$ $M_{tot} = 11.1 + 1.93 = 13 ft \cdot k$

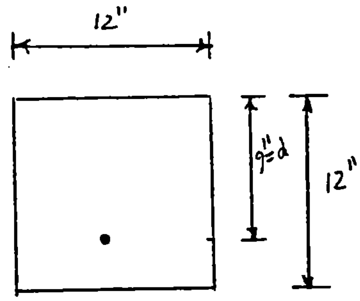
- LOADING CONFIGURATION (INTERIOR)



$M_A = .487 \frac{k}{ft} \times 4.69' \times 1'$
$+ 10k (3') = 32.3 ft\text{-}k$

- FLEXURE DESIGN

DESIGN MOMENT = 32.3 ft·k



DETERMINE ρ_{req}.

$M_N = 32.3 \text{ ft-k} / .9 = 35.9 \text{ ft-k}$

$\frac{M_N}{bd^2} = \frac{35.9 \times 12}{(12")(9")^2} = .443 \text{ ksi}$

$m = \frac{F_y}{.85 F'_c} = \frac{60 \text{ ksi}}{.85(4)} = 17.65$

JOB GENTILLY BRIDGE BY PWR DATE 7/11/94 JOB NUMBER

SHEET 3 OF

LINFIELD, HUNTER & JUNIUS, INC.
ENGINEERS AND ARCHITECTS

$$\rho_{req} = \frac{1}{17.66}\left(1 - \sqrt{1 - \frac{2(17.65)(.443ksi)}{60ksi}}\right) = .0079$$

AREA OF REINF REQ

$$A_{req} = .0079\,(12'')(9'') = .85\,in^2$$

TRY #7 @ 8" $A_s = .90\,in^2/ft$

CHECK FLEXURAL STRENGTH $d = 9''$ $b = 12''$

$$A_c = \frac{A_s F_y}{.85 f'_c} = \frac{(.90)(60ksi)}{.85\,(4)} = 15.88\,in^2$$

$$a = \frac{15.88\,in^2}{12''} = 1.32''$$

$$a/2 = .66''$$

$$\phi M_N = (.90)(.90\,in^2 \times 60ksi)(9'' - .66'') = 405\,in\cdot k = 33.8\,ft\cdot k > 32.3\,ft\cdot k = M_u$$

<u>OK</u>

- TEMP & SHRINKAGE STEEL

p.324 (CONC. TEXT (WANG))

$$\rho = .0018$$

$$A_s = .0018\,(b)(h) = .0018\,(12'')(12'') = .26\,in^2$$

USE #4 BARS @ 9" SPACING NORMAL TO MAIN REINFORCEMENT.

- CHECK SHEAR $\phi = .85$

$V_u = 10.49k$

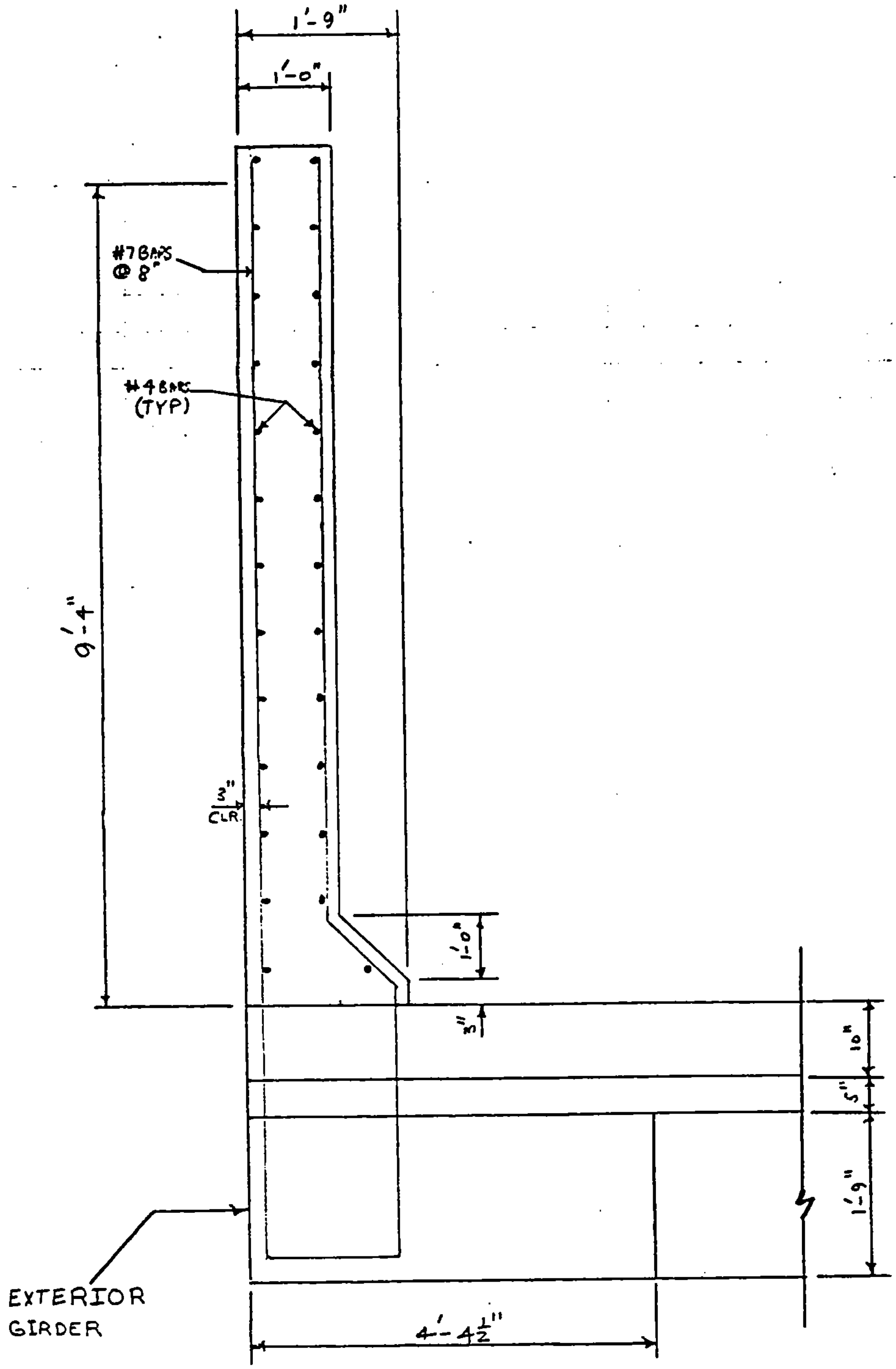
$b = 12''$ $d = 9''$

$$\phi V_c = 2\sqrt{4000}\,(12'')(9'') \times .85 = 11.61\,k > 10.49k$$ <u>OK</u>

- SUMMARY OF WALL DESIGN

#7 BARS @ 8" SPACING ARE ADEQUATE FOR BOTH INTERIOR & EXTERIOR LOADINGS.

#4 BARS @ 9" ARE ADEQUATE FOR TEMP. & SHRINKAGE REINF.



PROTECTIVE BARRIER DETAIL

SCALE: ½" = 1'

BEAM DESIGN FOR TORSION

ASSUME EXTERIOR GIRDERS TAKES ALL OF APPLIED TORSION
TORSION IS DUE TO WALL LOADING

- MAX. TORSION PER SPAN (refer to p. 2)

$$T_u = 13\,\frac{Ft \cdot k}{Ft} * 41' = 533\,Ft \cdot k$$

- LATERAL SHEAR (Refer to p. 2)

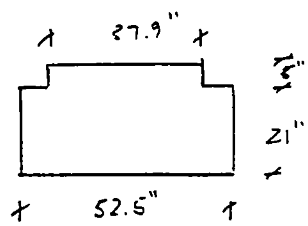
$$V_u = (3.56\ k/Ft + .412\ k/Ft) * 41'$$

$$V_u = 162.9\,k$$

- DESIGN PROCEDURE p. 3-42 PCI

(1). FACTORED TORSIONAL STRESS

$$V_{tu} = \frac{3\,T_u}{\phi\,\Sigma x^2 y}$$



$$\Sigma x^2 y = (21^2 * 52.5) + (5''^2 * 27.9'')$$
$$\Sigma x^2 y = 24100\ in^3$$

$$V_{tu} = \frac{3(533\,Ft \cdot k * 12)}{.85 * 24100\,in^3}$$

$$V_{tu} = 937\ psi$$

TORSION MAY BE NEGLECTED IF $V_{tu} < V_{tu}\,(min)$

$$V_{tu}\,(min) = 1.5 * \lambda \sqrt{f'_c}\,\gamma_t$$

$$\lambda = 1.0$$
$$\gamma_t = \sqrt{1 + 10 f_{pc} / f'_c}$$

f_{pc} = AVG PRESTRESS, psi
f_{pc} = 257 ksi FROM P.P.C. GIRDER DESIGN

$$\gamma_t = \sqrt{1 + 10\left(\frac{257000\,psi}{6000\,psi}\right)} = 20.7$$

$$V_{tu}(min) = 1.5 * 1.0 \sqrt{6000\,psi}\,(20.7) = 2405\,psi$$

V_{tu} = 937 psi < 2405 psi ∴ TORSION MAY BE NEGLECTED.

- CHECK FOR LATERAL SHEAR STRENGTH Refer to p. 526 Naaman

APPLIED SHEAR = V_u = 162.9 k ASSUME EXTERIOR GIRDER TAKES LATERAL SHEAR

$V_c = 2\sqrt{6000}\,(52.5'')(23'') = 187k > V_u$ OK.

CONSIDERATION OF PILE REQUIREMENTS

- BASED ON UNFACTORED LOADS

$V_{L_{INT}} = 55.6^k$ / LANE

$V_{L\,EXT} = 6.76^k$ (at side) $= 3.4^k$ / EXT GIRDER
(2 GIRDERS UNDER SIDEWALK)

$V_{D\,INT} = 34.42^K$

$V_{D\,EXT} = 75.63^K$

- ASSUME TOTAL LOAD DISTRIBUTED UNIFORMLY TO FOUNDATION

4 LANES — SIDEWALK EACH SIDE — INT GIRDERS

$W_T = 55.6(4) + 6.76^K(2) + 34.42^K(16)$

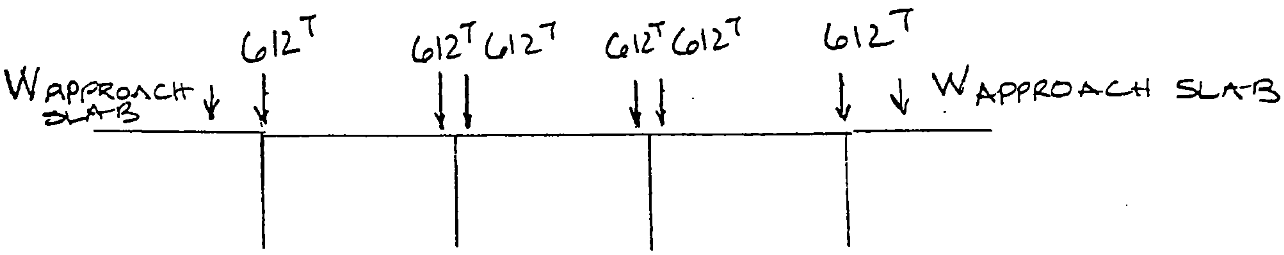
$+ 75.63^K(4)_{EXT.}$ GIRDERS

$= 1089.16^K$ (SINGLE SPAN)

W_C = CAP WT = 3 × 3 × 100 × 150 PCF = 135^K

$W_{DESIGN} = W_T + W_C = 1224^K$

$1224K = 612^T$ = END REACTION AT GIRDERS



1224 TONS / 80 TON/PILE = 15.3 PILES USE 16-24"
INTERMEDIATE BENTS.
@ -80' ELEV

SPACING $\frac{100}{16}$ = 6.25' O.C.

ASSUME ABUTMENTS TAKE 60% OF INTERMEDIATE BENT LOADING
734 TONS / 64 TONS/PILE = 11.5 PILES USE 12 PILES — 16" @ -80' ELEV.

London Ave Bridges

neglecting the effects of levee fill materials, the required penetration is approximately to el -13.0.

53. Sheetpile Recommendations. Based on the analyses described above, the following table summarizes the recommended sheetpile penetration and bending moments.

Reach	Location	Recommended Tip Elevation In Feet MSL	Recommended Bending Moment In Ft-Lb./Ft. F.S. = 1.0
I	Sta. 0+00 to 21+00	-34	23192
I	Sta. 0+00 to 21+00	-42	35970
II	Sta. 21+00 to 37+00	-20.5	14964
III	Sta. 37+00 to 120+00	-20	15506
IV (East)	Sta. 120+00 to 127+00	-21	15667
IV (West)	Sta. 120+00 to 127+00	-1	1945
V (East)	Sta. 127+00 to 147+50	-1	1945
V (East)	Sta. 147+50 to Lake	-16	18205
V (West)	Sta. 127+00 to 142+50	-13	1945
V (West)	Sta. 142+50 to 145+00	-1 to -16*	1945 to 18205*
V (West)	Sta. 147+50 to Lake	-16	18205

*Transition

54. Sheetpiles should be driven with a single acting air or steam hammer delivering between 8000 and 16,000 ft-lb of energy per blow. Consideration should be given to the use of a vibratory hammer. However, buried wood encountered at many boring locations may preclude the efficient use of a vibratory hammer in Reach III.

Bridge Modifications

55. Allowable Pile Load Capacities. The recommended allowable pile load capacities for various lengths and sizes of square precast prestressed concrete piles and 14-in. diameter pipe piles are tabulated on Figures 10 through 37. These

This is part of soils Report prepared By Eustis Engr for London Ave. Canal project

allowable pile load capacities contain a factor of safety of 2 against actual failure of the pile through the soil. Both tension and compression load capacities are provided for piles with butts at the existing grade crossing and at the elevation of the canal bottom. Pipe pile capacities are provided to evaluate the existing bridge foundations.

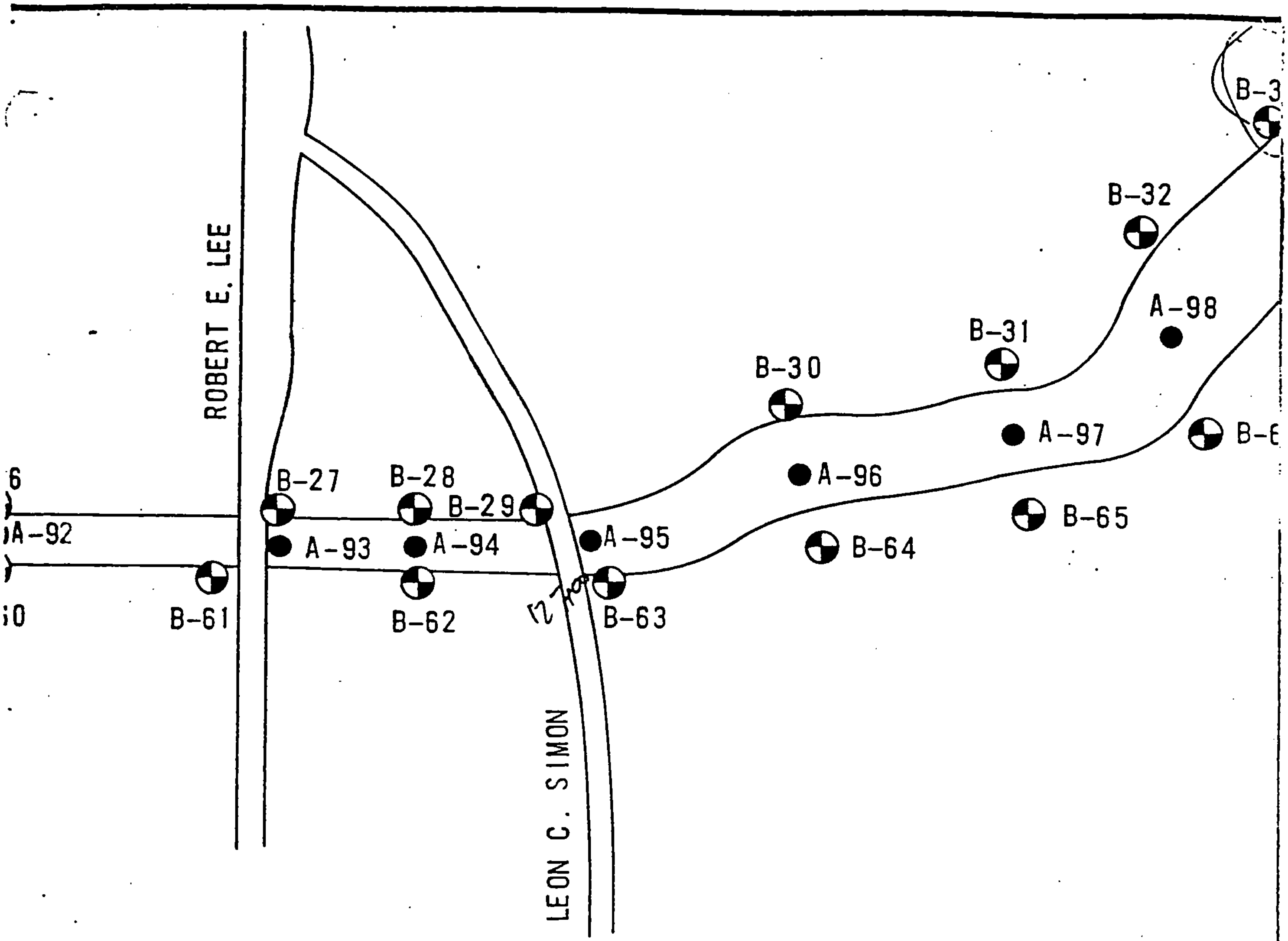
56. Pile Driving. It is recommended that the piles be driven with a steam or air hammer delivering approximately 19,500 ft-lb of energy per blow. In order for these piles to penetrate the sand strata encountered between approximate el -10 and -45 at Boring 15 and Boring 50, -12 and -45 at Borings 19 and 53, and -16 and -15 at Borings 27, 29, 61 and 63, predrilling may be required. Also, if piles are driven in the levee cross-section, it may be desirable to predrill in order to minimize the lateral dispacement of soils as well as to minimize the build up of excess pore pressures due to pile driving. If predrilling is required, it should be accomplished by a wet rotary method utilizing a fishtail bit. The diameter of the predrilled hole should not exceed 75 percent of the side dimension of the square pile. The depth of the predrilling operations should extend to no more than 5 feet below the bottom of the sand strata. Close field supervision must be maintained by experienced personnel to insure that proper procedures are followed and accurate records are kept on all piles.

57. Past experience indicates that pile driving operations may transmit vibrations to adjacent structures, particularly when piles are to be firmly seated or driven through a sand stratum with a high driving resistance. In addition, vibrations generated by pile driving operations may densify loose sand stratum resulting in settlement of existing structures. Also, surface waves propagating through soft organic soils may also cause damage to existing structures. A study should be made to determine the tolerance of existing structures to vibratory loads and settlements. Eustis Engineering Company is available to monitor vibrations during all pile driving operations and can provide consultation concerning the effect of vibrations on existing structures.

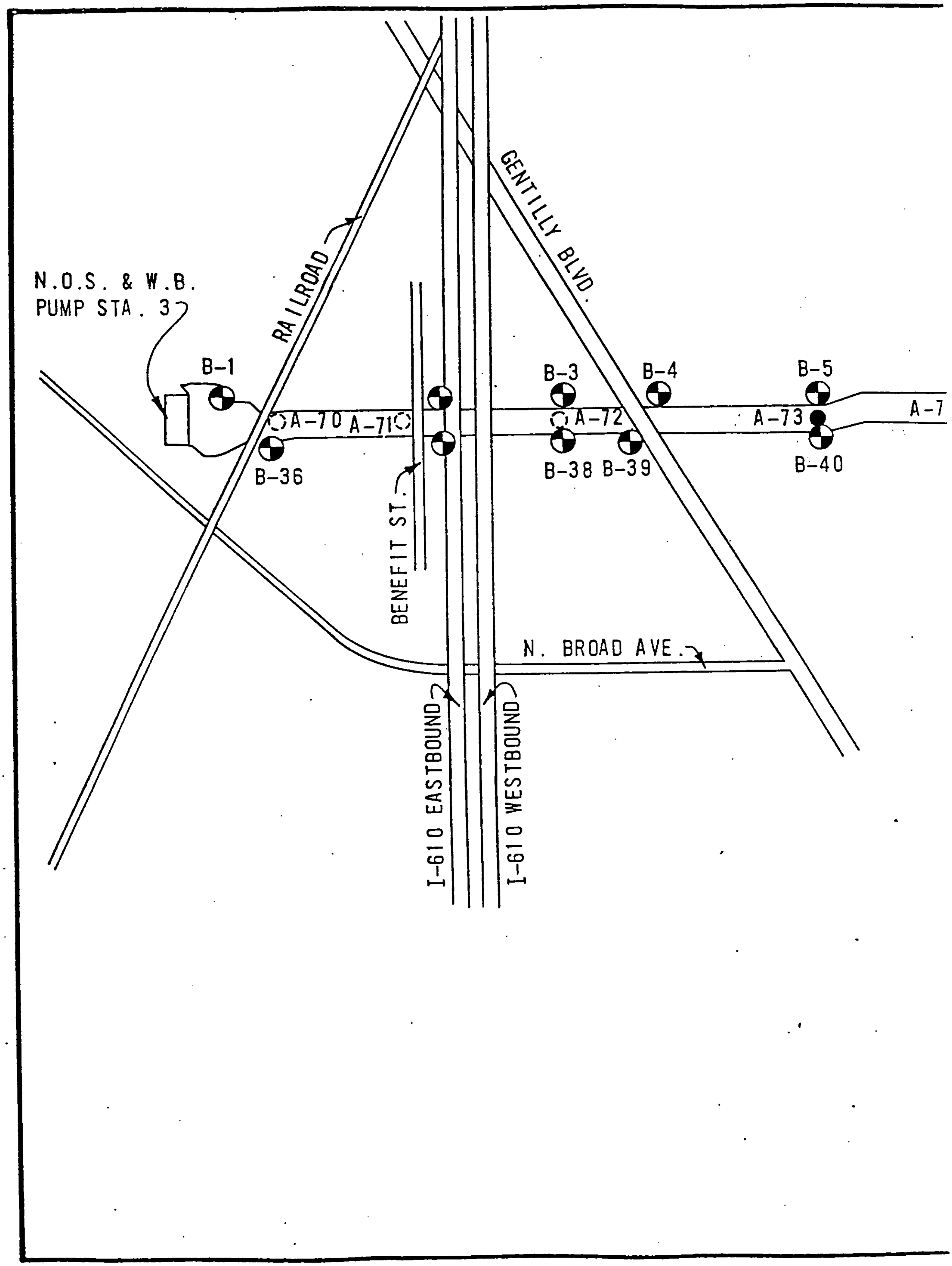
58. <u>Test Piles and Pile Load Tests.</u> It is recommended that at least one test pile of the type anticipated for final design be driven at each bridge site location to give a general indication of the expected driving resistances throughout the project site. These test piles should be driven with the same type of equipment and techniques that will be used to drive the job piles. The test piles will provide valuable information regarding the expected driving resistances and vibrations that may be anticipated during the driving of the job piles. At least one pile should be load tested to verify the estimated design load capacities contained in this report. The pile showing the least resistance to driving should be the one selected for the pile load test. The pile should be load tested to failure in accordance with ASTM D 1143. The U.S. Army Corps of Engineers has standardized specifications outlining load increments and load cycling. Eustis Engineering Company recommends that the load increments past the design load be one-half the increments recommended by the ASTM specification.

59. Eustis Engineering Company will be available for discussions regarding the formulation of a test pile program, and can provide personnel for the logging of the test piles, application of the loads and evaluation of the results of the load tests. We can also log the driving of the job piles as well as evaluate the integrity of the job piles based on the driving logs.

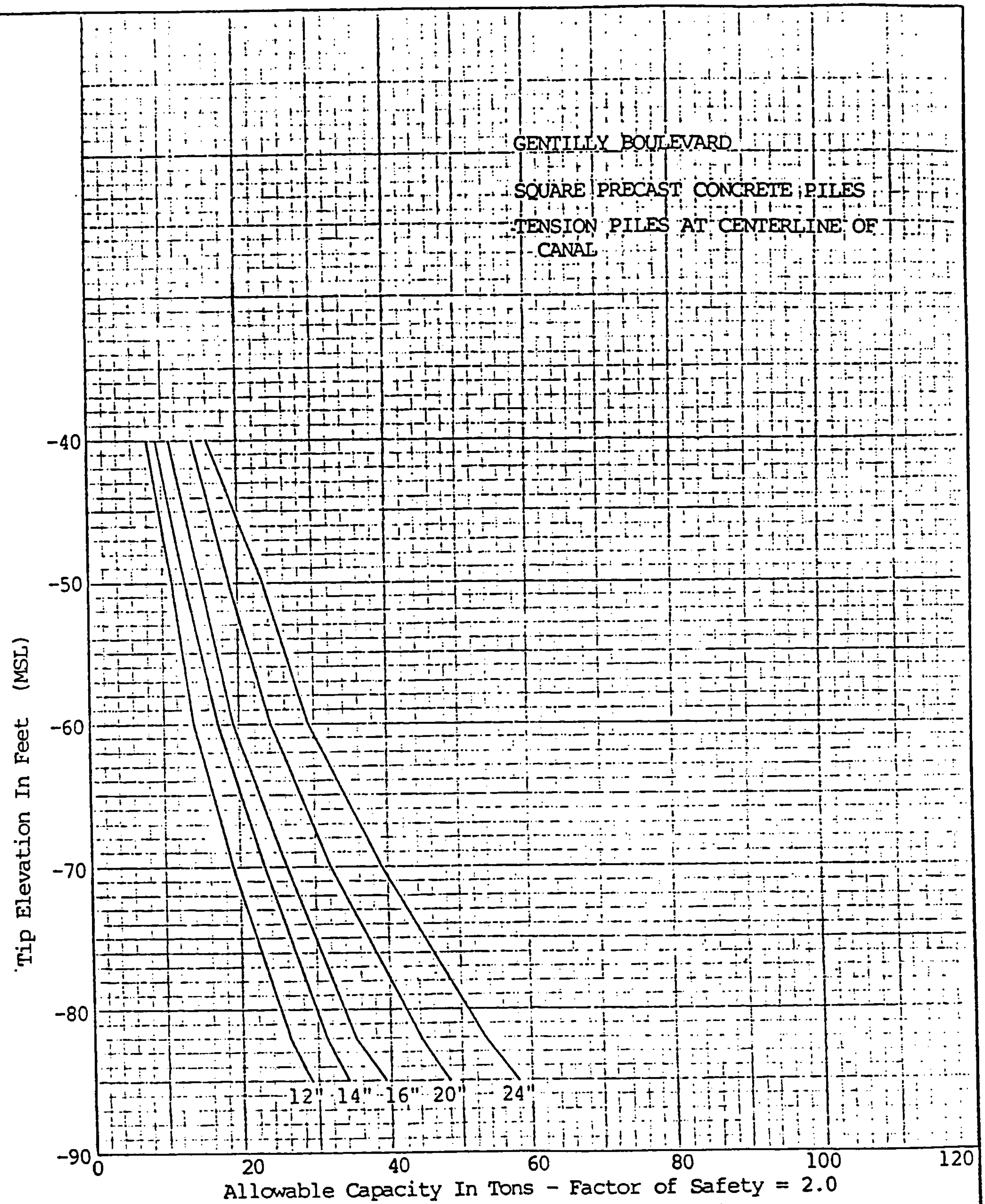
60. <u>Estimated Settlement.</u> It is estimated that the settlement due to imposed structural loads on the pile lengths recommended in this report for use at the bridge modifications will be small and on the order of 0.25 to 0.5 of an inch. Our settlement analyses assume that the bridge modifications are supported by widely spaced single rows of piles or by isolated groups of piles not exceeding four piles per group. Analyses assume that little or no fill is needed. If fill in excess of 2 feet is required at the bridges or pile group dimensions other than cited above are proposed, Eustis Engineering Company should be notified in order that our settlement analyses can be refined.



ROBERT E. LEE
LEON C. SIMON
A-92
B-27
B-28
B-29
A-93
A-94
A-95
B-61
B-62
B-63
B-30
A-96
B-64
B-31
A-97
B-65
B-32
A-98



N.O.S. & W.B.
PUMP STA. 3
RAILROAD
GENTILLY BLVD.
B-1
B-3
B-4
B-5
A-70
A-71
A-72
A-73
A-7
B-36
B-38
B-39
B-40
BENEFIT ST.
N. BROAD AVE.
I-610 EASTBOUND
I-610 WESTBOUND

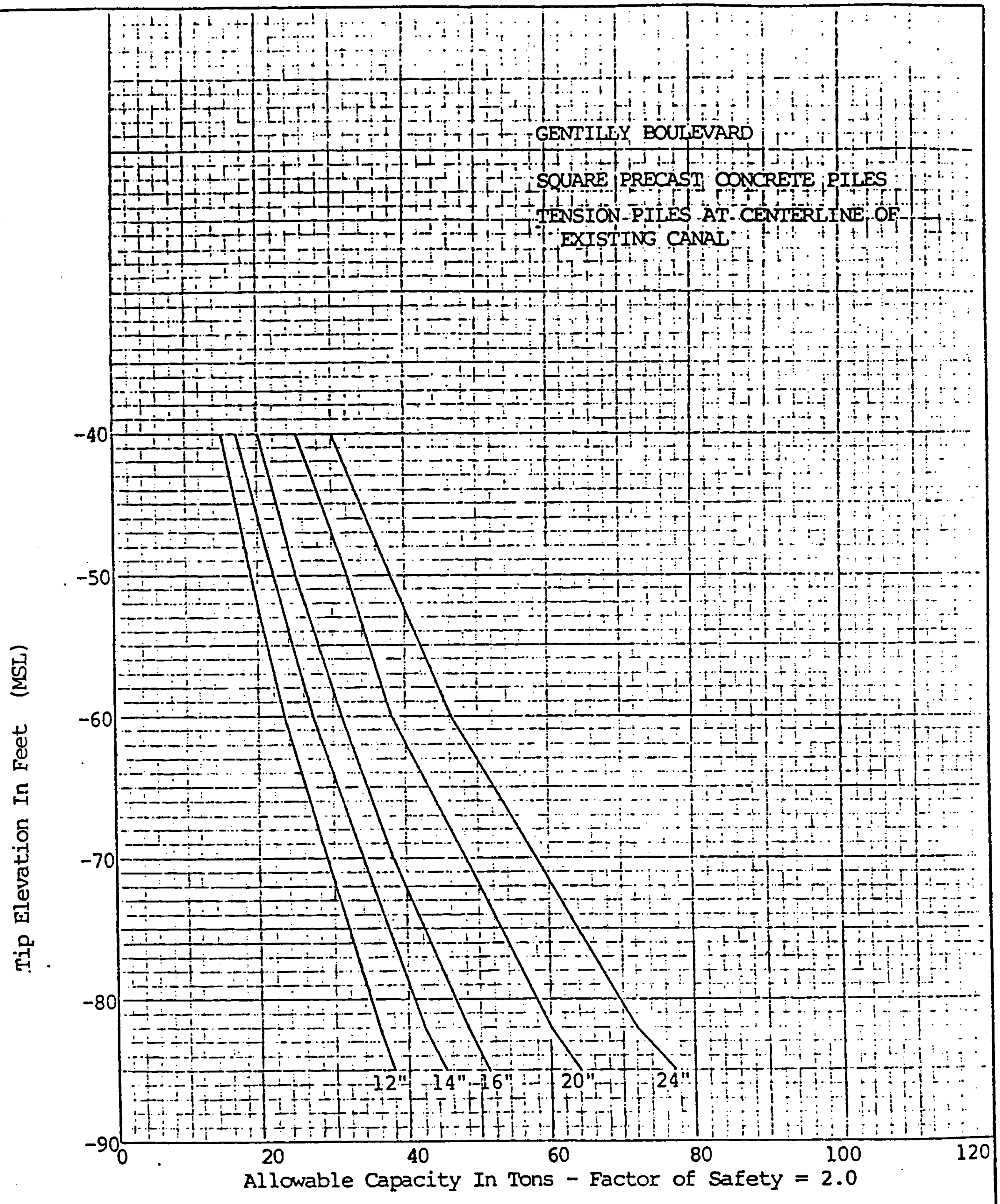


Geotechnical Investigation
London Avenue Canal
Levee and Floodwall Improvements
Orleans Levee Board Project No. 2049-0269
New Orleans, Louisiana

For: The Board of Levee Commissioners of the Orleans Levee District
New Orleans, Louisiana
Burk & Associates, Inc., New Orleans, Louisiana

Fig. 16

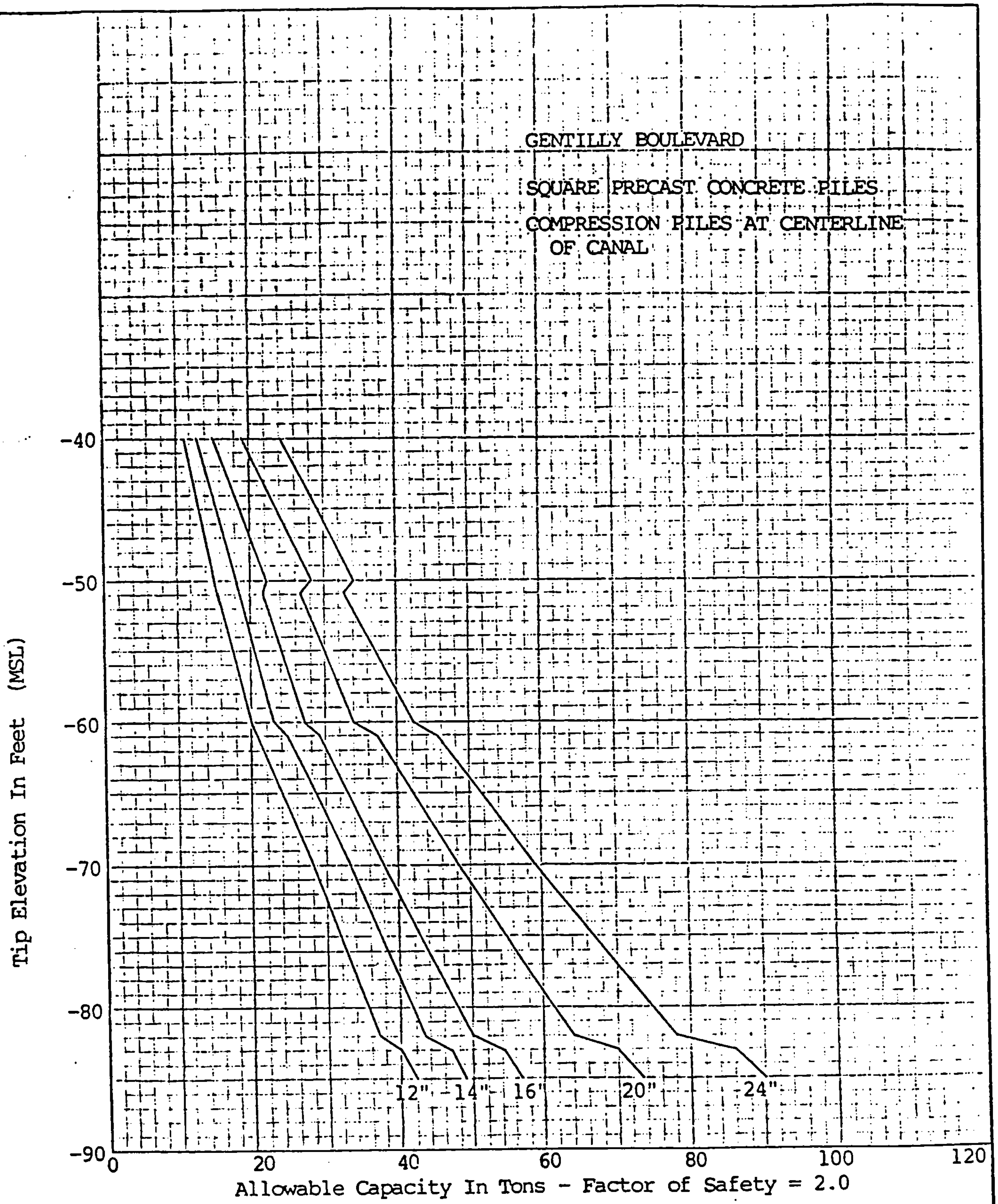
EUSTIS ENGINEERING COMPANY
SOIL AND FOUNDATION CONSULTANTS



Geotechnical Investigation
London Avenue Canal
Levee and Floodwall Improvements
Orleans Levee Board Project No. 2049-0269
New Orleans, Louisiana

For: The Board of Levee Commissioners of the Orleans Levee District
New Orleans, Louisiana
Burk & Associates, Inc., New Orleans, Louisiana

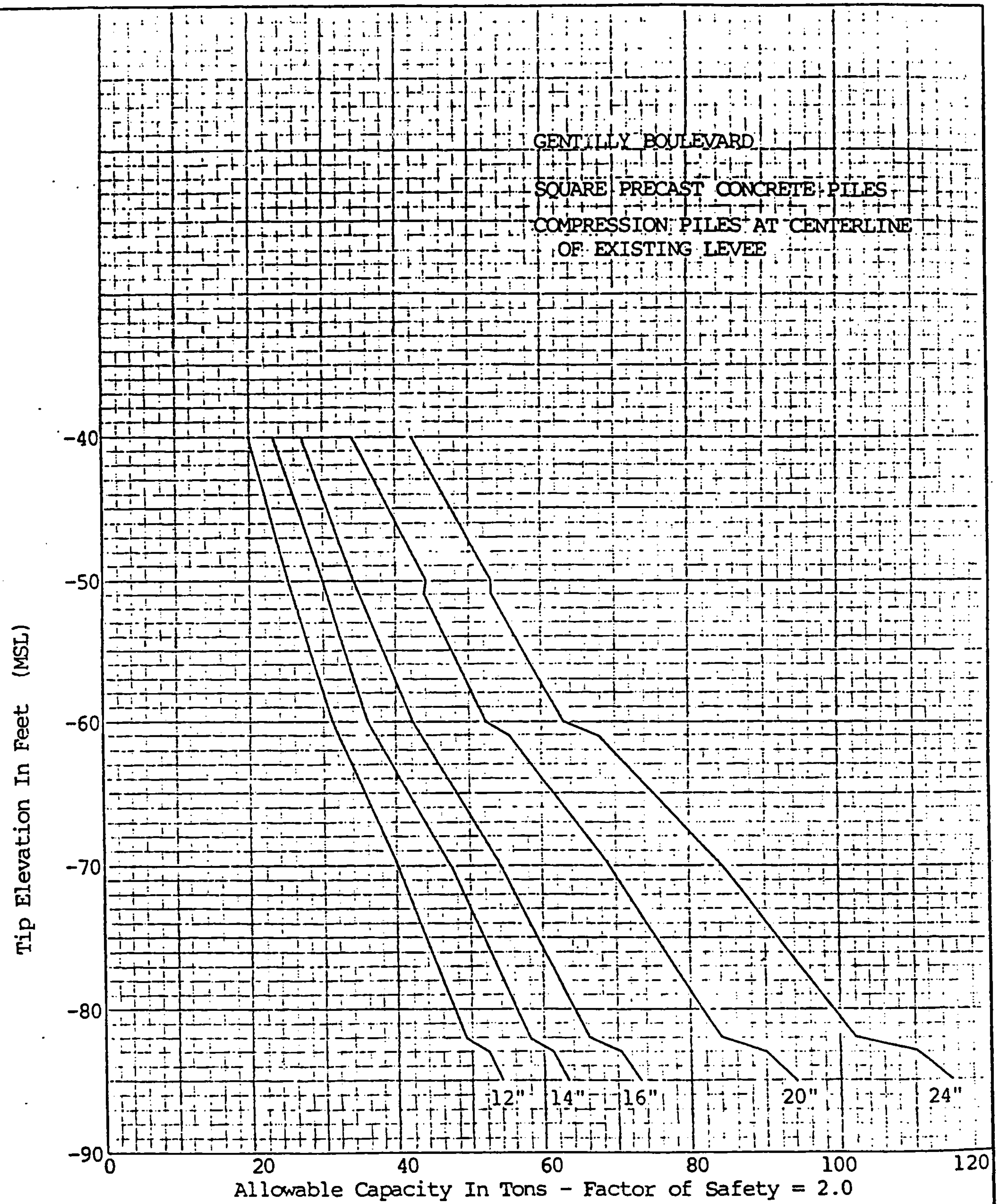
Fig. 17



Geotechnical Investigation
London Avenue Canal
Levee and Floodwall Improvements
Orleans Levee Board Project No. 2049-0269
New Orleans, Louisiana

For: The Board of Levee Commissioners of the Orleans Levee District
New Orleans, Louisiana
Burk & Associates, Inc., New Orleans, Louisiana

Fig. 18



Geotechnical Investigation
London Avenue Canal
Levee and Floodwall Improvements
Orleans Levee Board Project No. 2049-0269
New Orleans, Louisiana

For: The Board of Levee Commissioners of the Orleans Levee District
New Orleans, Louisiana
Burk & Associates, Inc., New Orleans, Louisiana

Fig. 19

APPENDIX B

WAIVER STUDY REPORT

For

SEALED BRIDGES AT

LEON C. SIMON BOULEVARD

And

GENTILLY BOULEVARD

OVER THE LONDON AVENUE OUTFALL CANAL

Prepared for

THE BOARD OF COMMISSIONERS

Of The

ORLEANS LEVEE DISTRICT

NEW ORLEANS, LOUISIANA

OCTOBER 31, 1995

Prepared by:

Linfield, Hunter and Junius, Inc.
Engineers and Architects
3500 N. Causeway Blvd.
Suite 200
Metairie, Louisiana 70002

TABLE OF CONTENTS

I. INTENT AND PURPOSE

It is the intent of this report to convey the findings of our Design Waiver Study for the Leon C. Simon and Gentilly Boulevard sealed bridges over the London Avenue Outfall. Sealed bridges were selected for hurricane protection at the canal crossings as the economical flood control alternative that meets the needs of the using public and surrounding neighborhoods. This alternative is consistent with the recommendations of the Mayor of the City of New Orleans Task Force on the London Avenue and Orleans Avenue Outfall Canals. This report will outline the deviations from current design standards required to safely meet the community needs.

II. BACKGROUND

On November 2, 1994, Mayor Marc Moral commissioned "The Mayor's Task Force for the London & Orleans Avenue Outfall Canal Bridges." The purpose of the Mayor's Task Force was to study and discuss all issues relating to the crossings over the two canals and to recommend to the Mayor a method that would have minimal impact on the quality of life in each affected neighborhood and also provide maximum flood protection for the City. Alternate methods available that meet the flood control requirements at the project sites are floodgates, raised bridges over the flood walls, and sealed bridges at the existing bridge elevations.

In February, 1995, the Task Force, after reviewing all of the proposed methods, recommended sealed bridges at existing elevations. However, because of the constraints imposed by existing conditions (elevations, intersecting streets, driveways, Right of Ways, etc., the sealed bridge method requires a number of exceptions to the current standard roadway and bridge design criteria. The Orleans Levee District (OLD), The City of New Orleans (City) and The United States Army Corps of Engineers (USACE) have agreed to pursue obtaining the design waivers required to rebuild and seal the bridges at existing grade.

The Task Force's recommendation is contingent upon the bridge designs having minimal impacts on the neighborhoods. In order to minimize disruption to neighborhoods, the Task Force recommended that design waivers to the American Association of State Highway and Transportation Officials (AASHTO), the Louisiana Department of Transportation and Development (LADOTD) and the New Orleans Department of Streets (NODOS) standards be identified and presented to the Task Force. AASHTO is the national design standard used for roadway and bridge design in the United States. LADOTD and NODS standards are based on AASHTO but contain modifications to suit local conditions and preferences.

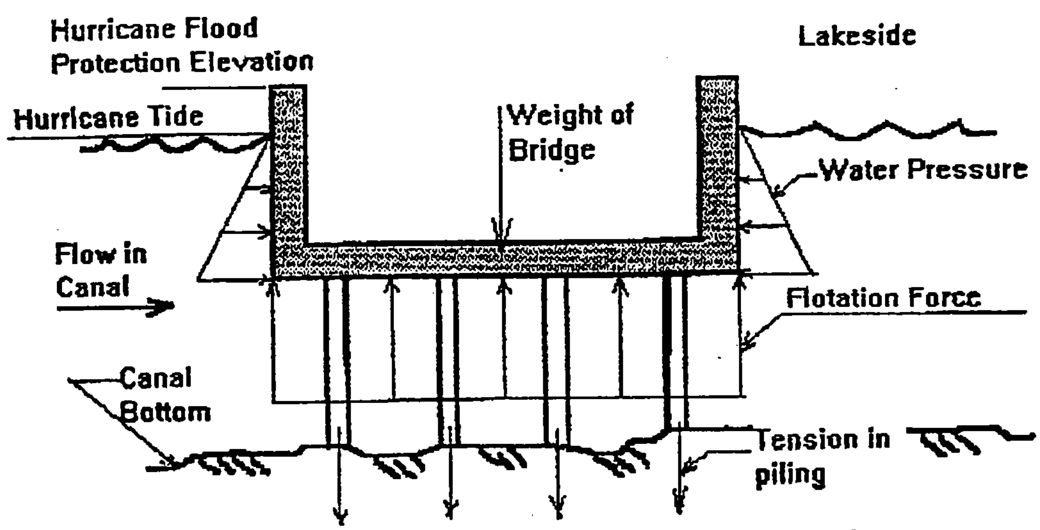
In keeping with the Mayor's Task Force recommendations, Linfield, Hunter and Junius, Inc. (LH&J) is tasked with designing sealed bridges which must consider the following priorities:

1. FLOOD CONTROL - Flood protection against both hurricane tidal flooding and urban rainfall runoff. The new bridges can not impede the Sewerage and Water Board's ability to pump storm runoff through the canal any more than the existing bridges.

2. NEIGHBORHOOD IMPACTS - Maintain as close as possible the existing vertical geometry thereby minimizing the impact of the new bridges on the surrounding neighborhoods.

3. TRAFFIC SAFETY - Incorporate the latest AASHTO design codes as to the maximum extent possible given the restraints of item 2 above.

The proposed sealed bridges will generally consist of pre-cast and cast in place concrete beams, slabs and walls which will prevent hurricane flood waters from entering the city at the road crossing locations. The main differences between a sealed bridge and a conventional bridge are the buoyant force of the water trying to float the sealed bridge and the water pressure exerted on the barrier rails of the sealed bridge. During design high water conditions the buoyant force on the bridge exceeds the weight of the bridge and results in a net upward force. This upward force on the bridge tends to lift the bridge deck off of the bridge support piling. The upward force is resisted by tension connections between the bridge girders and pile caps and between the pile caps and the piling. Also, all construction joints will be sealed to prevent water from entering the "Dry" side of the bridges. Figure No. 1 below shows a schematic drawing of a sealed bridge cross section with the design forces acting upon it.



TYPICAL FORCES ON A SUBMERGED BRIDGE

FIGURE 1

The proposed sealed bridges and approaches will be designed in accordance with the latest AASHTO, LADOTD and NODOS design standards except as identified herein.

III. FINDINGS

A. LEON C. SIMON BOULEVARD BRIDGE

A.1. CURRENT DESIGN CRITERIA

The following is a tabulation of pertinent design criteria currently used by the NODOS which relates to the Leon C. Simon site:

* Leon C. Simon is classified as a "Minor Arterial Roadway" by the NODOS.
* Design speed is 40 mph with a posted speed of 35 mph.
* Bridge should be at least as wide (curb to curb) as the approach roadway plus two feet on each side.
* Sidewalks should be minimum six feet wide if no barrier is provided.
* Median barrier recommended between opposing traffic lanes with a four foot shoulder.
* Minimum stopping sight distance 250 feet.
* Minimum lane width 11 feet, 12 feet desirable.
* Minimum cross slope 0.025 ft./ft.
* Maximum grade is 6% (8% in special cases).
* AASHTO requires a minimum of two foot clearance between the bottom of bridges and the design high water elevation.
* Maximum slope for sidewalks is 1:20 (5%).
* Sidewalks must conform to The Americans with Disabilities Act (ADA).

A.2. EXISTING CONDITIONS

The existing geometric layout of the Leon C. Simon bridge was obtained from topographic survey data taken by BFM Corporation. This survey along with site visits by our engineers were used to determine the existing bridge conditions. A cross section of the existing bridge is depicted on Figure 2.

The following is a list of the pertinent existing conditions which relate to traffic safety, neighborhood impact and current design criteria which are the primary reasons for obtaining design waivers:

* The posted speed limit on Leon C. Simon Blvd. is 35 mph.
* The existing roadway and bridge have four - 12 feet wide lanes with no shoulders.

* The calculated stopping sight distance (according to the AASHTO Geometric Policy Manual) for the eastbound downramp and the Westbound downramp approximates the value for a design speed of 35 mph.
* The calculated stopping sight distance for both the eastbound upramp and the westbound upramp approximates the value for a 23 mph design speed. The combined effects of a sharp horizontal curve and a relatively steep vertical slope are the major limiting factors.
* The posted speed should be 18 mph (based on posted speed 5 mph less than design speed).
* Sidewalks exist on both sides of the bridge. However, the sidewalk on the southeast downramp stops at a stairway a few feet from the bridge. This sidewalk/stairway combination does not meet handicap requirements.

A.3. SEALED BRIDGE

A sealed bridge was recommended at Leon C. Simon Boulevard because it will cause the least impact to the surrounding neighborhood, provide the required level of flood protection and will not degrade traffic safety.

The proposed sealed bridge will be constructed at approximately the same elevation as the existing bridge and will have a smooth underside which causes less turbulence when the water in the canal is higher than the bottom of the bridge. The smooth bottom will increase the efficiency of flow under the bridge thereby minimizing the head loss at the bridge. The side walls of the sealed bridge will extend to the same elevation as the top of the adjacent flood walls and levees so that water will not overtop the bridge and flood the city. Figure 2 also shows a cross section of the proposed sealed bridge.

Referring to Figure 3, the east bound approach work begins just west of the Pratt Street intersection and continues eastward to the bridge. The street work west of the Pratt Street intersection and in the intersection is required to smooth out the intersection of the streets and will require a very minimal change in grade (elevation). Work on the west bound approach begins approximately 300 feet east of the bridge and ends at the bridge abutment. The maximum change in roadway elevation on either of the approaches is approximately 0.9 feet as indicated on the profile view of Figure 3. No private drives or drainage will be effected by the approach work and no permanent street closings are required.

Traffic safety is maintained with the sealed bridge by regrading the approaches and changing the slope gradient of the vertical curve. The horizontal alignment of the west bound lane will be altered slightly to improve the horizontal site distance as is indicated by the cross hatched area shown on Figure 3. This will change the design speed at the bridge from approximately 24 mph to approximately 35 mph.

The side walls of the sealed bridge will extend approximately seven to eight feet above the sidewalk elevation.

A.4. DEVIATIONS FROM CURRENT DESIGN CRITERIA

The following are a list of deviations from the current bridge design criteria. The required criteria is shown in brackets.

* Stopping site distance is approximately 225 feet. {250}
* Design speed is 35 mph.{40}
* Maximum vertical gradient is approximately 4.7%. {6}
* Horizontal degree of curvature is 9 degrees. {8}
* Design high water level is approximately 11 feet above bottom of bridge.

Based on the above deviations from current design standards, the following design waivers will be required.

1. If the NODOS wishes to maintain the 35 mph speed limit posted for Leon C. Simon, then an exception by the LADOTD and the NODOS to allow the use of the posted speed equal to the design speed will be required. The NODOS and\or LADOTD will have to post Advisory signage accordingly to alert vehicles of the condition.

2. A design waiver is required to allow for the design high water level in the canal being higher than the bridge deck elevation.

3. A waiver is required for handicap access on the southeast side of the bridge if a new sidewalk is not constructed (none exists now).

The LADOTD and/or the City of New Orleans Department of Streets can grant the necessary waivers for the proposed sealed bridge and approaches. Additional waivers may become necessary as the final design is developed.

B. GENTILLY BOULEVARD BRIDGE

B.1 CURRENT DESIGN CRITERIA

The following is a tabulation of pertinent design criteria currently used by the NODOS which relates to the Gentilly Boulevard bridge site.

* Gentilly Boulevard is classified as a "Minor Arterial Roadway" by the NODOS.
* Design speed is 40 mph with a posted speed of 35 mph.
* Bridge should be at least as wide (curb to curb) as the approach roadway plus two feet on each side.
* Side walks should be a minimum of six feet wide if no barrier is provided.
* Minimum stopping sight distance is 250 feet.
* Minimum lane width is 11 feet, 12 feet desirable.
* Minimum cross slope is 0.025 ft./ft.
* Maximum grade is 6% (8% in special cases).
* AASHTO requires a minimum of two foot clearance between the bottom of bridges and the design high water elevation.
* The maximum slope on sidewalks is 1:20 (5%).
* Sidewalks must comply with ADA requirements.

B.2 EXISTING CONDITIONS

The existing geometric layout of the Gentilly Boulevard Bridge was also obtained from topographic survey data by BFM Corporation. This survey along with site visits by our engineers were used to determine the existing bridge and approach geometry. A cross section of the existing bridge is depicted on Figure 4.

The existing bridge has three lanes in each direction with no shoulders. The outside lanes on either side of the bridge are used as parking lanes along the roadway. East of the bridge the roadway necks down to two lanes in each direction to allow turn lanes onto New Orleans Street. On the existing bridge itself, only two of the three lanes are used because of the third lane is used for parking on the approach roadways.

The following is a list of the pertinent existing conditions which relate to traffic safety, neighborhood impact and current design criteria:

* The apparent speed limit on Gentilly Boulevard is 35 mph (there are not speed limit signs in the vicinity of the bridge).
* The existing approach roadways have two travel lanes and one parking lane in each direction. The existing bridge has three travel lanes in each direction with no shoulders.
* The existing bridge has a six foot wide by eight inch high concrete median between opposing traffic lanes.

* The steep grades and short segments of the approaches on both sides of the bridge limit the stopping sight distance approximately to 23 mph design speed (based on AASHTO Geometric Policy Manual).
* The safe posted speed should be 18 mph (based on posted speed 5 mph less than design speed).
* Sidewalks exist on each side of the bridge. Neither sidewalk meets handicap requirements due to step downs at the bridge abutments.

B.3 SEALED BRIDGE

A sealed bridge was recommended at Gentilly Boulevard because it will cause the least impact to the surrounding neighborhood, provide the required level of flood protection and will not degrade traffic safety.

The proposed sealed bridge deck elevation must be raised approximately one foot to allow for a deeper bridge structure. The existing bridge structure consists of steel beams and girders and is thinner than the required sealed bridge. The sealed bridge requires a deeper bridge structure to resist the uplift (buoyant force) on the bridge during high water conditions. The bottom elevation of the sealed bridge can not be lower than the existing bridge bottom elevation so that the drainage capacity of the canal is not decreased.

The proposed sealed bridge will have two 12 feet wide traffic lanes and an eight foot shoulder on each side (See Figure 4). There will also be a six foot wide median between the travel lanes with a two foot shoulder between the median and the travel lanes. The south side of the bridge will have a six foot wide sidewalk (same as existing) and the north side of the bridge will have a 9 foot wide sidewalk. The wider sidewalk on the north side will allow minimum required sight distances for motorists turning right off of Pleasure Street onto Gentilly Boulevard.

The side walls of the sealed bridge will extend approximately ten feet above the bridge sidewalk elevation.

Approach changes required by the sealed bridge are shown on Figure 5. The west approach work begins approximately 240 feet west of the west abutment and continues to the bridge. The resulting maximum change in elevation of the eastbound lane will be approximately one foot to minimize impact on the intersecting driveways. The east approach work begins approximately 400 feet eastward of the east bridge abutment and continues westward to the abutment.

The car detailing business on the northwest corner of the bridge at Pleasure Street will have a portion of its driveway reconstructed due to the required change in roadway elevation.

Five private residence driveways will require reconstruction to accommodate the new roadway elevation. This will result in driveways with slopes up to eight percent gradients. Area drains will also be added in front of these residences to collect storm water runoffs.

Pleasure Street will be realigned slightly to increase sight distance for vehicles turning onto Gentilly Boulevard.

The driveway nearest the northeast corner of the bridge will be sloped approximately eight percent to match the roadway profile. This slope will cause the adjacent sidewalk to exceed ADA guidelines for cross slopes on sidewalks.

Traffic safety is maintained at the sealed bridge by regrading the approaches and changing the gradient and length of the vertical curve. Stopping sight distance is changed by widening the sidewalk on the north side of the bridge and realigning Pleasure Street. This will change the design speed at the bridge from approximately 23 mph to approximately 30 mph.

B.4 DEVIATIONS FROM CURRENT DESIGN CRITERIA

The following is a list of deviations from the current bridge design criteria required to construct the sealed bridges as described above. The required criteria is shown in brackets.

* Design speed is 30 mph. {40}
* Stopping site distance is approximately 200 feet. {250}
* Maximum vertical gradient is approximately 3.7%. {6% maximum}
* Design high water level is approximately 14 feet above the bottom of the bridge. {2 feet below the bridge is required.}
* Cross slope on northeast sidewalk is greater than 8%. {8% maximum}

Based on the above deviations from current design standards, the following design waivers will be required.

1. If the NODOS wishes to post the bridge design speed of 30 mph as the bridge speed then a waiver is required. The NODOS and/or LADOTD will have to post advisory signage accordingly to alert drivers of the condition.

2. A design waiver is required to allow for the design high water level in the canal being higher than the bridge bottom elevation.

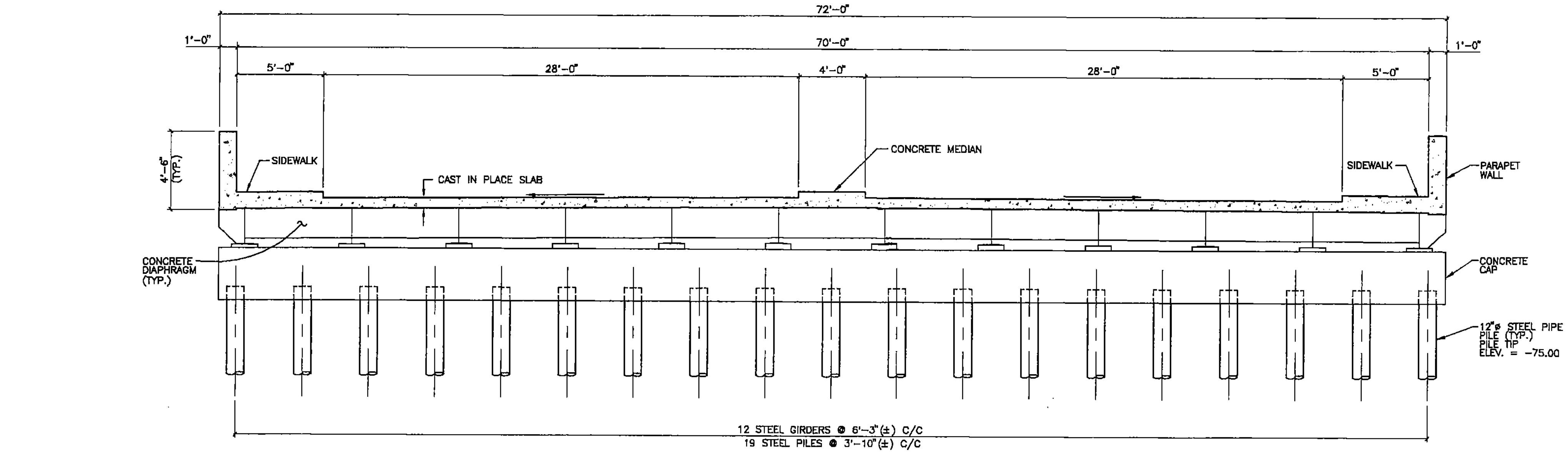
3. A waiver is required to allow for construction of a sidewalk on the northeast corner of the bridge with a cross slope exceeding that set by LADOTD and ADA guidelines.

4. NODOS must approve the change from three travel lanes to two travel lanes in each direction on the sealed bridge.

The LADOTD and/or the NODOS can grant the necessary waivers for the proposed sealed bridge and approaches. Additional waivers may become necessary as the final design is developed.

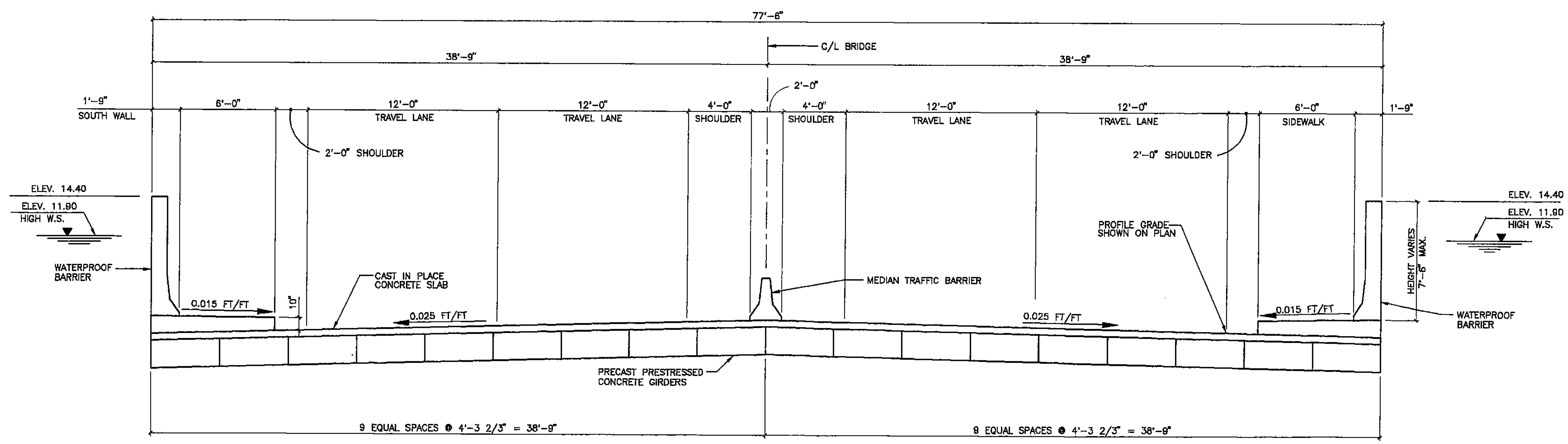
IV. CONCLUSIONS

The task of providing bridge crossings over the London Avenue canal while maintaining the character of the existing neighborhoods, providing the required flood protection and provided an acceptable level of traffic safety is formidable. However, based on our study of the existing geometric conditions, we believe that the sealed bridges proposed herein contain a melding of the requirements of the Mayor's Task Force and the engineering design standards required. Therefore we recommend that the sealed bridges described herein be submitted to the Mayor's Task Force for approval.



1 LEON C. SIMON BLVD. EXISTING BRIDGE CROSS SECTION

LEON C. SIMON BLVD. SCALE: 1/4" = 1'-0"



2 PROPOSED SEALED BRIDGE SECTION

LEON C. SIMON BRIDGE SCALE: 1/4"=1'-0"

LINFIELD, HUNTER & JUNIUS, INC.
CONSULTING ENGINEERS AND ARCHITECTS
3500 North Causeway Blvd. Suite 200
Metairie, Louisiana 70002

SEAL

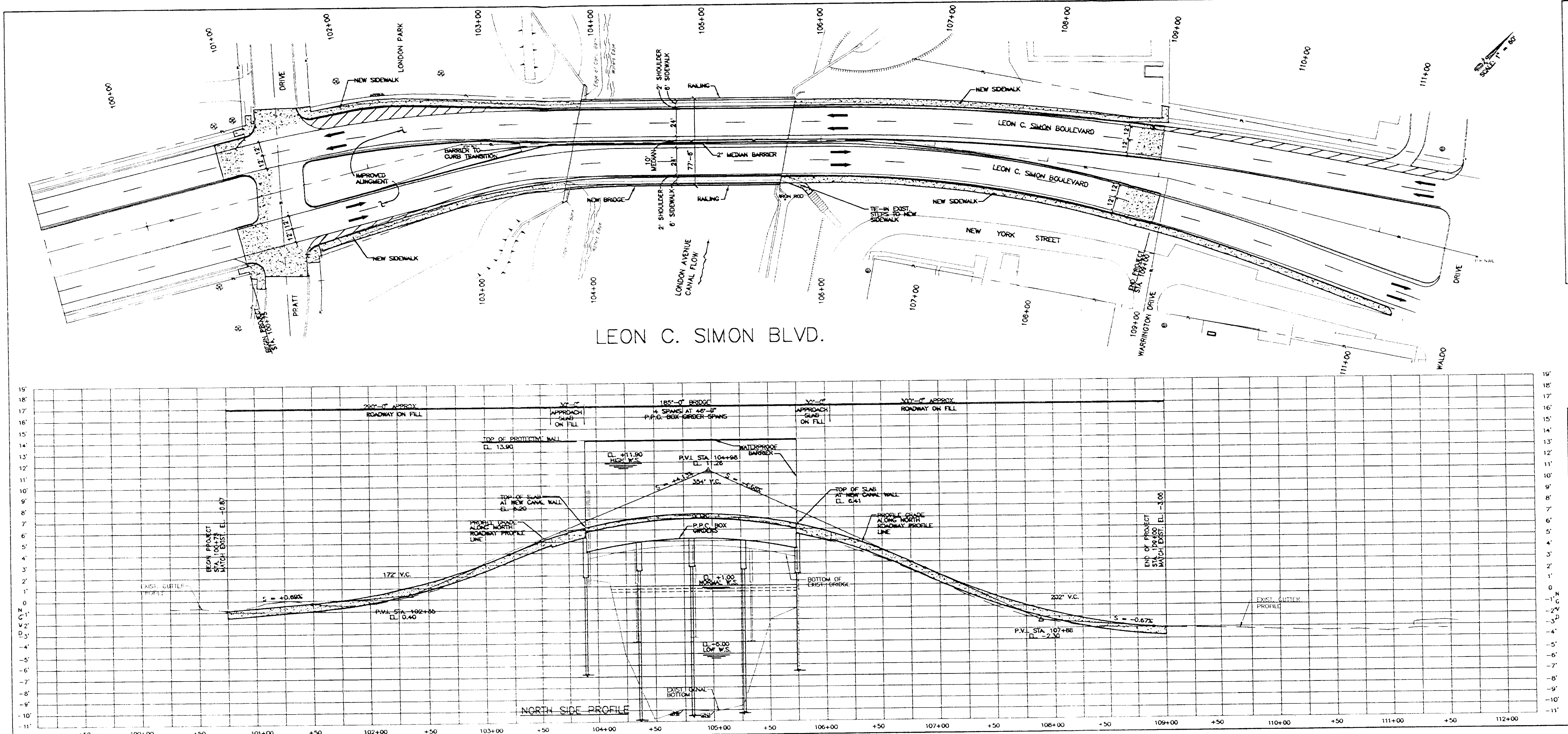
REV. NO.	DATE

ORLEANS LEVEE DISTRICT
LONDON AVENUE OUTFALL CANAL
WAIVER STUDY REPORT

THIS SHEET: BRIDGE SECTIONS

DRAWN BY: T.F.B. | CHECKED BY: S.G.J. | APPROVED BY: A.F.G. | CAD FILE NO. 9260

PROJ. NO. 92-60
DATE 8/30/95
SHEET NO. FIGURE 2
OF SHEETS

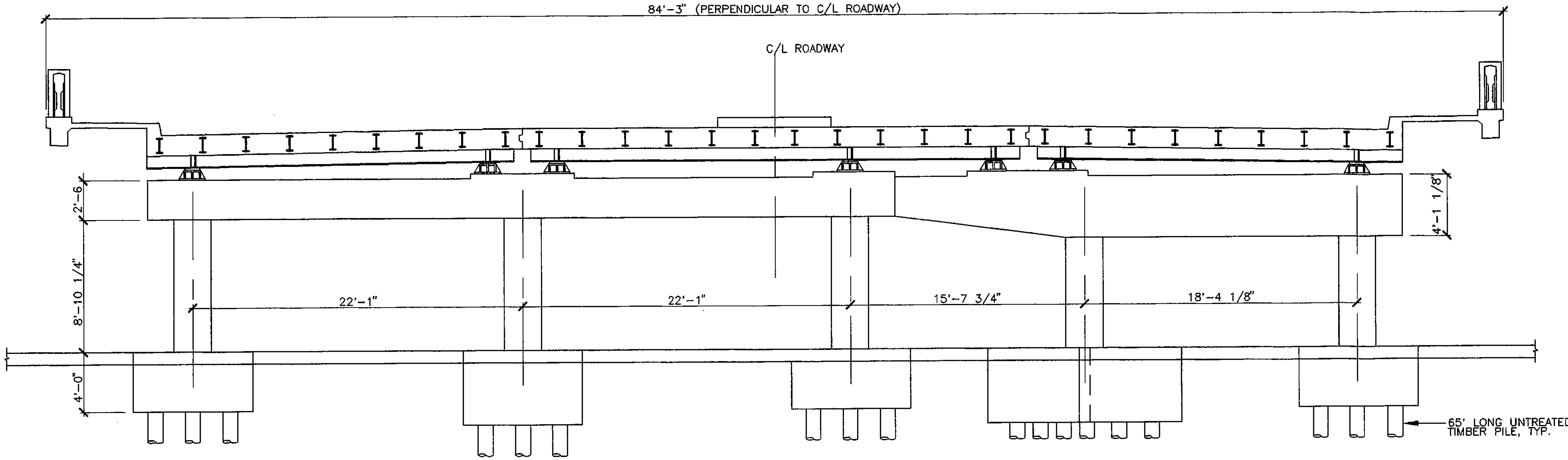


LINFIELD, HUNTER & JUNIUS, INC.
CONSULTING ENGINEERS AND ARCHITECTS
3500 North Causeway Blvd. Suite 200
Metairie, Louisiana 70002

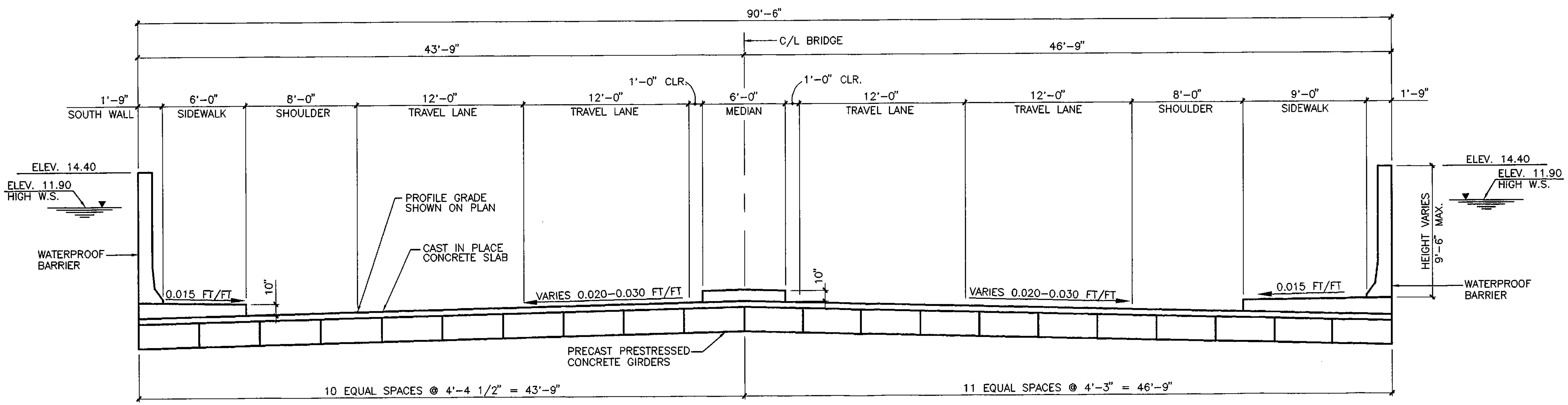
ORLEANS LEVEE DISTRICT
LONDON AVENUE OUTFALL CANAL
WAIVER STUDY REPORT

LEON C. SIMON BLVD. SEALED BRIDGE

FIGURE 3



1 EXISTING BRIDGE SECTION
GENTILLY BLVD. BRIDGE SCALE: 1/4"=1'-0"



2 PROPOSED SEALED BRIDGE SECTION
GENTILLY BLVD. BRIDGE SCALE: 1/4"=1'-0"

LINFIELD, HUNTER & JUNIUS, INC.
CONSULTING ENGINEERS AND ARCHITECTS
3500 North Causeway Blvd. Suite 200
Metairie, Louisiana 70002

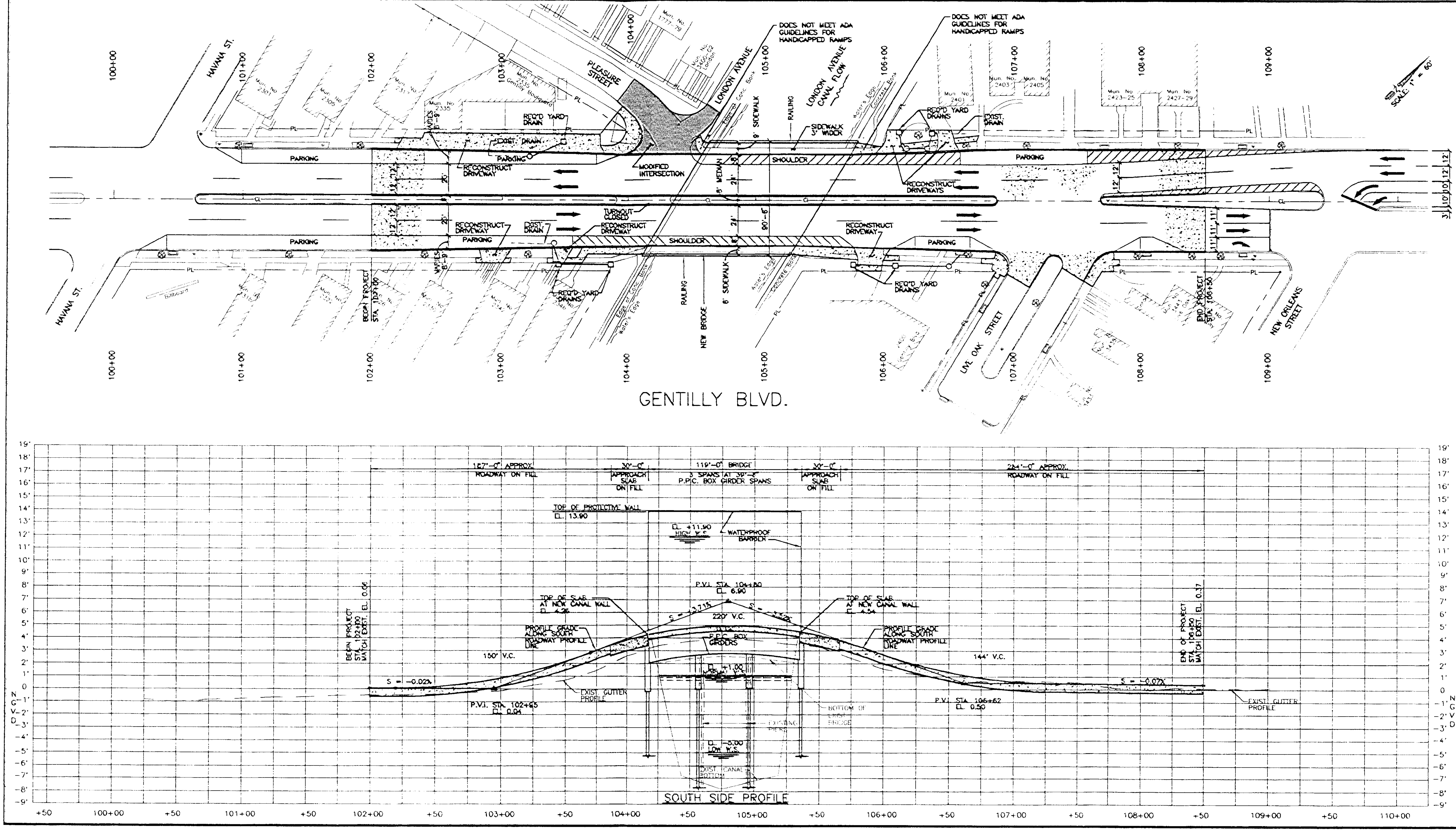
SEAL

REV. NO.	DATE

ORLEANS LEVEE DISTRICT
LONDON AVENUE OUTFALL CANAL
BRIDGE REMEDIATION SUPPLIMENTAL DESIGN MEMORANDUM

THIS SHEET: EXISTING GENTILLY BLVD. BRIDGE
DRAWN BY: T.B.F
CHECKED BY
APPROVED BY
CAD FILE NO. 9260

PROJ. NO. 92-60
DATE 6/07/94
SHEET NO. FIGURE 4
OF SHEETS



LINFIELD, HUNTER & JUNIUS, INC.
CONSULTING ENGINEERS AND ARCHITECTS
3500 North Causeway Blvd. Suite 200
Metairie, Louisiana 70002

ORLEANS LEVEE DISTRICT
LONDON AVENUE OUTFALL CANAL
WAIVER STUDY REPORT

GENTILLY BLVD. SEALED BRIDGE

PROJ. NO. 92-60
DATE 8/31/90

FIGURE
5