



## Technical Memorandum

September 22, 2015

Attention: Jason Waldron, PE

From: Lucas L. Olson, PE; Cory Imhoff, PE

**RE: Cost to extending KC Streetcar north approximately ½ mile**

HDR was asked for their opinion on the rough order of magnitude cost to extend the streetcar north approximately ½ mile from the intersection of 3<sup>rd</sup> Street and Grand Boulevard to the riverfront area (approximately the intersection of River Front Rd and Front St). This effort includes looking at two potential alternatives. One includes accessing the riverfront via the existing Grand Boulevard viaduct and the other includes a new structure east of the Heart of America Bridge to access the riverfront. This evaluation should be considered a “high level” analysis that looked primarily at cost and at select areas (such as the existing structure) for feasibility. It is intended to support early decision making but should be considered preliminary and will require a more detailed study in order to validate the assumptions made and refine the cost estimate further. For the purpose of this initial memo, the lower cost option to use the existing Grand Boulevard viaduct was the main focus for evaluation. A new structure was discussed and would cost approximately \$13.2 million (see appendix D) which is almost as much as the entire cost of building the streetcar on Grand Boulevard (not including vehicles and other non-construction costs). Given the cost difference and lack of definition (i.e. knowing where and how a new viaduct would cross into the riverfront area), our effort was focused on the lowest cost option to extend the existing line along Grand Boulevard using the existing streets and structures.

Our preliminary analysis indicates that extending the alignment north to the riverfront on the existing Grand Boulevard structure is very likely feasible and would cost approximately \$29.5 million in today’s (2016) dollars. A graphic of the proposed double track alignment can be found in Appendix A along with a detailed cost estimate in appendix B. The following sections of this memo include cost assumptions and a preliminary discussion on the potential structural feasibility of using the Grand Boulevard Viaduct for streetcars.

### **Cost Assumptions**

Below are a number of assumptions that serve as the basis for the analysis. These are high level/general assumptions. A more detailed analysis would be needed to validate and further refine these assumptions and associated cost estimates.

### **General cost assumptions**

- Unit costs – unless otherwise noted, unit costs are primarily based on the final unit costs for the base project with some escalation or adjustment for inflation/economy of scales.
- Allowances – most of the allowances given, unless otherwise noted, are based on converting the base project total cost for a specific element into a “track foot” cost and applying it to the length of the extension. As an example signing and striping for the base project was converted to a track foot (TF) cost and then used as a TF allowance for the extension.



## **Specific assumptions by FTA Standard Cost Categories (SCC)**

### **SCC 10 – Guideway and Track elements**

- Track length - assumed double track from 3<sup>rd</sup> and Grand Boulevard to the intersection of River Front Rd and Front St. Note that neither the northbound nor the southbound tracks would use any part of the existing non-revenue track for operating on the extension (i.e. there would be 3 tracks between 3<sup>rd</sup> and 2<sup>nd</sup> on Grand, one for the existing non-revenue and 2 new revenue tracks in the existing auto lanes for NB and SB streetcars that straddle the existing, median running non-revenue track).
- Special Trackwork south – at the sound end (3<sup>rd</sup> and Grand), it was assumed that 2 turnouts would be needed to connect the NB and SB extension track with the existing loop track (creating a wye). In addition, a diamond crossing between the existing yard lead and NB extension track at 2<sup>nd</sup> and Grand Boulevard would be needed.
- Special Trackwork north – at the north end, a center platform with double track has been assumed to allow for two cars at the platform and provide the ability to “layover” a streetcar at the northern terminus. The vehicle would switch tracks (NB to SB) by using a turnout and tail track east of the center stop. Note – A double crossover to the west of the stop would provide the most efficient and flexible operations but was not used given a substantial (\$1 million plus) cost differential over the single turnout and tail track assumed.
- Existing structure – the existing Grand Boulevard structure has excess capacity and sufficient service life to be considered for the streetcar. Based on limited evaluation (see additional detail on the structural evaluation later in this memo), it appears the existing structure would likely accommodate the additional dead load and live loads of the streetcar. This assumes an approach to milling off the existing wearing surface and installing a shallow (4.5”) track slab/overlay on the existing deck similar to the approach that was used on the base project for the Delaware Street and Main Street Viaduct structures.

### **SCC 20 – Stations, Stops, etc.**

- One station was assumed to be added at the riverfront terminus. The cost was based on the average cost of the existing system with some inflation.
- The existing streetcar stop at 3<sup>rd</sup> and Grand may require modification, adjustment or relocation depending on the final configuration of the track connections at 3<sup>rd</sup> and Grand. It is a risk element that will remain unknown without further study.

### **SCC 30 – Support Facilities: Yards, Shops, etc.**

- It was assumed that an additional storage track would be built at the existing maintenance facility. This would include a new turnout and additional track. The purpose would be to accommodate an additional streetcar vehicle and provide additional flexibility within the yard.

### **SCC 40 – Sitework & Special Conditions**

- Demo/Roadway – the per-track cost of the base project was applied as an allowance for the extension.
- Utilities – an allowance of \$300/TF was used for the at-grade segments of the riverfront extension. This is entirely an assumption, as no utility information was part of these preliminary evaluations.



### **SCC 50 – Systems**

- A new substation is very likely to be required for this extension. Given the distance (approximately ½ route-mile), one (1) substation of similar size to the existing substations should suffice and was assumed in the cost estimate.
- OCS was assumed for the entire length, and the assumed cost was based on the base project pricing. This assumption was applied both on and off the structure.
- Traffic signals – 1 modified and 2 new traffic signals were assumed for the north extension at the intersections of 3<sup>rd</sup>/Grand (modified), 2<sup>nd</sup>/Grand (new) and River Front Rd/Front St (new).

### **60 – ROW, Land, Etc.**

- It was assumed that all improvements for the extension would be within public right-of-way.

### **70 – Vehicles**

- It was assumed that 1 vehicle would be needed, at a minimum, to maintain the existing peak headways at 10 minutes with the approximate ½ mile extension. The current system, with 3 vehicles in operation, can operate a 10 minute headway which equates to approximately 1 vehicle per track mile (including the spare/4<sup>th</sup> vehicle). With the addition of ½ mile/1 track mile of track, using the same ratio (1 vehicle/track mile) a 5<sup>th</sup> vehicle would be needed. This would allow for 4 vehicles operating and 1 spare or a 25% spare ratio. While this is above the typical 20% desired spare ratio, it only includes 1 spare and therefore it may be advisable, if within the budget, to consider purchasing a 2<sup>nd</sup> spare vehicle.

### **80 – Professional Services**

- Similar to the base project and other streetcar projects, it assumed that the professional services would be approximately 30% of the construction cost. This would cover the City, other agency and consultant costs for design, construction management and project management support.

### **90 – Unallocated Contingency**

- Given the high level of the estimate, an unallocated contingency was used in lieu of splitting the contingency between allocated and unallocated contingencies. 30% was used for this estimate given the limited level of detail. As additional detail is developed the contingency should reduce.

### **Grand Boulevard Viaduct – Structural Considerations**

The plans for this bridge were released for construction on August 8, 1997. The design criteria was the 1992 Editions of the AASHTO Standard Specifications (LFD) with interims through 1995. The design followed normal practice at the time utilizing MODOT criteria in addition to the AASHTO criteria for HS20 Modified Loading and a 35psf future wearing surface allowance. The structure is a continuous composite chorded plate girder. Select plan sheets from the record drawing set are attached for reference and can be found in Appendix C.

Spans range from 73'-0" to 122'-0" with a total structure length of 1302'-6". The roadway width is 29'-8" with a 32'-0" out-to-out deck width. The deck is 8 ½" thick with 5 ½" cast-in-place concrete on 3" precast prestressed panels. Clear cover to top reinforcement is 2 ¾".



Vertical clearance to the coal chute near the west end of the bridge is approximately 22.65'. Vertical clearance to the superstructure of the Heart Of America Bridge is approximately 19.12' and the Max vertical grade per the as-built drawings is 5.16%.

The Inventory Rating is 38 Tons, the Operating Rating is 63 Tons and the Sufficiency Rating is 77.6 based on information obtained from MoDOT's current Structural Inventory and Appraisal Sheet. Deck, Superstructure and Substructure all received condition ratings of 8 out of 10. The structure is in good condition, with repair of general deterioration recommended at an estimated cost of approximately \$5 Million (FY 2015). There are no load postings and no known condition issues of serious concern. The current SI&A is also attached.

Based on results of prior studies completed on structures along Main Street and Grand Boulevard for the first phase of streetcar, this structure compares favorably and should be a good candidate for retrofits necessary to support streetcar infrastructure and loading.

The combination of an unutilized 35psf future wearing surface allowance, original design loading of HS20 Modified (25% increase over and above typical HS20 loading) , 2 3/4" clear cover to top mat of deck reinforcing, rating information and condition information are all indicative of a structure that can be successfully retrofitted to support streetcar infrastructure. The method of construction would include milling 1 1/2" of existing concrete and overlaying (with embedded streetcar rails) with a 4 1/2" low slump concrete overlay. The net increase in dead load is 37.5psf whereas the original allowance for future wearing surface was 35psf.

Items of concern include the need to reset grated drain inlets, resetting finger plate expansion joints, vertical clearances for overhead catenary systems below the coal chute and Heart of America Bridge and the use of precast prestressed panels for deck forming. Further, in-depth studies of these items would need to be completed to confirm that a streetcar retrofit is reasonable, cost effective and maintainable. However, these items are not deemed to be fatal flaws at this time.

### **Conclusion**

The double track on Grand Boulevard alternative appears to be feasible and substantially cheaper than building a new structure. The total cost is approximately \$29.5 million in 2016 dollars. For each year beyond 2016 an annual inflation factor of approximately 3% should be used to approximate the cost increase due to inflation. In order to further define the project details, evaluate feasibility and refine the cost estimate, additional analysis will be required. Please review this initial memo and findings and let HDR know if you have additional questions or would like additional detail.

### **Attachments**

- Appendix A – Graphic of Proposed Extension on Grand Boulevard
- Appendix B – Cost estimate for Grand Boulevard alternative using the existing viaduct
- Appendix C – Select structural drawings/load ratings of the Grand Boulevard Viaduct
- Appendix D – Rough order of magnitude cost for a new structure







Appendix A – Graphic of Proposed Extension on Grand Boulevard





**Appendix B – Cost estimate for Grand Boulevard alternative using the existing viaduct**





Kansas City Streetcar - Waterfront Extensions Order of Magnitude Cost				
Double Track on Grand Blvd				Date 9.18.2015
ITEM	Qty	Unit	Unit Price	Subtotal
<b>10 GUIDEWAY &amp; TRACK ELEMENTS (ROUTE MILES)</b>				<b>\$ 4,177,452.38</b>
GUIDEWAY: AT-GRADE IN MIXED TRAFFIC				\$ 130,900.00
BASE/SUBGRADE ALLOWANCE	3,740	TF	\$ 35.00	\$ 130,900.00
GUIDEWAY: AERIAL STRUCTURE				\$ 790,200.00
MILL 1.5" FROM BRIDGE DECK	4,500	SY	\$ 5.57	\$ 25,075.35
PLACE 4.5" CONCRETE WEARING COURSE	4,500	SY	\$ 83.73	\$ 376,779.15
OCS BLISTERS ON BRIDGE (2 @ 80' CENTERS)	34	EA	\$ 3,300.00	\$ 112,200.00
MISC. CONDUITS ON BRIDGE (ALLOWANCE)	1	LS	\$ 276,145.50	\$ 276,145.50
TRACK: EMBEDDED				\$ 2,356,352.38
EMBEDDED TRACK, 112 TRAM ON STEEL TIES	3,440	TF	\$ 350.23	\$ 1,204,794.30
EMBEDDED TRACK, 112 TRAM OVER GRAND VIADUCT	2,730	TF	\$ 372.37	\$ 1,016,558.09
EMBEDDED TRACK 112 TRAM PRECURVED	300	TF	\$ 450.00	\$ 135,000.00
TRACK: SPECIAL (SWITCHES, TURNOUTS)				\$ 900,000.00
25M EMBEDDED TURNOUT	3	EA	\$ 200,000.00	\$ 600,000.00
EMBEDDED DIAMOND CROSSING	1	EA	\$ 300,000.00	\$ 300,000.00
<b>20 STATIONS, STOPS, TERMINALS, INTERMODAL (NUMBER)</b>				<b>\$ 150,000.00</b>
AT-GRADE STATION, STOP, SHELTER, MALL, TERMINAL, P				\$ 150,000.00
NEW STREETCAR STOP	1	EA	\$ 150,000.00	\$ 150,000.00
<b>30 SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS</b>				<b>\$ 373,064.24</b>
YARD AND YARD TRACK				\$ 373,064.24
NEW YARD TRACK (FOR ADDITIONAL STORGE)	300	TF	\$ 326.88	\$ 98,064.24
25 METER #4 YARD TURNOUT	1	EA	\$ 175,000.00	\$ 175,000.00
SITE CIVIL ALLOWANCE FOR YARD	1	LS	\$ 100,000.00	\$ 100,000.00
<b>40 SITEWORK &amp; SPECIAL CONDITIONS</b>				<b>\$ 4,252,951.32</b>
DEMOLITION, CLEARING, EARTHWORK				\$ 130,900.00
DEMO ALLOWANC	3,740	TF	\$ 35.00	\$ 130,900.00
SITE UTILITIES, UTILITY RELOCATION				\$ 1,122,000.00
UTILITY ALLOWANCE	3,740	TF	\$ 300.00	\$ 1,122,000.00
AUTOMOBILE, BUS, VAN ACCESS WAYS INCLUDING ROADS,				\$ 830,090.00
ROADWAY/SIDEWALK ALLOWANCE	3,740	TF	\$ 140.00	\$ 523,600.00
SIGNAGE ALLOWANCE	3,740	TF	\$ 6.00	\$ 22,440.00
STRIPING ALLOWANCE	6,470	TF	\$ 15.00	\$ 97,050.00
STREET LIGHTING ALLOWANCE	3,740	TF	\$ 50.00	\$ 187,000.00
TEMPORARY FACILITIES AND OTHER INDIRECT COSTS DUR				\$ 2,169,961.32
CONTRACTOR INDIRECTS ALLOWANCE	20%	LS	\$ 10,849,806.62	\$ 2,169,961.32
<b>50 SYSTEMS</b>				<b>\$ 4,066,300.00</b>
TRAFFIC SIGNALS AND CROSSING PROTECTION				\$ 750,000.00
TRAFFIC SIGNAL ALLOWANCE (NEW/MODIFIED)	3	EA	\$ 250,000.00	\$ 750,000.00
TRACTION POWER SUPPLY: SUBSTATIONS				\$ 1,250,000.00
NEW SUBSTATION	1	EA	\$ 1,250,000.00	\$ 1,250,000.00
TRACTION POWER DISTRIBUTION: CATENARY AND THIRD R				\$ 2,066,300.00
OCS FOUNDATIONS ALLOWANCE	3,740	TF	\$ 120.00	\$ 448,800.00
OCS POLES, SUPPORTS AND CABLE ALLOWANCE	6,470	TF	\$ 250.00	\$ 1,617,500.00

Kansas City Streetcar - Waterfront Extensions Order of Magnitude Cost					
Double Track on Grand Blvd				Date	9.18.2015
ITEM	Qty	Unit	Unit Price	Subtotal	
<b>60 ROW, LAND, EXISTING IMPROVEMENTS</b>				\$ -	
<b>70 VEHICLES (NUMBER)</b>				\$ 5,750,000.00	
STREETCAR VEHICLE	1	EA	\$ 4,750,000.00	\$ 4,750,000.00	
VEHICLE CONSULTANT	1	LS	\$ 750,000.00	\$ 750,000.00	
SPARE PARTS	1	LS	\$ 250,000.00	\$ 250,000.00	
<b>80 PROFESSIONAL SERVICES</b>				\$ 3,905,930.38	
PROFESSIONAL SERVICES ALLOWANCE (30%)	1	LS	\$ 3,905,930.38	\$ 3,905,930.38	
<b>90 UNALLOCATED CONTINGENCY</b>	<b>30%</b>	<b>LS</b>	<b>\$ 22,675,698.33</b>	<b>\$ 6,802,709.50</b>	
<b>100 FINANCE CHARGES</b>					
<b>TOTAL COST</b>				<b>\$ 29,478,407.82</b>	

2016 Dollars





**Appendix C – Select structural drawings/load ratings of the Grand Boulevard Viaduct**



# PORT AUTHORITY OF KANSAS CITY, MISSOURI

## GRAND BOULEVARD VIADUCT REPLACEMENT

**LEGEND**

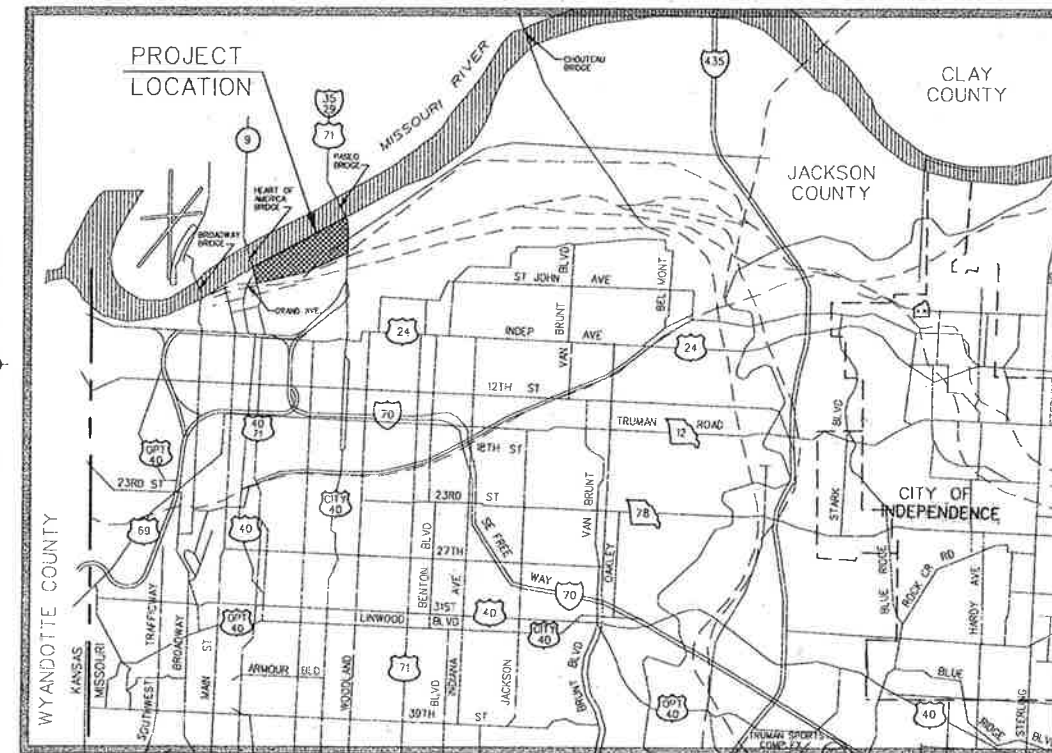
△	SURVEY CONTROL POINT	□	GRATE INLET
⊕	BENCH MARK	○	STORM SEWER MANHOLE
⊙	PROPERTY CORNER	○	SANITARY SEWER MANHOLE
⊙	ELECTRICAL MANHOLE	⊙	FIRE HYDRANT
⊙	LIGHT POLE	⊙	WATER METER
⊙	POWER POLE	⊙	WATER VALVE
⊙	TRAFFIC SIGNAL	→	GUY WIRE
⊙	TELEPHONE POLE	→	GUY WIRE W/ POLE
⊙	GAS METER	⊙	SIGN
⊙	GAS VALVE	⊙	TREE (DECIDUOUS)
⊙	TREE (DECIDUOUS)	⊙	TREE (CONIFEROUS)

**EMERGENCY UTILITY NUMBERS**

AMERICAN CABLEVISION	358-5360, EXT. 333 OR 338
AT&T	1-800-252-1133
K.C.P. & L. COMPANY	471-5275
KCMO - STREET & TRAFFIC DIVISION DISPATCHER	871-3275
KCMO - WATER SERVICES DEPARTMENT	274-1256 AFTER 5 PM, 274-2464
MCI/WESTERN UNION	314-291-8000
MISSOURI GAS ENERGY	1-800-562-0000
MISSOURI PUBLIC SERVICE COMPANY	353-5000
SOUTHWESTERN BELL TELEPHONE COMPANY	DIAL "0" ASK FOR ENTERPRISE 9800

**UTILITY CONTACTS**

UTILITY LOCATION MARKING	1-800-DIG-RITE
PUBLIC WORKS DEPT.	871-3245
WATER DEPT.	274-1755
MISSOURI GAS ENERGY (MGE)	472-3484
K.C.P.L. CO. NO. of 39th St.	245-3647
K.C.P.L. CO. SO. of 39th St.	276-5578
S.W. BELL TEL. CO.	676-1859
AMERICAN CABLEVISION	358-5360
POLLUTION CONTROL	274-2800
A.T.&T. CO.	1-800-852-3786
WESTERN UNION COMPANY	1-201-986-5100
MCI TELECOMMUNICATION	1-800-950-5555
MISSOURI PACIFIC R.R.	1-800-336-9193
U.P. COMMUNICATION DEPT.	1-712-329-5056



LOCATION MAP  
NOT TO SCALE

**LENGTH OF PROJECT**

BEGINNING OF PROJECT	STA. 97+25.00
END OF PROJECT	STA. 117+00.00
PROJECT LENGTH	1,975.00'
BRIDGE LENGTH	1,302.50'

**DESIGN DESIGNATIONS**

A.D.T. = 25,000 (2010)
D.H.V. = 2,500
D. = 60%
T. = 5%
V. = 40 mph

Revised Construction Issue 8/20/97  
Construction Issue 5/5/97  
Partial Foundation Package No. 2  
10/10/97  
8/8/97  
Partial Foundation Package

**TALIAFERRO & BROWNE, INC.**  
CONSULTING ENGINEERS-ARCHITECTS  
KANSAS CITY, MISSOURI

**McKnight Associates**  
Landscape Architects & Urban Designers  
809 Walnut, Kansas City, Missouri 64108

**JBM**  
Engineers & Planners  
a division of  
**TRANSYSTEMS CORPORATION**

**BOYD BROWN STUDE & CAMBERN**  
CONSULTING ENGINEERS  
a division of  
**TRANSYSTEMS CORPORATION**

**FINAL REVIEWS**

**DESCRIPTION OF WORK**

The Grand Blvd. Viaduct package is a component of the Riverfront Drive and Park development. The work involves the construction of a new viaduct to accommodate vehicular traffic associated with the proposed mixed-use development. The construction of Riverfront Drive is not included in this package.

Specifically the major work for this Grand Blvd. Viaduct package involves the construction of a 1300' long, six unit, 15 span continuous, composite steel girder bridge comprising of 2 abutments, on Mechanically Stabilized Earth approaches and 14 piers. Also included is the installation of electrical conduit and bridge lighting. The majority of the work is within the Riverfront Park Right-of-Way. The contractor's staging area is in the existing parking lot on the site.

The project construction will be overseen by a Kansas City, Missouri resident engineer. Kansas City, Missouri will perform final inspection of the viaduct before acceptance of the project. Access to/from Riverfront Drive and Grand Blvd. (north of 2nd Street) will not be permitted until all work is complete and accepted. Grand Blvd. Viaduct is proposed to be constructed in phases. The initial phase includes a two-lane roadway and eventually a four-lane roadway, with an exit ramp into the existing parking lot on the site. The proposed improvements are designed to accommodate future conditions.

NOTE: Riverfront Drive is assumed to be under construction at the same time as this Grand Blvd. Viaduct package. Coordination with the "Site Grading, Drainage, and Paving" package Contractor and utility companies, is necessary in order to construct the viaduct.

**GENERAL NOTES**

- The construction covered by these plans shall conform to the current "City Standards" and Specifications of the Public Works Department, Kansas City, MO, except as noted. The construction shall also conform to the "Missouri Standard Specifications for Highway Construction", Missouri Highway and Transportation Commission, 1996 Edition.

Exceptions:

- NONE
- 
- 

- I hereby certify that this project has been designed, and these plans prepared, to meet or exceed the design criteria of Kansas City, Missouri, in current usage except as indicated above. **FOR PLANS PREPARED BY TRANSYSTEMS.**

*[Signature]* (Name)  
5/12/97 (Date)

- Contractor shall verify location of existing utilities.
- I have reviewed these plans and understand what is proposed. The work shall be accomplished in MULTIPLE contracts with a work breakdown as follows:

- SITE CLEARING AND DEMOLITION
- VIADUCT
- GRADING, STORM DRAINAGE, AND PAVING
- PARK IMPROVEMENTS

Any incidental work not specifically permitted (i.e. final cleanup) will be completed by the Bridge contractor.

KANSAS CITY, MISSOURI PORT AUTHORITY (Owner's sign)  
(Date)

- I have not been retained to provide as-built drawings for this project. **FOR PLANS PREPARED BY TRANSYSTEMS.**

*[Signature]* (Engrs. sign)  
5/12/97 (Date)



**GENERAL NOTES**

**DESIGN SPECIFICATIONS:**

AASHTO - 1992 and Interim Specifications through 1995  
Load Factor Design  
Seismic Performance Category A  
Acceleration Coefficient = 0.05

**CONSTRUCTION SPECIFICATIONS:**

City of Kansas City, Missouri Specification, Special Provisions  
MHTC Missouri Standard Specification for Highway Construction, 1996 Edition.

**DESIGN LOADING:**

HS20 Modified  
35 psf Future Wearing Surface  
Earth 120 psf, Equivalent Fluid Pressure 45 psf  
Fatigue Stress - Case II  
Superstructure: Continuous, non-composite for dead load. Continuous, composite for live load.

**DESIGN UNIT STRESSES:**

Class B Concrete (Air Entrained) (Substructure)	$f_c = 1,200$ psi	$f'_c = 3,000$ psi
Class B1 Concrete (Air Entrained) (Cast-In-Place Concrete Pile)	$f_c = 1,600$ psi	$f'_c = 4,000$ psi
MC1B Mix No. WA 634-3/4-4 (Traprock) (Air Entrained) Superstructure	$f_c = 1,800$ psi	$f'_c = 4,500$ psi
Epoxy Coated Reinforcing Steel (Superstructure)	$f_s = 24,000$ psi	$f_y = 60,000$ psi
Reinforcing Steel (Substructure)	$f_s = 24,000$ psi	$f_y = 60,000$ psi

Note: Where Class B1 or Class B2 is referred to for the superstructure elements and approach slab in this set of plans, MC1B Mix No. WA634-3/4-4 shall be used as described above.

Structural Steel  
ASTM A709 Grade 50W Weathering Steel  $f_s = 27,000$  psi  $f_y = 50,000$  psi  
Cast-In-Place Concrete Pile Allowable Load  
(12.75' diameter Extra Strong Steel Pipe welded or seamless conforming to ASTM A-252, Grade 2 filled with Class B1 Concrete) 90 Tons per Pile  
For Precast Concrete Panel Structures, see Steel No. 88

**FABRICATED STEEL CONNECTIONS:**

Field connections, high strength bolts 3/4" diameter, holes 13/16" diameter, except as noted.

**JOINT FILLER:**

All joint filler shall meet the requirements of Std. Spec. 1057.2.4, except as noted.

**REINFORCING STEEL:**

Minimum clearance to reinforcing steel shall be 1 1/2", unless otherwise shown. All dimensions for reinforcing steel are cut to cut. Hooks and bends shall be in accordance with the CRSI Manual of Standard Practice for Detailing Reinforced Concrete Structures, stirrups and tie dimensions. Actual lengths are measured along the centerline of bar to the nearest inch.

**COATING STEEL STRUCTURES:**

The surfaces of all structural steel located under expansion joints shall be cleaned and coated with two coats of inorganic zinc primer (5 mils minimum) for a distance of 1-1/2 times the girder depth, but not less than 10 feet, from the centerline of the joint on either side of Pier 2, Pier 5, Pier 8, Pier 11 and Pier 12. The cost of coating shall be included in the contract unit price for other items.

Girder Chairs at Abutments:  
Structural Steel for the girder chairs shall be coated with one coat of inorganic zinc primer. Scratched or damaged surfaces are to be touched up in the field before concrete is poured. In lieu of coating, the girder chairs may be galvanized in accordance with ASTM A123. The cost of coating or galvanizing girder chairs shall be included in the contract unit price for other items.

**RAILROAD CONSTRUCTION CLEARANCES:**

A minimum vertical clearance of 21'-6" from the top of rails and a minimum lateral clearance of 12'-0" from the centerline of track to the nearest temporary construction falsework shall be maintained during construction.

**HIGH STRENGTH BOLTS:**

High strength bolts, nuts and washers will be supplied for quality assurance as specified in Std. Spec. 106 and Field Section (FS-712) from the Materials Manual.

**INTEGRAL ABUTMENTS:**

All concrete above the construction joint in the abutments is included with the Superstructure Quantities. All reinforcement in the abutments is included in the Estimated Quantities for Slab on Steel.

All concrete in the abutment above the top of beam and below top of slab shall be Class B2. Concrete diaphragms shall be poured prior to the slab, allowing sufficient time for the set of the concrete in the diaphragms.

**APPROACH FILL AT PILE CAP ABUTMENTS:**

Mechanically Stabilized Earth Wall (MSE) fill shall be completed to the final roadway section and up to the elevation of the bottom of the concrete approach slab within the limits of the structure and no closer than 25 feet in back of the fill face of the abutments before piles are driven for any abutments falling within the embankment section.

**PREBORE FOR PILES:**

Prebore for piles at Abutment 1, Pier 1 and Pier 6 to plan bearing elevation. Core shall be taken at these locations to avoid conflict with existing utilities.

**FINAL RAILROAD CLEARANCES:**

Final vertical clearance from the top of rail to the bottom of superstructure shall be at least 23'-6". Track elevations should be verified in the field prior to construction to determine if the final vertical clearance shown will be obtained.

**CAST-IN-PLACE CONCRETE PILE:**

Contractor shall perform a wave equation analysis to verify that stresses in the pile during driving with the proposed hammer/antivibration system do not exceed allowable stresses.

**PLATE GIRDERS WITH CAMBER:**

Plate Girders shall be fabricated to conform to the camber diagram on Sheets 44-46. Camber includes allowance for vertical curve and for dead load deflection due to concrete slab, bridge railing and structural steel.

**WEB STIFFENERS:**

Transverse web stiffeners shall be located as shown in the plan of structural steel.

**PRESTRESSED CONCRETE PANELS:**

Concrete for prestressed panels shall be Class A1 with  $f'_c = 5,000$  psi,  $f'_d = 3,500$  psi.

The top surface of all panels shall receive a scored finish with a depth of scoring of 1/8" perpendicular to the prestressing strands in the panels (See special provisions).

Prestressing strands shall be high-tensile strength uncoated seven-wire (7), low-relaxation strands for prestressed concrete conforming to AASHTO M203, except that nominal diameter of strand = 7/8" and nominal area = 0.085 sq. in. and minimum ultimate strength = 21.25 kips (250 kN). Larger strands may be used with the same spacing and initial tension. Initial prestressing force = 14.9 kips per strand.

The method and sequence of releasing the strands shall be shown on the shop drawings. Suitable anchorage devices for lifting panels may be cast in panels, provided they are shown on the shop drawings and approved by the engineer. Panel lengths shall be determined by the contractor and shown on the shop drawings.

When square end panels are used at skewed bents, and within 1'-6" of the centerline of expansion joints, it is required that the skewed portion and the area near the expansion joints be cast full depth. No separate payment will be made for additional concrete and reinforcing required.

**NEOPRENE BEARING PADS:**

Anchor Bolts shall be 1/2" diameter ASTM A709 Grade 50 steel swaged bolts and shall extend 18" into the concrete with ASTM A194 - 2, 2H or ASTM A563 - C, C3, D, D4, D43 heavy hexagon nuts. Actual manufacturer's certified mill test reports (chemical and mechanical) shall be provided. Swedging length shall be 1" less than extension into the concrete. All structural steel for anchor bolts and heavy hexagon nuts shall be coated with a minimum of two coats of inorganic zinc primer (5 mils minimum) or galvanized in accordance with ASTM A153.

Neoprene Elastomer Pads shall be 60 Durometer. The neoprene pad shall be bonded to the bearing seat with an epoxy adhesive as approved by the bearing manufacturer for bonding neoprene to concrete.

Structural Steel for the sole plate shall be ASTM A709 Grade 36 and shall be coated with a minimum of two coats of inorganic zinc primer (5 mils minimum). The sole plate shall be furnished with the bearing and field welded to the girders.

Payment for the sole plate, anchor bolts and heavy hexagon nuts shall be included in the cost of the bearing assembly. The cost of furnishing, fabricating and installing Neoprene Bearing Pad assemblies, complete in place, will be paid for at the contract unit price for Laminated Neoprene Bearing Pad (Steel Structures) or Plain Neoprene Bearing Pad (Steel Structures), each.

**FINGER PLATE EXPANSION DEVICES:**

See Steel 47 for General Notes.

**STRIP SEAL EXPANSION DEVICES:**

The expansion device shall be fabricated and installed in accordance with the recommendations of the manufacturer, and as set forth in the Special Provisions. The contractor shall verify all dimensions prior to fabrication. All welds shall conform to Section 712 of the Standard Specifications. Splices of steel extrusion shall develop full strength. All steel shall be ASTM A709 Grade 36, except steel extrusions shall be ASTM A709 Grade 50 or Grade 36. Neoprene Strip Seal shall meet ASTM D-2628. Anchors for the extrusions or armor shall be approved welded studs.

Structural Steel for the expansion device and curb plate shall be coated with a minimum of two coats of inorganic zinc primer (5 mils minimum) or galvanized in accordance with ASTM A123. Anchors need not be protected from overpray.

Payment for steel extrusions and neoprene strip seal shall be made under the contract unit price for Strip Seal Expansion Device. Payment for furnishing, coating or galvanizing and placing structural steel plates and angles shall be included in the contract unit price for Strip Seal Expansion Device.

**CONTINUOUS SLABS FOR PLATE GIRDER BRIDGES:**

The contractor shall pour and satisfactorily finish the slab pours at the rate given. Retarder, if used, shall be an approved type and retard the set of concrete to 2.5 hours. Machine finishing as specified in Section 703.3.14 will not be required.

**SLAB DRAINS:**

Slab drains may be fabricated from either 1/2" welded sheets of ASTM A709 Grade 36 steel or from 1/2" structural steel tubing ASTM A500 or A501. SNIFF reinforcing steel in field where necessary to clear drains. The drains and bracket assembly shall be galvanized in accordance with ASTM A123. All bolts, hardened washers, lock washers and nuts shall be galvanized in accordance with ASTM A153. The bolts and nut holes required to attach the bracket assembly attachment shall be located on the plate girder shop drawings.

**REINFORCED CONCRETE:**

All exposed edges of concrete shall be beveled 3/4". Construction joints shall be made only at locations shown on the plans, except with the approval of the Engineer.

**MECHANICALLY STABILIZED EARTH (MSE) WALLS:**

Factor of safety shall be 2.0 for overturning, 1.5 for sliding, and 2.0 for bearing. Random backfill to be retained by the MSE Wall shall be the same material as the granular backfill material. Fill angle = 28° (maximum) for foundation material the wall is to rest on. The fill angle for the selected granular backfill shall be determined by the wall manufacturer. All concrete for footing and coping shall be Class B1.

The boring logs, MSE Wall material recommendations, or other factual records of subsurface data and investigations performed by the Owner's geotechnical engineer for the design of this project are available from the Owner upon written request.

Panel reinforcement shall be epoxy coated. Anchorage reinforcement shall be spaced to avoid roadway drop inlet behind wall. A filter cloth shall be placed between the selected granular backfill and the random backfill. The contractor shall coordinate construction of the wall with bridge and roadway construction.

Abutment piles shall be prebored and driven before MSE Wall construction. Piles shall be cut-off at final top of pile elevation. A 2" dia. casing shall be placed around each pile, with the top of casing level with bottom of abutment beam, and filled with sand. MSE wall construction shall then proceed. The cost of the casing and sand shall be included in the unit price bid for Mechanically Stabilized Retaining Walls. The following is a list of proprietary mechanically stabilized earth retaining wall systems which may be used (Plans are included in this set):

- Reinforced Earth Company (Metallic System Only)
- VSL Corporation

**BRIDGE APPROACH SLAB:**

All concrete for the bridge approach slab and sleeper slab shall be in accordance with Section 503.17a - 4,000 psi. All joint filler shall meet the requirements of Section 1057.2.5, except as noted. The reinforcing steel in the approach slab and the sleeper slab shall be epoxy coated Grade 60 reinforcing with  $f_y = 60,000$  psi. Minimum clearance to reinforcing steel shall be 1 1/2", unless noted otherwise. Hooks and bends shall be in accordance with the CRSI Manual of Standard Practice for Detailing Reinforced Concrete Structures, stirrup and tie dimensions.

The contractor shall pour and satisfactorily finish the bridge slab before pouring the bridge approach slabs.

Payment for furnishing all materials, labor and excavation necessary to construct the approach slab, including the appendages and incidental work as shown on this sheet, complete in place, shall be considered as completely covered under the contract unit price for Bridge Approach Slab (Bridges), per sq. yd..

**CONCRETE STAIN PROTECTION:**

All exposed concrete surfaces on the curbs, railings, exposed pier areas (including bearing seats) and exposed areas of MSE Walls and coping shall be coated with a Masonry Protection System and a Graffiti Protection System. See special provisions.

**BORING LOG DATA:**

The locations of all subsurface boring for this structure are shown in the geotechnical report. The boring data for all locations indicated, as well as any other boring logs or other factual records of subsurface data and investigations performed on behalf of the Port Authority for the design of the project, is available from the Port Authority upon written request.

The Port Authority does not represent or warrant that any such boring data accurately depicts the conditions to be encountered in constructing this project. The contractor assumes all risks if any encounter in basing its bid prices, time or schedule of performance on the boring data available from the Port Authority, or on any other documentation not expressly warranted, which the contractor may obtain from the Port Authority.

**INDEX OF BRIDGE SHEETS**

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2	GENERAL NOTES & INDEX OF SHEETS
3	ESTIMATED QUANTITIES
4	SURVEY CONTROL
5-6	GENERAL PLAN AND ELEVATION
7	FOOTING LAYOUT
8-9	ABUTMENT DETAILS
10-24	PIER DETAILS
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26-33	FRAMING PLAN
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39-43	FIELD SPLICE DETAILS
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59-82	BARRIER CURB ELEVATION & DETAILS
83-85	MSE WALL DETAILS
86	ABUTMENT 1 APPROACH SLAB
87	1st STREET MODIFICATION
88	PRESTRESSED PANEL DETAILS
89	VERTICAL DRAIN AT ABUTMENTS
90-99	BILL OF REINFORCING STEEL
	REINFORCED EARTH RETAINING WALL PLANS
	VSL RETAINING WALL PLANS

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1/9/98	Revised Expansion Joints				
10/10/97	Partial Foundation Package No. 2				
8/26/97	Pile Length Revision				
8/20/97	Revised Construction Issue				
8/8/97	Partial Foundation Package				
5/5/97	Construction Issue				
DATE	REVISIONS AND ISSUES OF SHEET	NO.	BY	CHK	APP

**TALIAFERRO & BROWNE, INC.**  
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KANSAS CITY, MISSOURI

**McKnight Associates**  
Landscape Architects & Urban Designers  
200 Walnut, Kansas City, Missouri 64108

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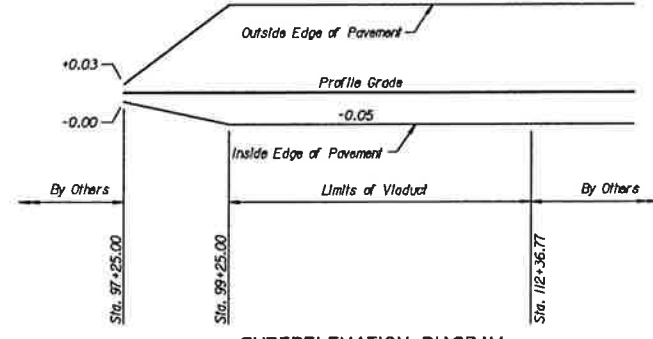
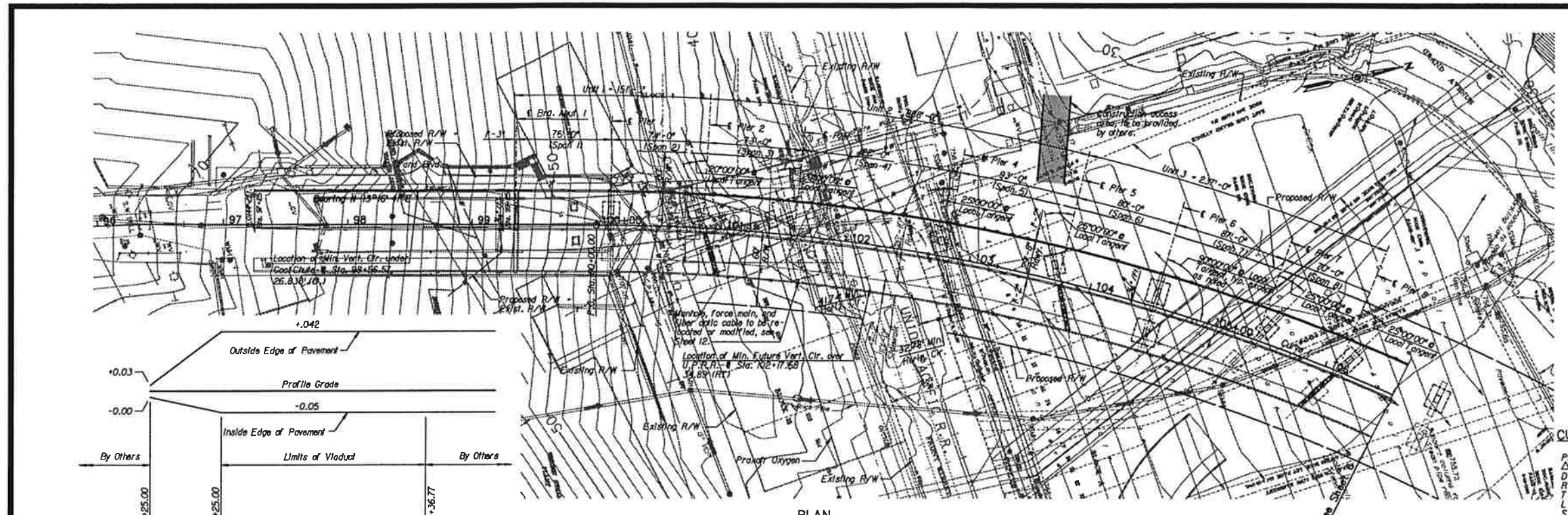
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10 PETTICOAT LANE SUITE 250  
KANSAS CITY, MO. 64108

**KRNOYD BOULEVARD VIADUCT REPLACEMENT**

**GENERAL NOTES & INDEX OF SHEETS**

DESIGNED BY	DATE	APP	DRAWN	SCALE
CHECKED BY	DATE	APP	SCALE	

PROJECT NO. 80-2000

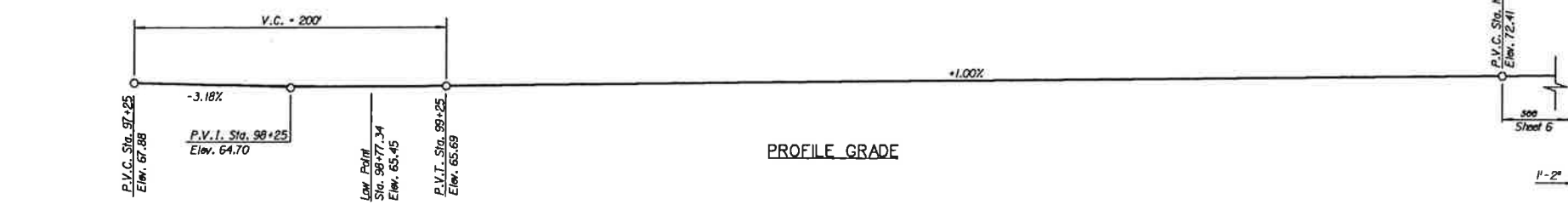


**CURVE DATA**

Curve 1  
 P.I. Sta. 109+39.68  
 $\Delta = 60^\circ 58' 37''$  (RT)  
 $D = 3^\circ 35' 23.86''$   
 $R = 1,596.000'$   
 $L = 939.683'$   
 $T = 1,688.540'$   
 $S.E. = \frac{1}{8} VFI$

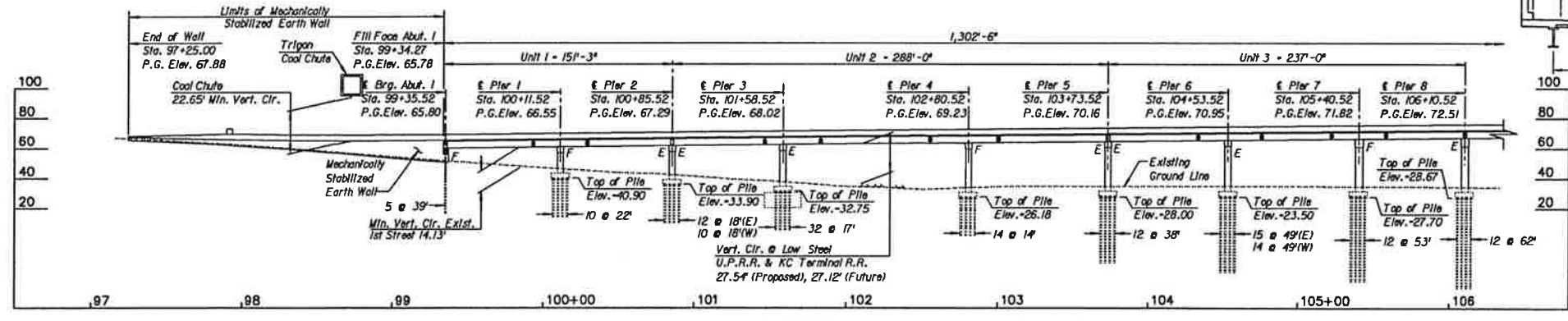
PLAN

SUPERELEVATION DIAGRAM

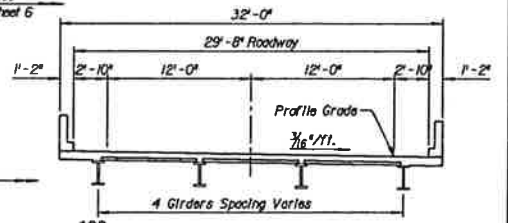


PROFILE GRADE

NOTE: THE INFORMATION SHOWN ON THIS DRAWING CONCERNING TYPE AND LOCATION OF UNDERGROUND AND OTHER UTILITIES IS NOT GUARANTEED TO BE ACCURATE OR ALL INCLUSIVE. THE CONTRACTOR IS RESPONSIBLE FOR MAKING HIS OWN DETERMINATIONS AS TO THE TYPE AND LOCATION OF UNDERGROUND AND OTHER UTILITIES AS MAY BE NECESSARY TO AVOID DAMAGE THERETO.



ELEVATION



TYPICAL SECTION THRU BRIDGE

Notes:  
 For Control Points, Bench Marks and Project References, see Sheet 4.  
 E denotes Expansion Bearing.  
 F denotes Fixed Bearing.

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DATE	DESCRIPTION AND RECORD OF REVISION	NO.	BY	DATE
9/16/97	Review Comments			
8/26/97	Pile Length Revision			
8/20/97	Revised Construction Issue			
5/5/97	Construction Issue			

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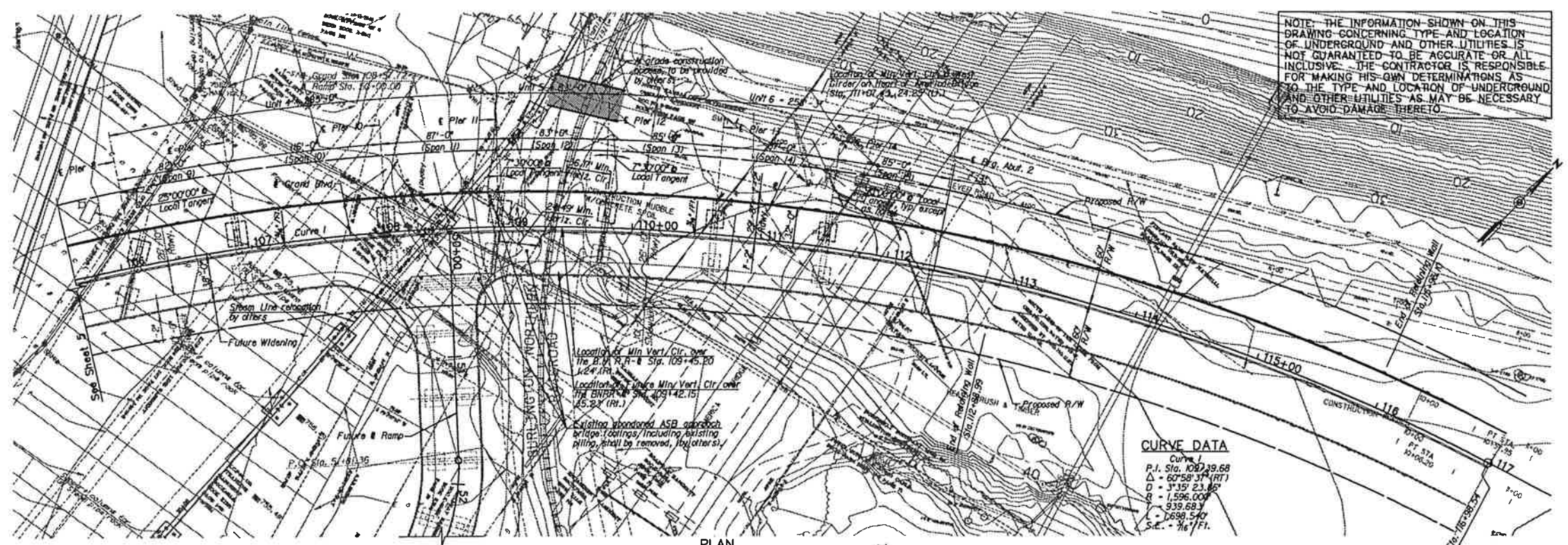
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 10 PETTICOAT LANE SUITE 250  
 KANSAS CITY, MO. 64108

**GRAND BOULEVARD VIADUCT REPLACEMENT**

**GENERAL PLAN AND ELEVATION**

DESIGNED BY	DATE	CHKD BY	DATE	DESIGNED BY	DATE	CHKD BY	DATE

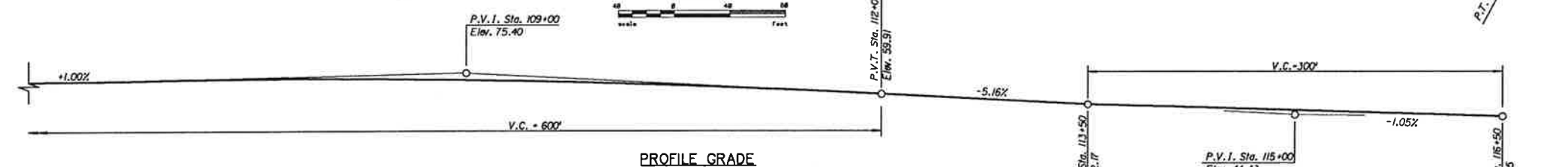




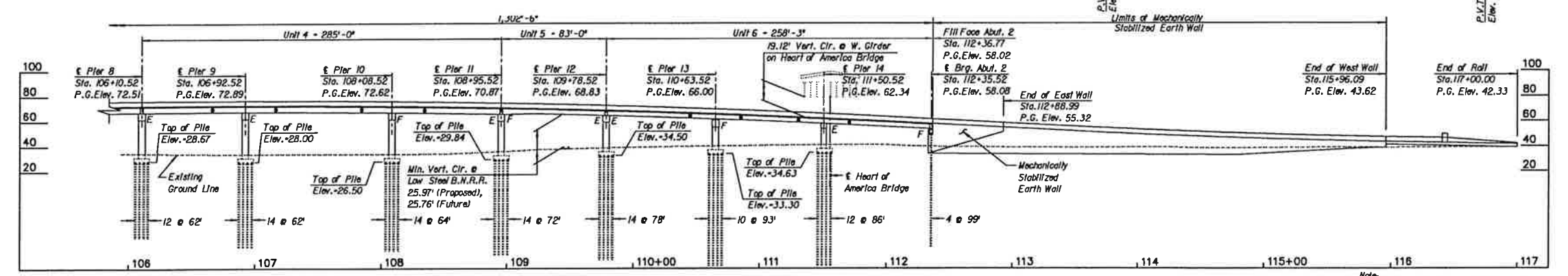
NOTE: THE INFORMATION SHOWN ON THIS DRAWING CONCERNING TYPE AND LOCATION OF UNDERGROUND AND OTHER UTILITIES IS NOT GUARANTEED TO BE ACCURATE OR ALL INCLUSIVE. THE CONTRACTOR IS RESPONSIBLE FOR MAKING HIS OWN DETERMINATIONS AS TO THE TYPE AND LOCATION OF UNDERGROUND AND OTHER UTILITIES AS MAY BE NECESSARY TO AVOID DAMAGE THERETO.

**CURVE DATA**  
 Curve 1  
 P.I. Sta. 108+39.68  
 $\Delta = 60^\circ 58' 31''$  (RT)  
 $D = 3^\circ 35' 23.86''$   
 $R = 1,596.00'$   
 $L = 339.683'$   
 $E.C. = 108+74.47$   
 $S.C. = 108+74.47$

PLAN



PROFILE GRADE



ELEVATION

Note:  
 For Control Points, Bench Marks and Project References, see Sheet 4.  
 E denotes Expansion Bearing.  
 F denotes Fixed Bearing.

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9/16/97	Review Comments	
8/26/97	Pile Length Revision	
8/20/97	Revised Construction Issue	
5/5/97	Construction Issue	
DATE	REVISION AND RECORD OF SHEET	NO. BY DATE

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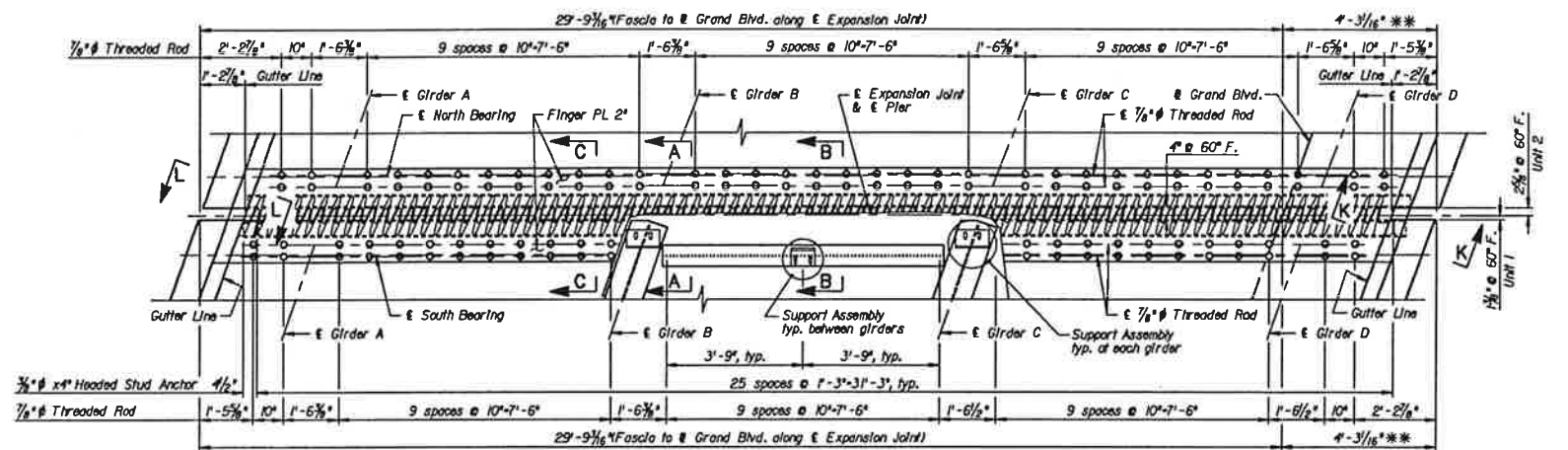
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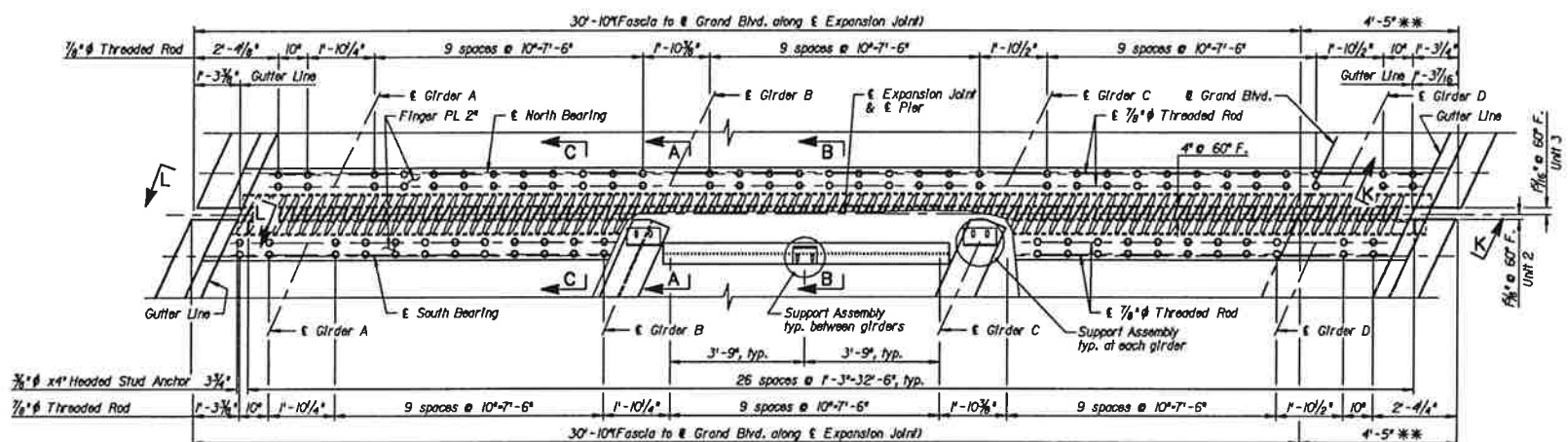
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 10 PETTICOAT LANE SUITE 260  
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**GRAND BOULEVARD VIADUCT REPLACEMENT**

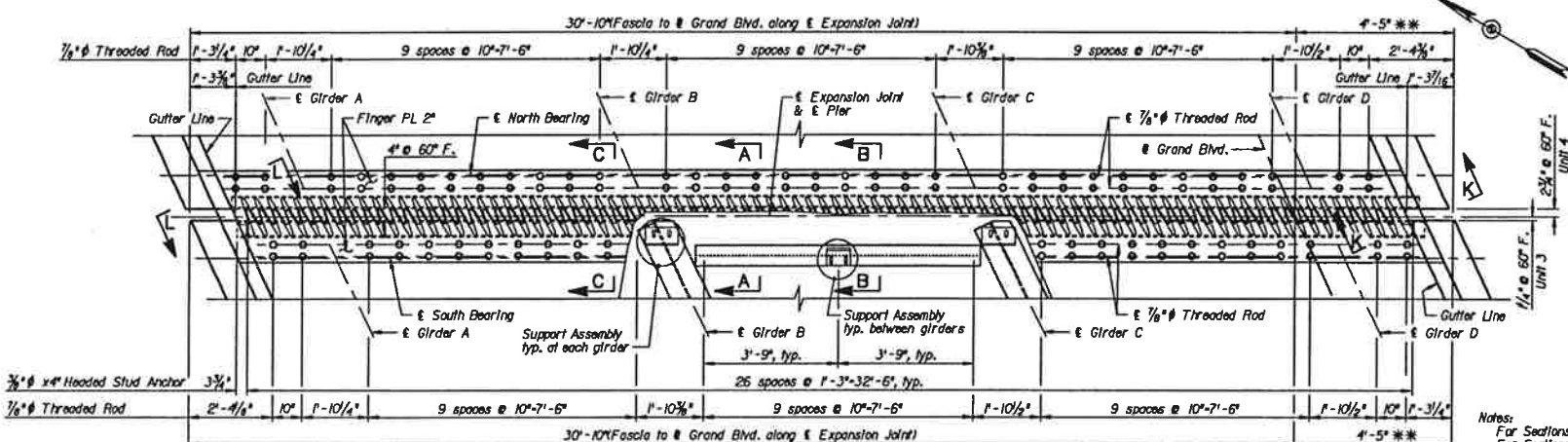
GENERAL PLAN AND ELEVATION			
DESIGNED BY	DATE DESIGNED	DETAILED BY	DATE DETAILED
CHECKED BY	DATE CHECKED	SCALE	SCALE



PIER 2  
PLAN



PIER 5  
PLAN



PIER 8  
PLAN

Notes:  
The expansion device shall be fabricated in one section, except for staged construction and when the length is over 50 feet, splicing is permissible. The expansion device shall be mitered to conform to curb and railing.

The Contractor shall verify all dimensions prior to fabrication.  
Finger plate shall be cut with a machine guided gas torch from one plate. The plate from which fingers are cut may be spliced before fingers are cut. The surface of cut shall be perpendicular to the surface of the plate. The cut shall not exceed 1/16\"/>

All welds shall conform to Section 712 of the Standard Specifications.  
Material for expansion device shall be ASTM A709 Grade 36 structural steel. Anchors for the expansion device shall be approved stud welded anchors. All 7/8\"/>

Shipping requirements for galvanized bolts and nuts must meet AASHTO requirements. The galvanized rods and nuts are to be treated as a matched assembly. Nuts and rods must be shipped together in the same shipping container in a plastic bag to protect the lubricants.

Structural steel for the joint support assemblies shall not be paid for separately but shall be considered subsidiary to the bid item "Expansion Device (Finger Plate)".

Structural steel for the expansion device shall be coated with a minimum of two coats of Inorganic zinc primer (5 mils minimum) or galvanized in accordance with ASTM A153. Anchors need not be protected from overspray.

The fabric material for the trough shall meet the requirements below and will be subsidiary to the bid item "Expansion Device (Finger Plate)". The fabric trough material shall be composed of one or two ply tightly woven nylon fabric bonded to laminated or covered on both sides with a high density polyurethane, ethylene-propylene-diene-monomer (EPDM), or buta-nitrile PVC and shall comply with the requirements listed below:

		ASTM Test Method
Thickness (Inches)	0.115-0.195	
Weight (minimum)	105 Oz./sq. yd.	
Durability hardness (Shore A)	50A to 75A	D2240
Low Temperature Brittleness	No Cracking	
(Wrapped around a 3" Dia. Mandrell)	(22 hrs at -20X F)	
Tensile Strength	800 psi min.	D-412
(Minimum both directions)		
Elongation (maximum)	30%	D-412
Tear (Dile C)	120 lbs./in.	D-624
Ozone Resistance	No Cracks for 100 hours of exposure at 20% elongated samples @ 100X F and 100 PPHM ozone.	D-1149

The material shall be resistant to abrasion, sunlight, oils, and saltwater. Material certifications, including the appropriate test results, shall be submitted to the Engineer for approval.

The fabric shall be supplied in one piece. The backside of the 1/4\"/>

Concrete shall be forced under and around finger plate supporting hardware, studs, angles and bolts. Proper consolidation of the concrete shall be achieved by localized internal vibration.

Longitudinal reinforcing steel shall be placed so that ends shall not be more than 1\"/>

The expansion device shall be installed in the following suggested sequence. The anchor units shall be in place at the proper grade and alignment. The Joint Support Assemblies shall be positioned on the framing and bolted.

The erection channels shall then be installed to bring both of the anchor units to the proper position and in place with each other. All bolts shall be retightened. The support angles shall then be placed on one side of the joint. The deck concrete shall then be placed on one side of the joint. The concrete shall be thoroughly vibrated and compacted around the anchor units so that concrete comes through the vent holes and no voids exist under the anchor unit. The erection channels shall be removed after the concrete has its initial set. After the concrete has cured a minimum of 3 days, the bolts of the other side support assembly shall be loosened. The erection channels shall be reinstalled to bring the other side up to the proper position and in one piece with the anchor unit on the poured side. The bolts shall be retightened, the erection channels removed and the angles welded. Concrete slab shall then be placed on the other side of the joint in the same manner as before. Prior to installing the finger plates, the Engineer shall sound the top plate of the anchor unit to check for voids and loose bolts. Any voids shall be filled by drilling through the top anchor plate and filled with an approved epoxy mortar. The epoxy mortar shall be pumped with a pump that will develop 75 psi. This work shall be subsidiary to "Expansion Device (Finger Plate)". After the deck concrete has cured three days, the finger plates shall be installed according to MoDOT Standard Specifications. After the finger plates have been installed, the Engineer shall inspect the plates for alignment. Any fingers that the Engineer determines to be misaligned such that they may be hit by a snow plow, shall be ground as directed by the Engineer and coating repaired.

Furnishing, coating, or galvanizing and installing the expansion device and bridge rolling plates shall be included in the contract unit price for Expansion Device (Finger Plate).

Notes:  
For Sections A-A, B-B and C-C see Sheet 48.  
For Sections K-K and L-L, see Sheet 47a  
\*\* denotes Grand Blvd. to Fascia along  
Expansion Joint  
Expansion Joint  
For girder spacing and location, see Framing Plan.  
For location of clamping plate bolt spacing, see Sheet 47a

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1/9/98	Revised Expansion Joints
8/20/97	Revised Construction Issue
5/5/97	Construction Issue
DATE	REVISION AND RECORD OF DESIGN

**TALIAFERRO & BROWNE, INC.**  
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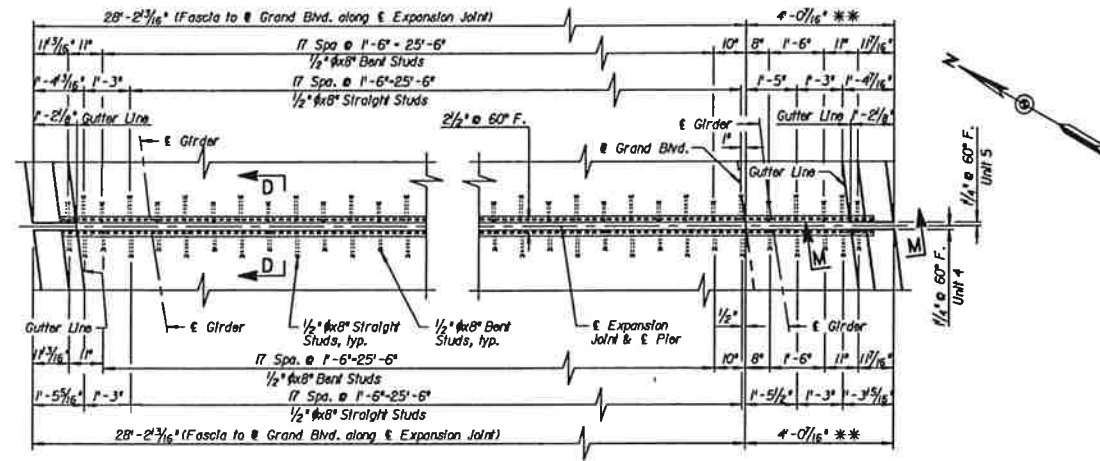
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CONSULTING ENGINEERS

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10 PETTICOAT LANE SUITE 250  
KANSAS CITY, MO. 64108

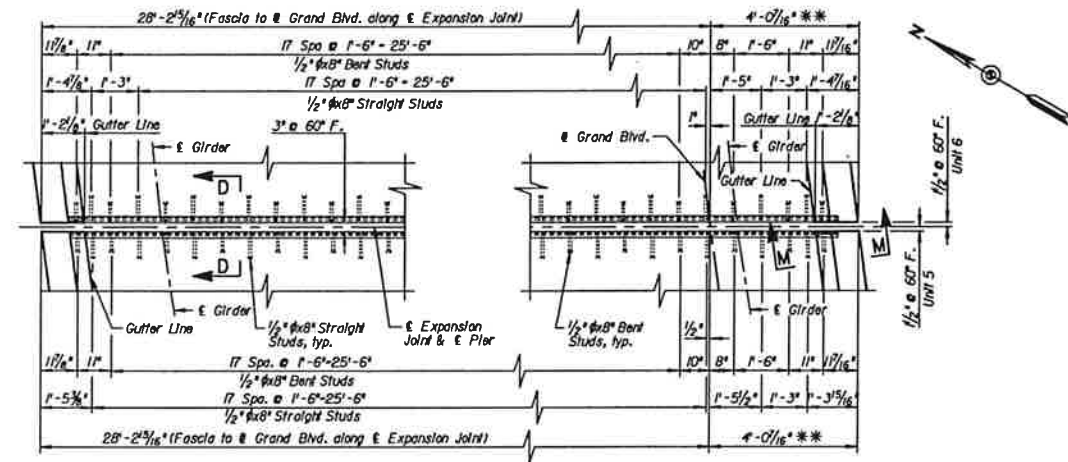
**GRAND BOULEVARD VIADUCT REPLACEMENT**

EXPANSION JOINT DETAILS			
DESIGNED BY	DATE	REVISION	DATE
DESIGNED BY	DATE	REVISION	DATE

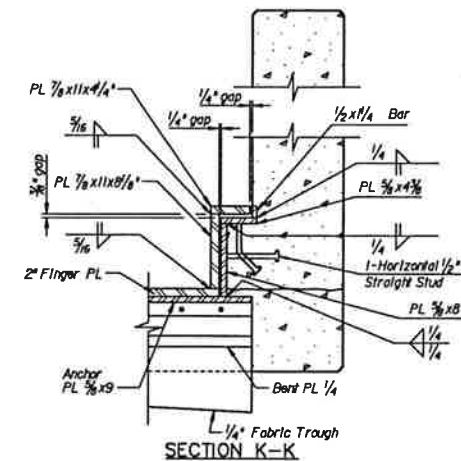




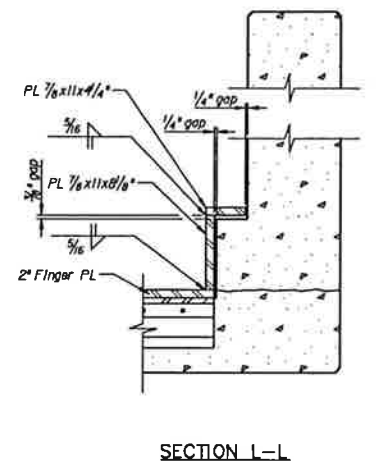
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PLAN



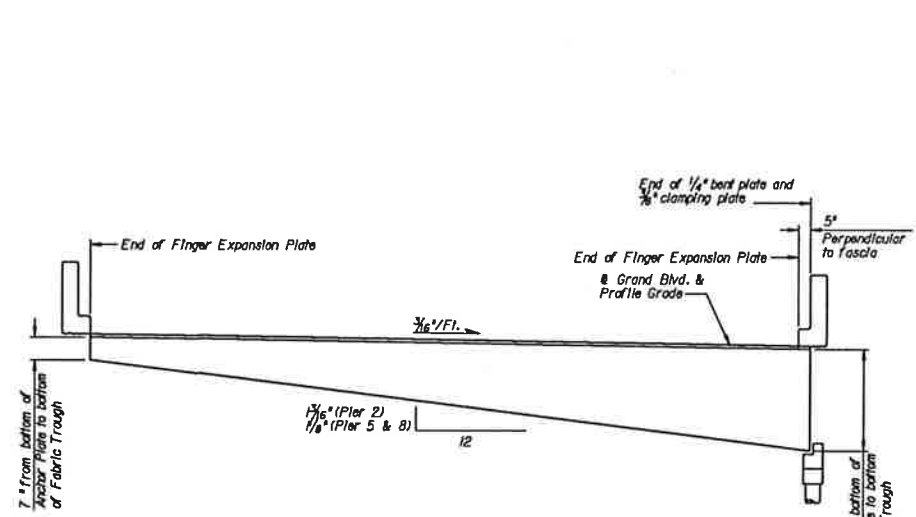
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PLAN



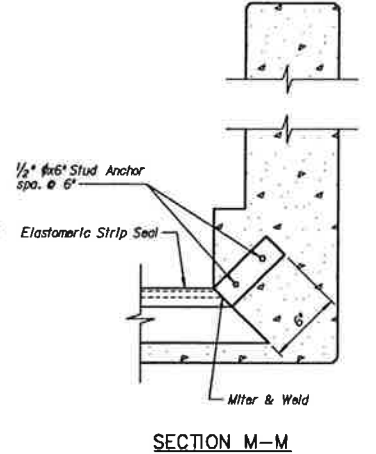
SECTION K-K



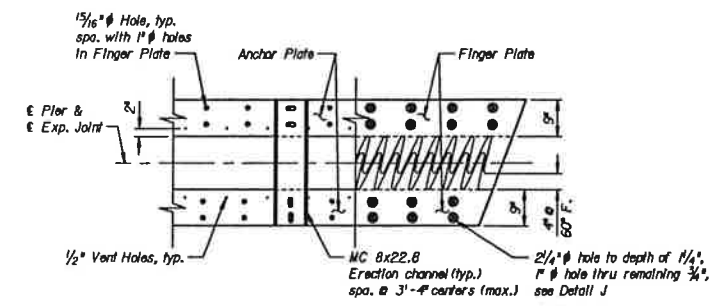
SECTION L-L



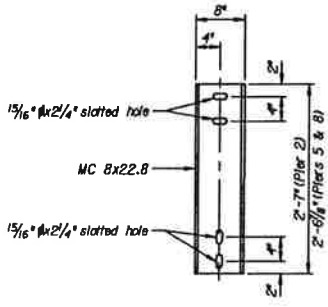
ELEVATION OF FABRIC TROUGH



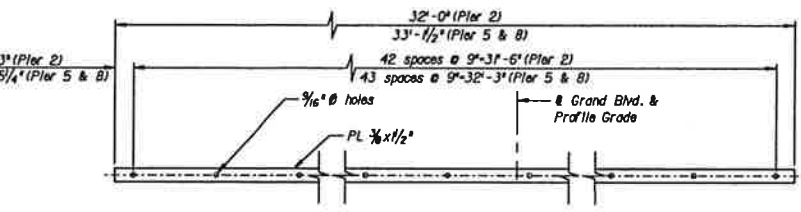
SECTION M-M



PLAN OF EXPANSION DEVICE SHOWING ERECTION CHANNEL



ERECTION CHANNEL



CLAMPING PLATE (GALVANIZED)

Notes:  
 For Section D-D and Detail J, see Sheet 48  
 \*\* denotes @ Grand Blvd. to Fascia along  
 Expansion Joint  
 For Girder spacing and location, see Framing Plan.

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1/9/98	Revised Expansion Joints
8/20/97	Revised Construction Issue
5/5/97	Construction Issue
DATE	EXTENSION AND RECORD OF REVISION

**TALIAFERRO & BROWNE, INC.**  
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 800 Walnut, Kansas City, Missouri 64106

**JBM**  
 Engineers & Planners

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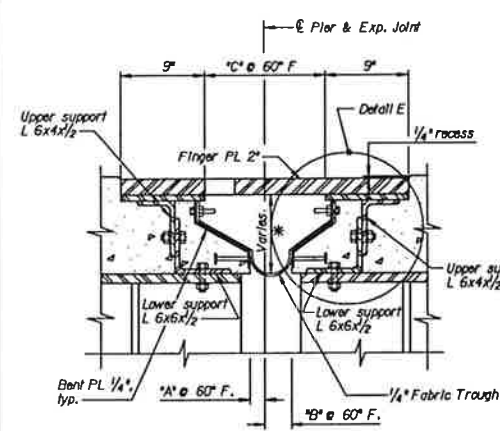
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 KANSAS CITY, MO. 64106

**GRAND BOULEVARD VIADUCT REPLACEMENT**

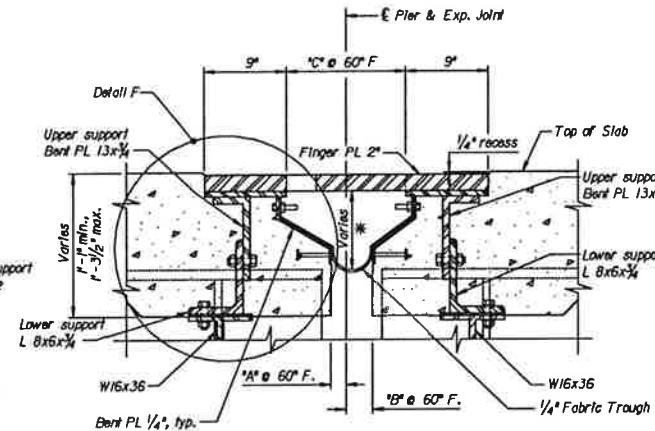
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DESIGNED BY	DATE	REVISION	DATE
CHECKED BY	DATE	DRAWN	SCALE

47a

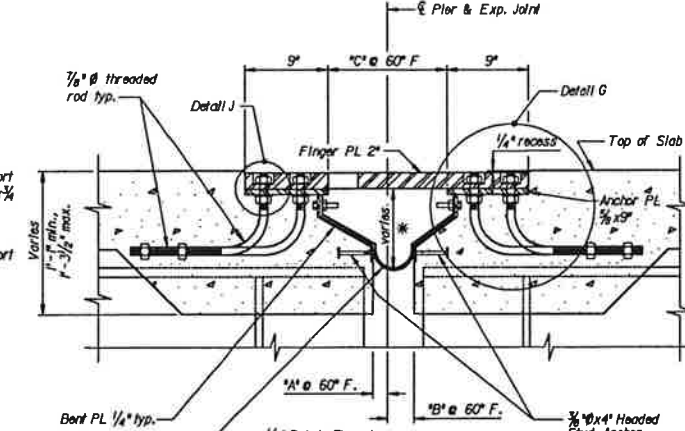
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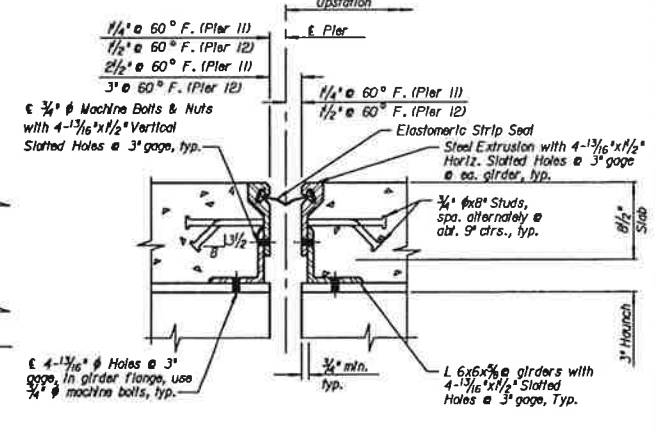
SECTION A-A @ PIERS 2.5 & 8



SECTION B-B @ PIERS 2.5 & 8



SECTION C-C @ PIERS 2.5 & 8

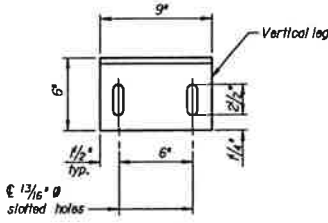


SECTION D-D @ PIERS 11 & 12

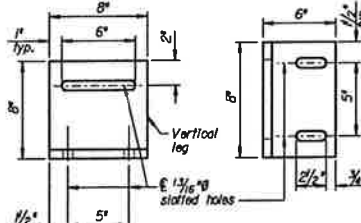
EXPANSION DIMENSION			
	"A"	"B"	"C"
Pier 2	1 3/8"	2 3/8"	1'-1"
Pier 5	1 3/8"	2 3/8"	1'-0 7/8"
Pier 8	1 3/8"	2 3/8"	1'-0 7/8"

Note: The joint hardware shall be positioned in the dock with a gap width, as shown in the details, based upon the average ambient air temperature during the 24 hour period prior to construction. The gap is based on a temperature of 60° F, measured perpendicular to the Expansion Joint. For every 10° F. increase in temperature, the gap width shall be reduced by 1/4". For every 10° F. decrease in temperature, the gap width shall be increased by 1/4".

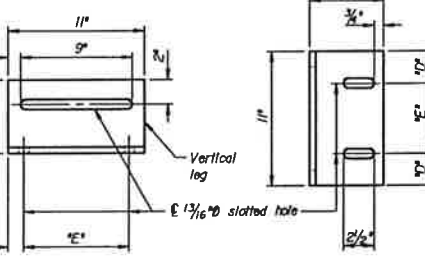
Pier	Unit	10"	14"
2	1	3 1/8"	4 3/8"
2	2	3 7/8"	4 3/8"
5	2	3 7/8"	4 3/8"
5	3	3 7/8"	4 3/8"
8	3	3 7/8"	4 3/8"
8	4	3 7/8"	4 3/8"



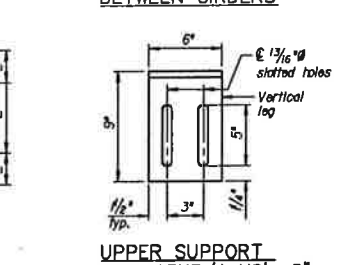
UPPER SUPPORT L 6X4X1/2 @ GIRDERS



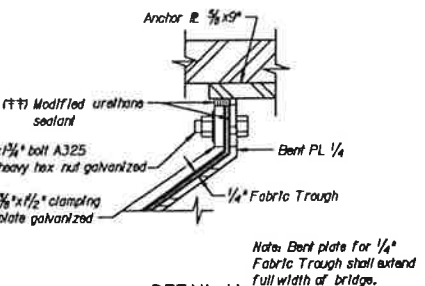
LOWER SUPPORT L 8X6X3/4 BETWEEN GIRDERS



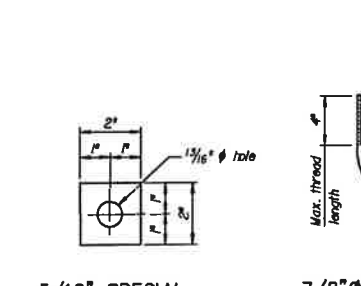
LOWER SUPPORT L 6X6X1/2 @ GIRDERS



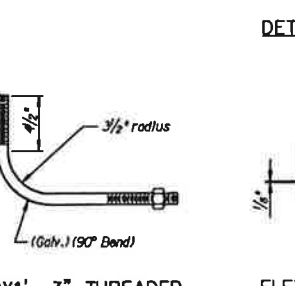
UPPER SUPPORT BENT PL 13X3/4 X 0'-6" BETWEEN GIRDERS



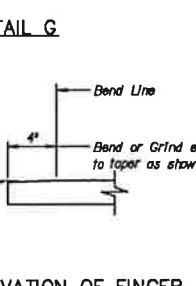
†† The backside of the 1/4" Fabric Trough shall be sealed to the 1/4" steel bent plate with a modified urethane sealant. Modified urethane sealant shall also be placed in the gap above the clamping plate and in the top holes in the finger plates.



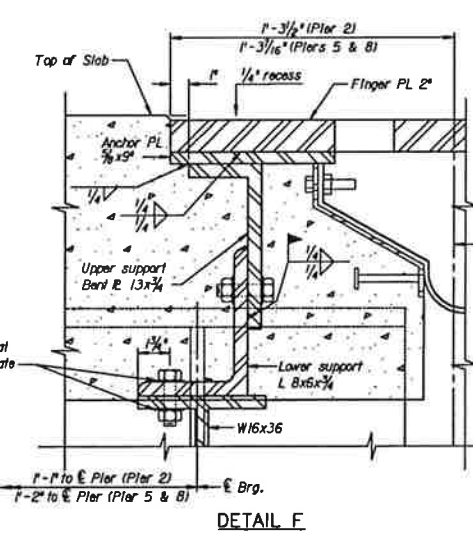
5/16" SPECIAL WASHER PLATE



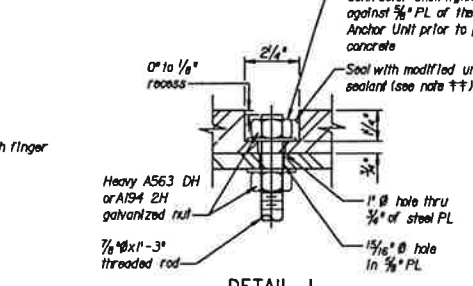
7/8" X 1' - 3" THREADED ROD W/ HEX NUT



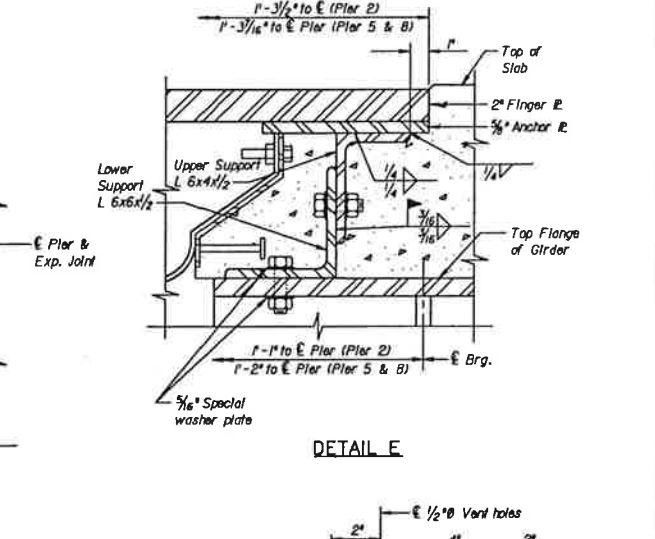
ELEVATION OF FINGER



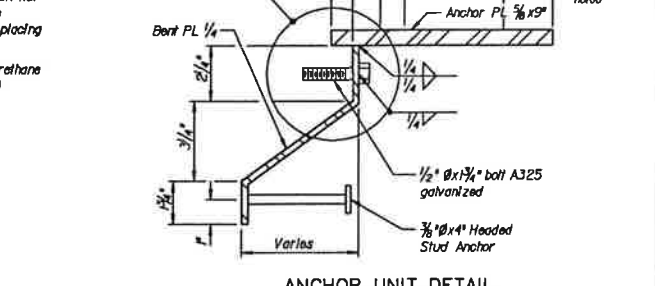
DETAIL F



DETAIL J



DETAIL E



ANCHOR UNIT DETAIL

Notes: Dimensions shown are perpendicular to centerline of joint and do not vary with skew. \* For elevation of Fabric Trough, see Sheet 47a

01/13/98 08:58:31  
\\S3P01\cadd\jrb\jrb.dwg

DATE	DESCRIPTION AND RECORD OF REVISION	NO.	BY	CHK
1/9/98	Revised Expansion Joint			
8/20/97	Revised Construction Issue			
5/5/97	Construction Issue			

**TALIAFERRO & BROWNE, INC.**  
CONSULTING ENGINEERS-ARCHITECTS  
KANSAS CITY, MISSOURI

**McKnight Associates**  
Landscape Architects & Urban Designers  
488 Walnut, Kansas City, Missouri 64104

**JBM**  
Engineers & Planners

**BOYD BROWN STUDE & CAMBERN**  
CONSULTING ENGINEERS

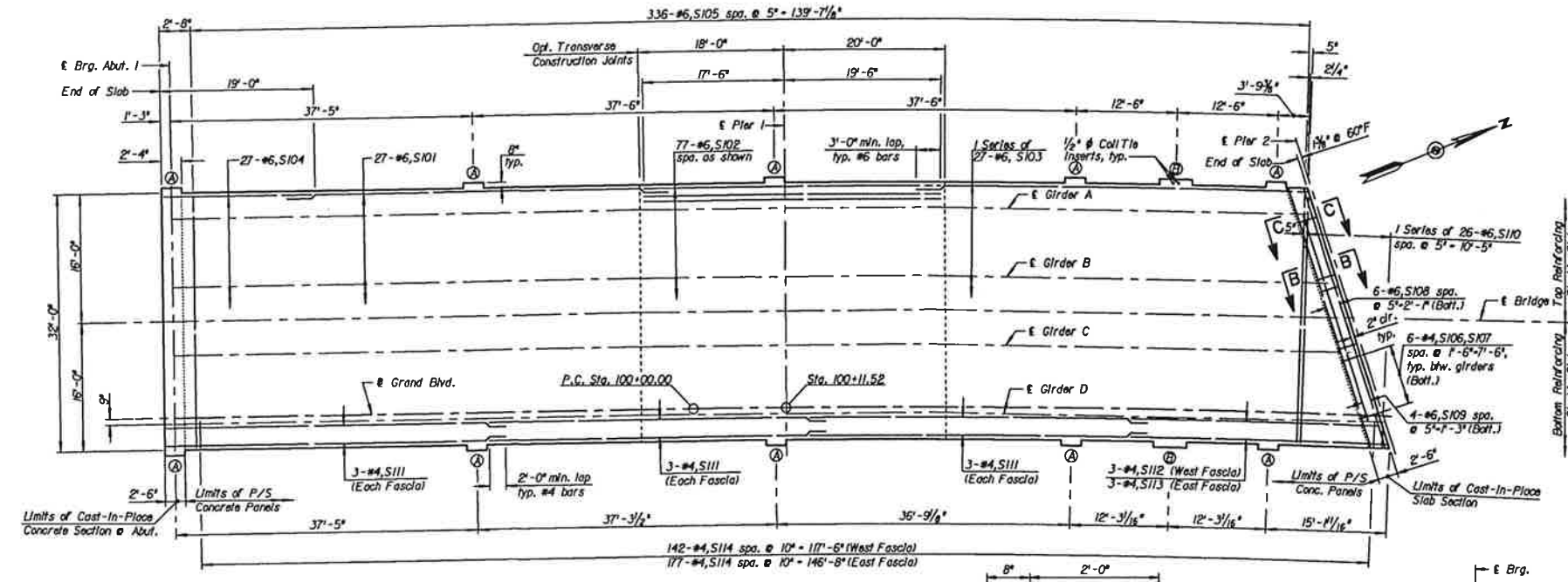
**PORT AUTHORITY OF KANSAS CITY, MISSOURI**  
10 PETTICOAT LANE SUITE 260  
KANSAS CITY, MO. 64108

**GRAND BOULEVARD VIADUCT REPLACEMENT**

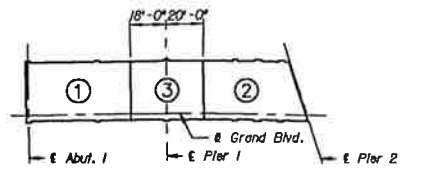
**EXPANSION JOINT DETAILS**

DESIGNED: PHE	DATE: 4-28-97	DRAWN: AM	DATE:
CHECKED: JMB	DATE: 4-28-97	SCALE:	

PROJECT NO.: PC-2099

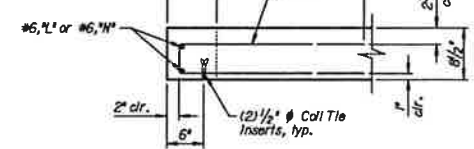


PLAN

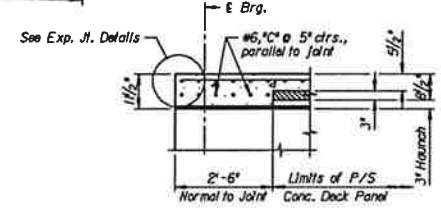


CONCRETE PLACING SEQUENCE

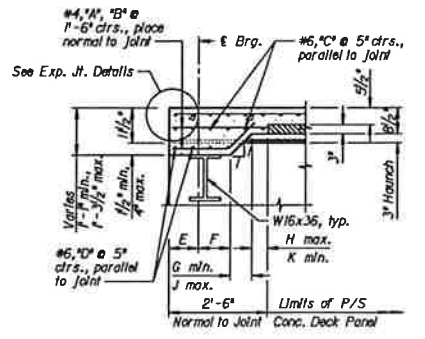
Note: Dimensions are along Grand Blvd. Joints shall be parallel to the adjoining Pier. The minimum rate of pour shall be 20 linear feet of bridge per hour and not less than 25 cu. yds. per hour. If the sequence of placing concrete in the slab is other than that shown in the Concrete Placing Sequence detail, the Contractor shall submit an alternate placing sequence for review. The alternate placing sequence shall include the proposed rate of concrete placement in cubic yards per hour, the plant capacity, a description of the equipment used in placing the concrete, proposed admixtures, and the quantity of concrete in each placing segment. Any additional cost for the Contractor's alternate plan of placing concrete, including admixtures, shall be at the Contractor's expense and shall be considered subsidiary to the bid item, "Class B2 Concrete (Air Entrained) Slab". Approval of the Contractor's alternate sequence is required prior to placement of concrete in the deck.



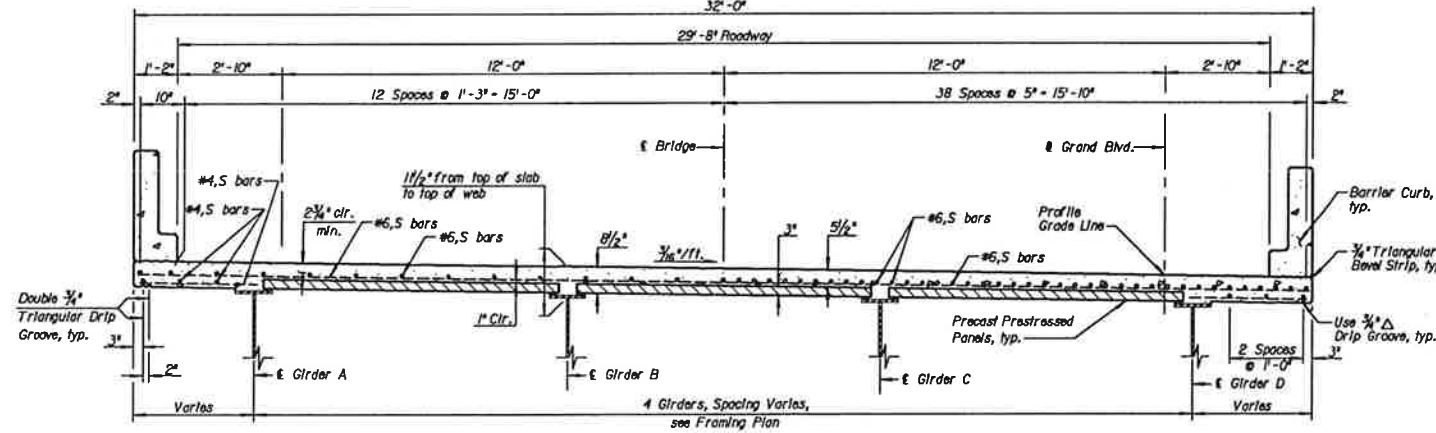
SECTION A-A



SECTION C-C



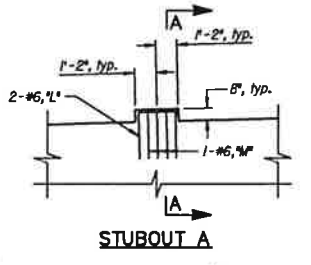
SECTION B-B



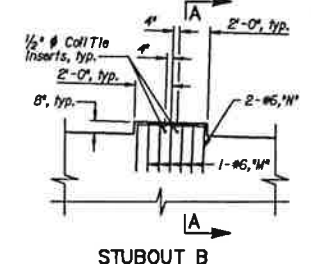
HALF-SECTION @ MID SPAN

HALF-SECTION NEAR PIER

Note: Section is similar to Units 2, 3, 4 and 6.



STUBOUT A



STUBOUT B

UNIT	PIER	A	B	C	D	E	F	G	H	J	K	L	M	N
1	2	S106	S107	S108	S109	10 3/16"	9 3/8"	5 1/2"	7"	3"	S115	S116	S117	
2	2	S204	S205	S206	S207	9 3/8"	10 3/8"	4 1/2"	5 1/2"	7"	3"	S218	S219	S220
2	5	S204	S205	S221	S222	11 3/4"	8 3/4"	4 1/2"	5 1/2"	7"	3"			
3	5	S304	S305	S306	S308	1'-0 1/16"	17 7/16"	4 1/2"	5 1/2"	7"	3"	S317	S318	S319
3	8	S304	S305	S306	S308	11 3/4"	8 3/4"	4 1/2"	5 1/2"	7"	3"			
4	8	S404	S405	S406	S407	10 1/2"	9 1/2"	4 1/2"	5 1/2"	7"	3"	S420	S421	S422
4	11	S404	S405	S418	S419	10 1/2"	9 1/2"	4 1/2"	5 1/2"	7"	3"			
5	11	S506	S507	S509	S508	10 1/2"	9 1/2"	4 1/2"	5 1/2"	7"	3"	S510	S511	S512
5	12	S506	S507	S509	S508	11"	9"	4 1/2"	5 1/2"	7"	3"			
6	12	S604	S605	S607	S606	11"	9"	4 1/2"	5 1/2"	7"	3"	S617	S618	S619

Notes:  
 For details of Precast Prestressed Panels, see Sheet B8.  
 For Bill of Reinforcing Steel, see Sheets 90 thru 99.  
 For Barrier Curb Details, see Sheets 59 thru 61.  
 For Section thru Abutment, see Abutment Details.  
 For Stubout (A) & (B) Details, see this Sheet.  
 For Sections B-B & C-C, see this Sheet.  
 Barrier Curb not shown in plan for clarity.  
 Transverse top reinforcing steel shall be placed radially measured along West fascia.

01/13/98 08:49:21  
 TA:366-00.cad/grd/slab1.sht

DATE	DESCRIPTION AND RECORD OF WORK	NO.	BY	CHK
1/9/98	Revised Expansion Joints			
8/20/97	Revised Construction Issue			
5/5/97	Construction Issue			

**TB**  
**TALLAFERRO & BROWNE, INC.**  
 CONSULTING ENGINEERS-ARCHITECTS  
 KANSAS CITY, MISSOURI

**McKnight Associates**  
 Landscape Architects & Urban Designers  
 600 Walnut Street, Kansas City, Missouri 64108

**JBM**  
 Engineers & Planners

**BOYD BROWN STUDE & CAMBERN**  
 CONSULTING ENGINEERS

**PORT AUTHORITY OF KANSAS CITY, MISSOURI**  
 10 PETTICOAT LANE SUITE 250  
 KANSAS CITY, MO. 64108

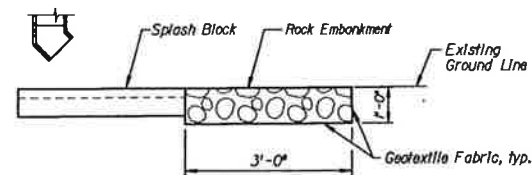
**GRAND BOULEVARD VIADUCT REPLACEMENT**

**SLAB PLAN UNIT 1**

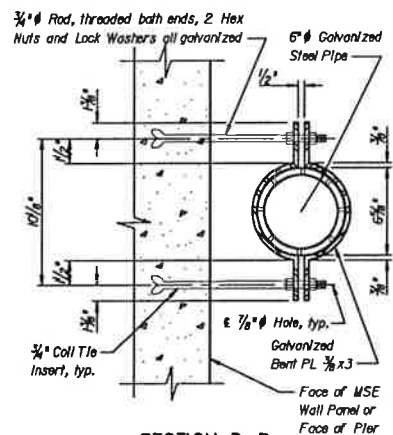
DESIGNED: PFB	DATE: 8/98	DETAILS: JFB	DATE: 8/98
CHECKED: JFB	DATE: 8/98	SCALE:	

49

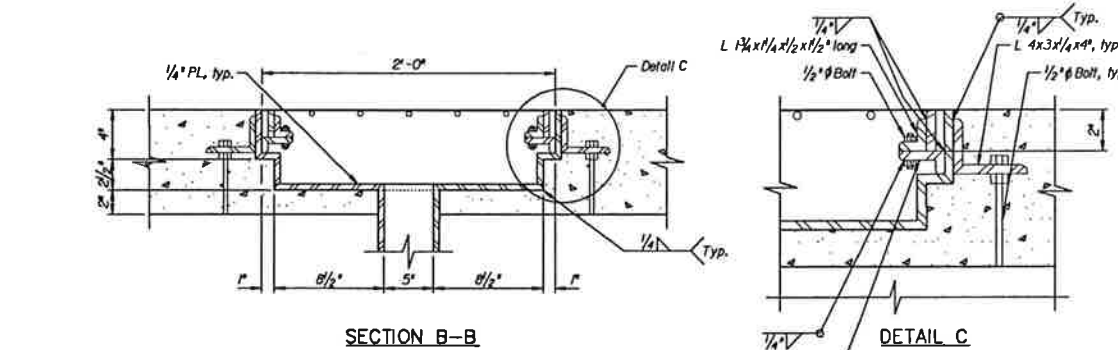
PROJECT NO.: 90-3807



SPLASH BLOCK DETAILS

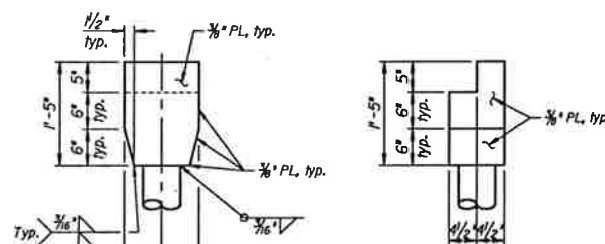


SECTION D-D



SECTION B-B

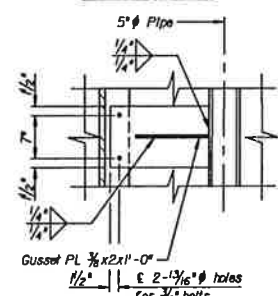
DETAIL C



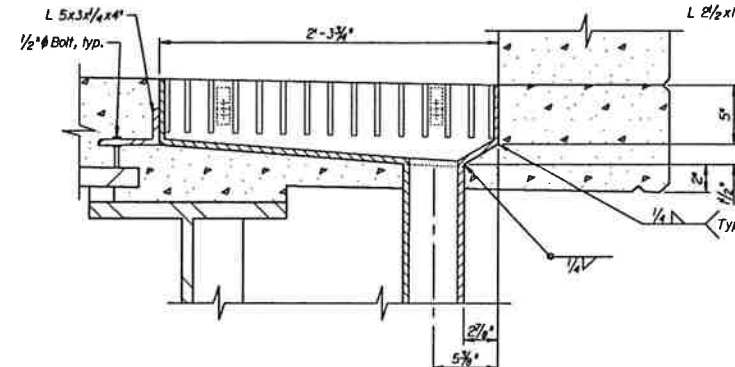
SIDE VIEW

SIDE VIEW

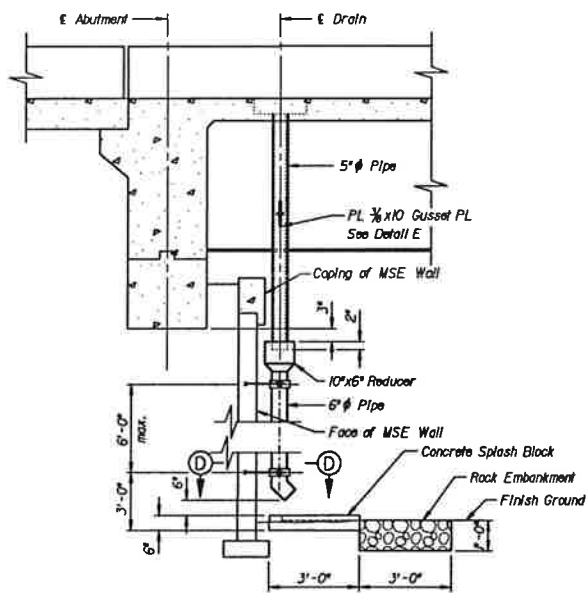
TROUGH DRAIN



DETAIL E

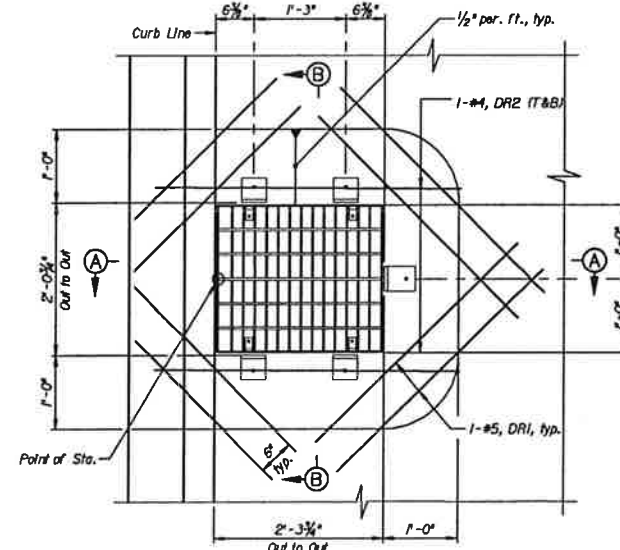


SECTION A-A

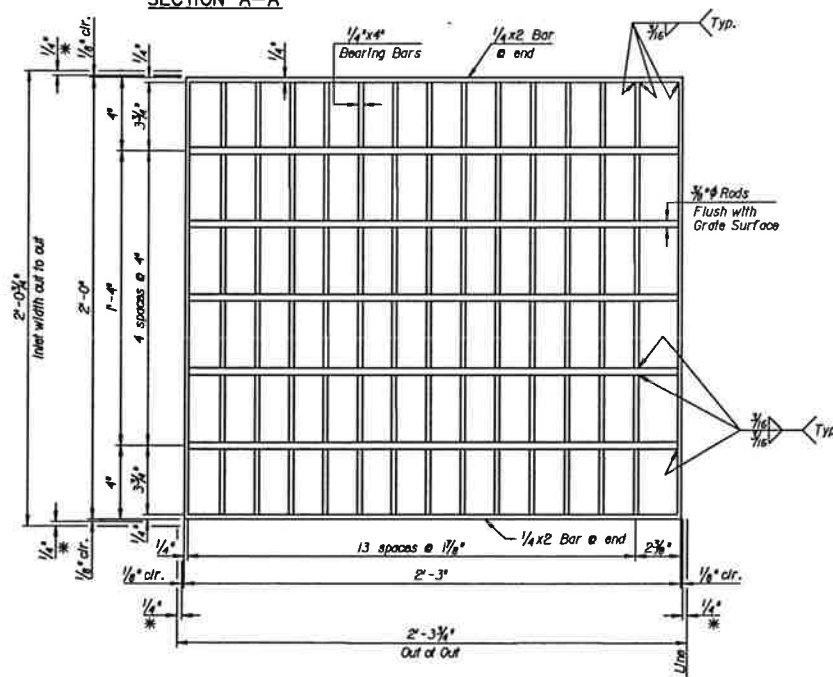


SECTION AT ABUTMENT

Note: For Location of Drain, see Sheet 55.



PLAN OF DRAIN DEPRESSION



GRATE DETAIL

\* Sidewall of drain

Note: For Location of Drains in Slab, see Sheet 55.

01/13/98 09:04:06  
E:\3616-01\lead\ar\dr02.dwg

1/9/98	Revised Expansion Joints
9/20/97	Revised Construction Issue
5/5/97	Construction Issue
DATE	REVISIONS AND RECORD OF WORK

**TB**  
TALLAFERRO & BROWNE, INC.  
CONSULTING ENGINEERS-ARCHITECTS  
KANSAS CITY, MISSOURI

**McKnight Associates**  
Landscape Architects & Urban Designers  
600 Walnut, Kansas City, Missouri 64101

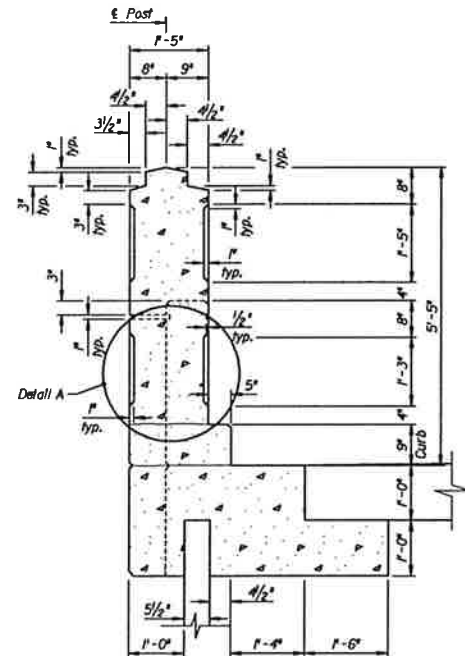
**JBM**  
Engineers & Planners  
**BOYD BROWN STUDE & CAMBERN**  
CONSULTING ENGINEERS

PORT AUTHORITY OF KANSAS CITY, MISSOURI  
10 PETTICOAT LANE SUITE 250  
KANSAS CITY, MO. 64108

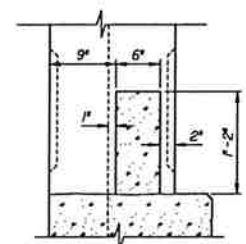
GRAND BOULEVARD  
VIADUCT REPLACEMENT

DRAINAGE DETAILS			
DESIGNED: JBE	DATE: 12/98	DETAILS: ALM	DATE: 02/99
CHECKED: JBE	DATE: 03/99	SCALE:	

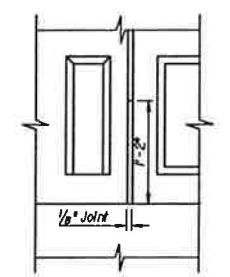




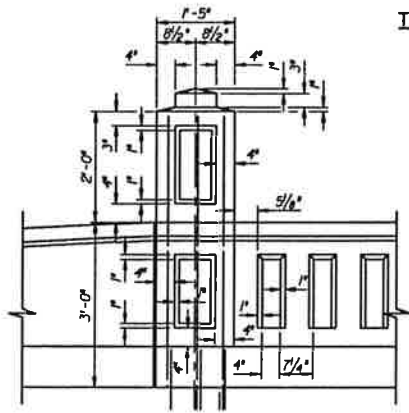
TYPICAL SECTION AT END POST ON MSE WALL



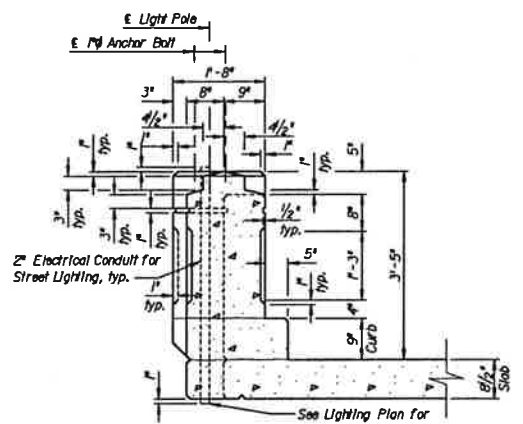
DETAIL A  
Typical joint where rail meets post



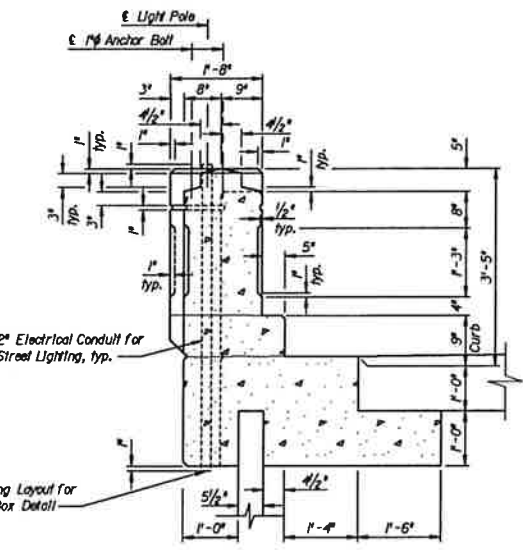
DETAIL B  
Typical joint where rail meets post



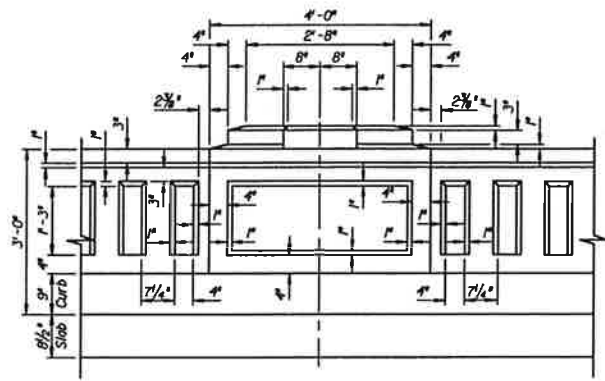
DETAIL OF END POST



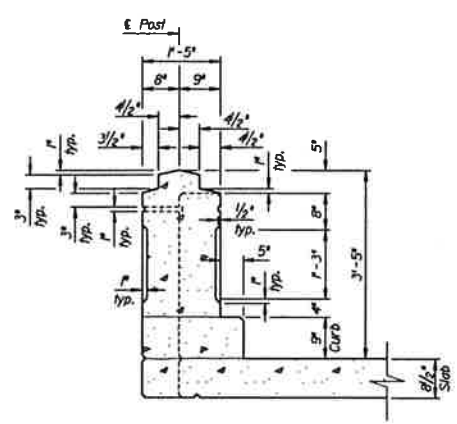
TYPICAL SECTION AT LIGHT POST



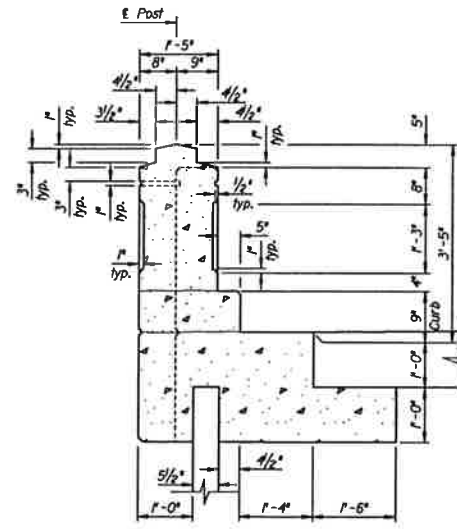
TYPICAL SECTION AT LIGHT POST ON MSE WALL



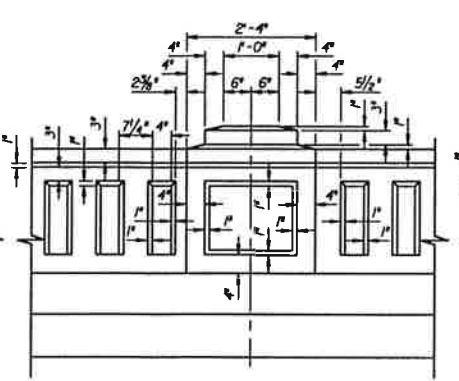
DETAIL OF LIGHT POST



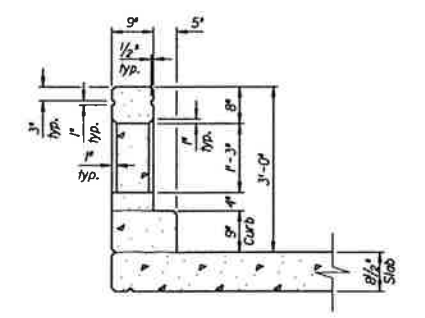
TYPICAL SECTION AT INTERMEDIATE POST



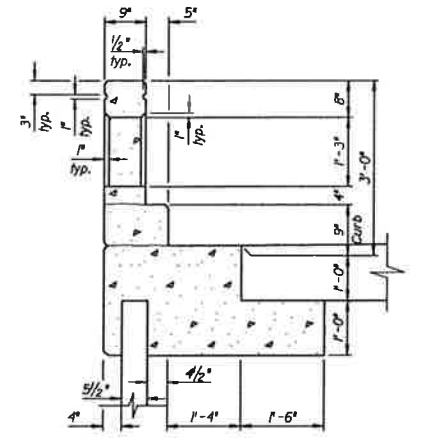
TYPICAL SECTION AT INTERMEDIATE POST ON MSE WALL



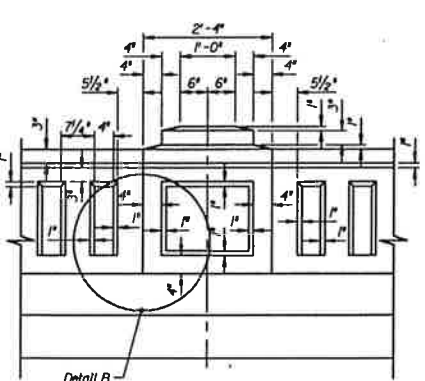
INTERMEDIATE POST ELEVATION



TYPICAL SECTION AT RAIL



TYPICAL SECTION AT RAIL ON MSE WALL



INTERMEDIATE POST ELEVATION

11/04/97 15:15:48  
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8/20/97	Revised Construction Issue
5/5/97	Construction Issue
DATE	EXTENSIONS AND RECORDS OF REVISION

**TB** TALLAFERRO & BROWNE, INC.  
CONSULTING ENGINEERS-ARCHITECTS  
KANSAS CITY, MISSOURI

**McKnight Associates**  
Landscape Architects & Urban Planners  
809 Walnut, Kansas City, Missouri 64106

**JBM** Engineers & Planners  
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PORT AUTHORITY OF KANSAS CITY, MISSOURI  
10 PETTICOAT LANE SUITE 250  
KANSAS CITY, MO. 64108

GRAND BOULEVARD  
VIADUCT REPLACEMENT

GENERAL BARRIER CURB  
POST DETAILS  
MSE WALL & BRIDGE

APPROVED FOR	DATE 09/97	DRAWN BY	DATE 09/97
CHECKED BY	DATE 09/97	SCALE	



**Missouri Department of Transportation  
Bridge Inventory and Inspection System  
Structural Inventory & Appraisal Sheet**

September 14, 2015  
8:12:13am

COUNTY : JACKSON	BRIDGE NO. S028B31 1	REVIEW STATUS : APPROVED	NBI STATUS : P
RECORD TYPE : ROUTE CARRIED 'ON' STRUCT		RUN DATE : 2/11/2015	SUBMITTAL YEAR : 2014

GENERAL STRUCTURE INFORMATION	ROUTE DESIGNATION INFORMATION
1 State MISSOURI	5A Record Type ROUTE CARRIED 'ON' STRUCT
2 District KC	5B Route Signing Prefix CST
3 County JACKSON	5C Designated Level of Service MAINLINE
8 Federal ID No. 25393	5D Route Number 00222
27 Year Built 1997	5E Directional Suffix NOT APPLICABLE
106 Year Reconstructed 0	7 Facility Carried GRAND AVE
42A Type of Service On HIGHWAY	12 Base Hwy. Network NO
21 Structure Maintenance CITY OR MUNICIPAL HWY AGY	13A LRS Inventory Route No.
22 Structure Owner CITY OR MUNICIPAL HWY AGY	13B Subroute No.
33 Br. Median Code NO MEDIAN	20 Toll Status ON FREE ROAD
37 Historical Significance NOT ELIGIBLE FOR NR OF HP	26 Functional Classification 16-URBAN MINOR ARTERIAL
101 Parallel Struc Desg NONE EXISTS	28A Lanes on Structure 02
103 Temporary Structure NOT TEMPORARY	100 STRAHNET Designation RTE NOT A DEFENSE HWY
112 NBIS Bridge Length YES	104 National Highway System NOT ON NHS
	105 Federal Lands Highway NOT APPLICABLE
	110 Designated Nat. Network NO

STRUCTURE LOCATION INFORMATION	STRUCTURE TRAFFIC INFORMATION
4 Place KANSAS CITY CITY	29 AADT 2885
Code 38000	30 AADT Year 2014
9 Location S 32 T 50 N R 33 W	102 Direction of Traffic 2-WAY TRAFFIC
11 Milepoint 0.10 miles	109 AADT Truck Percent 5%
16 Latitude 39 D 6 M 48 S	114 Future AADT 3751
17 Longitude 94 D 34 M 42 S	115 Future AADT Year 2034

UNDERRECORD INFORMATION	STRUCTURE GEOMETRIC INFORMATION
6 Features Intersected KCS RR, FIRST ST, UP RR	10 Inventory Rte. Vert. Clear 99 Ft. 99 In.
42B Type of Service Under HIGHWAY-RAILROAD	19 By pass Detour Length 4.96 miles
28B Lanes Under Structure 02	32 Approach Roadway Width 29 Ft. 10 In.
54A Vert. Clearance Ref. RAIL ROAD	34 Skew 99.00 Degrees
54B Vert. Clearance 13 Ft. 1 In.	35 Struct. Flared NO
55A Rt. Lat Clear Ref. RAIL ROAD	47 Total Horiz. Clear 29 Ft. 10 In.
55B Rt. Lat Clearance 2 Ft. 11 In.	48 Maximum Span Length 122 Ft. 0 In.
56 Left Lat Clearance 0 Ft. 0 In.	49 Structure Length 1,302 Ft. 0 In.
38 Navigation Control N/A	50A Left Curb/Sidewalk Width 0 Ft. 0 In.
39 Nav Vertical Clear 0 Ft. 0 In.	50B Right Curb/Sidewalk Width 0 Ft. 0 In.
40 Nav Horizontal Clear 0 Ft. 0 In.	51 Curb to Curb Br. Width 29 Ft. 10 In.
111 Nav. Pier Protection	52 Deck Width (Out-Out) 32 Ft. 1 In.
116 Nav. Cl. Vert. Clear	53 Vert. Clearance Over Deck 99 Ft. 99 In.





**Missouri Department of Transportation  
Bridge Inventory and Inspection System  
Structural Inventory & Appraisal Sheet**

September 14, 2015  
8:12:13am

COUNTY : JACKSON	BRIDGE NO. S028B31 1	REVIEW STATUS : APPROVED	NBI STATUS : P
RECORD TYPE : ROUTE CARRIED 'ON' STRUCT		RUN DATE : 2/11/2015	SUBMITTAL YEAR : 2014

LOAD RATING AND POSTING INFORMATION	MATERIAL/CONSTRUCTION INFORMATION																																																						
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**Appendix D – Rough order of magnitude cost for a new structure**



<b>Holmes Into East Bottoms - New Transit Bridge On Independent Alignment</b>				
<b>Description</b>	<b>Quantity</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Total Est. Cost</b>
New Bridge Into East Bottoms	40500	SF	\$225	\$9,112,500
<b>Total Estimated Construction Cost =</b>				<b>\$9,112,500</b>
<b>Construction Cost Contingency @ 15% =</b>				<b>\$1,366,875</b>
<b>Kansas City, Missouri Internal Costs @ 10% =</b>				<b>\$911,250</b>
<b>Final Design @ 10% =</b>				<b>\$911,250</b>
<b>Construction Services @10% =</b>				<b>\$911,250</b>
<b>Total Estimated Project Costs =</b>				<b>\$13,213,125</b>

Inclusions: barriers, deck, girders, track embedded on structure, bridge piers, foundations, and professional services following FTA averages.

Exclusions: right of way, embankment, special, non-standard architectural treatments for the structure, systems elements (OCS), signals, lighting, track on bridge approach, items not specifically included in inclusions (above).

Assumptions: weathering steel plate girders, 23'-6" clearance over railroad, direct fixation track, no other modes on structure other than streetcar, one 5'-0" wide emergency walkway is provided down the center of the structure versus two (one on each side), vehicle is assumed to be a 2.65M wide vehicle (CAF vehicle for the base project).

All costs are in 2016 dollars.