



## **ABBREVIATED BRIDGE CONDITION REPORT**

**CONTRACT NUMBER:** RR-10-5614

**TOLLWAY NAME:** Ronald Reagan Memorial Tollway (I-88)

**MILE POST NUMBER:** 91.4

**BRIDGE DESCRIPTION:** Annie Glidden / DeKalb West Road over Ronald Reagan Memorial Tollway (I-88)

**BRIDGE NUMBER** 1131 (Tollway), 019-9907 (IDOT)



**DATE PREPARED:** JUNE 29, 2011

**PREPARED BY:** GRAEF



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## I. GEOGRAPHICAL & ADMINISTRATIVE DESCRIPTION

<b>Tollway Name:</b>	Ronald Reagan Memorial Tollway (I-88)
<b>Mile Post Number:</b>	91.4
<b>Bridge Number:</b>	1131 (Tollway), 019-9907 (IDOT)
<b>Feature Carried:</b>	Annie Glidden / DeKalb West Road (I-88 Ramp)
<b>Feature Crossed:</b>	Ronald Reagan Memorial Tollway (I-88)
<b>Location:</b>	DeKalb County, West Edge of City of DeKalb
<b>Jurisdiction of Bridge:</b>	Illinois Tollway

## II. PHYSICAL DESCRIPTION

This structure carries Annie Glidden / DeKalb West Road (I-88 Ramp) over Mainline I-88. It consists of two main spans supported by 54-inch precast prestressed concrete (PPC) I-Beams and two vaulted approach spans supported by 36-inch PPC I-Beams. The north main span is over I-88 westbound and the south main span is over I-88 eastbound. The superstructure and substructure are uniformly skewed ahead-right 15 degrees from perpendicular. The DeKalb West Road vertical profile is a crest curve with the crown 10 feet south of the pier centerline. The I-88 vertical profile is a sag curve, with its point of intersection located approximately 10 feet east of the bridge centerline.

The bridge carries one lane of I-88 ramp traffic in each direction. The total roadway width from the inside faces of barriers is 38'-10", with a median barrier in the center. The deck crown aligns with the DeKalb West Road and bridge centerlines. The deck cross slope is 1.5% down toward the fascia parapets. Mainline I-88 under the bridge carries two traffic lanes in each direction as well as one Eastbound on-ramp lane. Per original plans, the design minimum vertical clearance is 16'-3". The current minimum clearance was not measured since no I-88 traffic lanes could be closed.

The deck is 7 1/2" thick by 43'-8" out-to-out. Between the beams, the deck was formed using 2 1/2" thick precast prestressed planks as stay-in-place forms. The deck is continuous over the center pier and there are two-inch expansion joints at the abutments. There are no open longitudinal deck joints. There are 1'-7" wide parapets on each side of the superstructure, extending the length of the deck and over the wingwalls.

Each end of the bridge has a 30'-0" long reinforced concrete approach slab. The slab is 12" thick and varies in width from 40'-6" at the approach bent to 43'-0" at the roadway end.

There are six main span beam lines spaced at 7'-7" on center with east and west overhangs of 2'-10 1/2". There are five approach span beam lines spaced at 7'-0", with 6'-10" exterior bays supported at the fascias by the curtain walls. The total number of beams for this structure is 22.

Bearings for the main span beams are fixed at the median pier and expansion at the abutments. Elastomeric bearings support the main span beams at the abutments, while 3/4" thick neoprene bearing pads are used at the pier. Neoprene bearing pads are used at each end of the approach span beams.

The bridge length is 237'-0" from back-to-back of the approach bents. The span lengths, from back of South approach bent, through the main span bearing centerlines and pier centerline, to the back of North approach bent, measured along the DeKalb West Road centerline, are 34'-0", 91'-0", 91'-0", and 21'-0".

The substructure consists of reinforced concrete vaulted abutments, reinforced concrete approach bents, and one multi trapezoid-column pier. The curtain walls are parallel to the centerline of DeKalb West Road and extend the length of the vaulted spans. Wingwalls extend several feet behind the approach bents. There are no vault access hatches. All substructure units are supported by 12-inch concrete filled metal shell piles.

Each vaulted abutment wall has one luminaire, centered horizontally on the wall about 3 feet down from the bearing seat. A junction box is located on the southwest curtain wall, with conduit extending to the South Abutment luminaire and under the west parapet to the North Abutment luminaire.

### **III. STRUCTURE HISTORY**

The structure carrying Annie Glidden / DeKalb West Road was originally built in about 1971 as part of Contract E7A, Bridge E7-29.

In 1996, minor repairs were performed as part of Contract MIP-91-464, which included resetting the bearings, patching and crack repair at substructures and slopewalls, concrete sealing, bridge seat cleaning, and PPC I-Beam repair and end encasement.

### **IV. STRUCTURE INSPECTION**

A visual field inspection of the structure carrying Annie Glidden / DeKalb West Road over Mainline I-88 was conducted by GRAEF on May 19, 2011. The top of deck was inspected from the shoulders, and the underside of the bridge was inspected from the ground and using a lift truck.

## **Superstructure**

### **Deck**

The deck was rated as good (NBIS Rating = 7) in the 2010 Structure Inspection Field Report. The deck condition observed in this field inspection concurs with the previous rating. The top of deck was not inspected for delaminations and there appears to be a fair amount of map cracking, but spalling is minimal and the overall top of deck condition appears good. For typical conditions, see Attachment B – photos 1 and 2.

At the deck underside only the precast plank stay-in-place forms are visible (except at the deck overhangs). The south main span planks have minimal transverse cracks (2 cracks noted) and have minimal spalling (0.5% of deck area). For typical conditions, see Attachment B – photo 3. 18 ft<sup>2</sup> of the spalling is noted in the westmost bay at the pier diaphragm. Additionally, the bottom of the thickened slab edge at the South Abutment is spalled for about 80% of the deck width.

The north main span planks have no significant transverse cracking. Approximately 1.3% of the underside is spalled, nearly all of which is located along the south end of the span, along the pier diaphragm. Heavy leaching and stalactites were noted along 16' of Beam 5 near the median pier. For typical conditions, see Attachment B – photo 4. Additionally, the bottom of the thickened slab edge at the North Abutment is spalled approximately 4' long.

### **Concrete Parapets**

A 20 foot segment of the bottom one foot of the outside of the east parapet had heavy rust staining with a few small popouts. Much of this area was sounded and no delaminations were found. See Attachment B – photos 5 and 6.

### **Expansion Joints**

The expansion joint at the South Abutment is in poor condition. Sand and dirt have accumulated along the South joint. See Attachment B – photo 7. The entire South Abutment backwall below the joint was wet during light rain. Also, as noted above, the underside of the thickened slab edge is spalled along 80% of the length. The expansion joint at the North Abutment is also in poor condition. Sand and dirt has accumulated along the joint, and although the joint appears intact, about half of the North Abutment backwall below the joint was wet during light rain. See Attachment B – photo 8.

### **Beams**

The superstructure was rated as good (NBIS Rating = 7) in the 2010 Structure Inspection Field Report. Based on this field inspection, GRAEF recommends downgrading the superstructure condition rating to poor (NBIS Rating = 4).

#### South Main Span Beams:

At the South Abutment, the ends of Beams 1, 2, 5, and 6 were previously encased with concrete at least 1'-6" in length. For an example of concrete end encasement, see Attachment B – photo 9. The sides of the beam-end bottom flanges are spalled with exposed strands and stirrups at the following locations: Beam 1 – west side, Beam 2 – east side, Beam 3 – west side. The spalls are about 6" to 8" long. Also, the west side of the bottom flange at the end of Beam 4 is delaminated for a length of about 8", and the east side of the bottom flange at the end of Beam 3 is delaminated for a length of about 18". The Beam 3 delamination extends about halfway into the sloped portion of the bottom flange. See Attachment B – photo 10. The end 4 feet of the Beam 6 bottom flange at the South Abutment is in particularly poor condition. Five strands are exposed, two of which have completely rusted away. See Attachment B – photo 11. There is a 3'-3" long delamination on the west side of the top flange at the North end of Beam 6. There are bottom flange spalls with exposed strands at the north end of Beams 1 and 6. All other south main span beams are in good condition at the pier.

#### North Main Span Beams:

At the North Abutment, the ends of Beams 1, 2, and 6 were previously encased with concrete at least 1'-6" in length. The west side of the bottom flange of Beam 5 has delaminated approximately 8" in length near the bearing seat. The sides of the beam-end bottom flanges are spalled with exposed strands and stirrups at the following locations: Beam 1 – west side, Beam 3 – both sides, Beam 4 – both sides. The spalls are about 6" to 8" long. Additionally, the north end of the Beam 4 east web face is spalled about 4" in length. There are top flange delaminations about 8" long at the south ends of Beams 4 and 6, both on the west side. There are bottom flange spalls with exposed strands at the south end of Beams 1 and 6. The spalls are on the exterior sides of the flanges.

#### Diaphragms

This bridge has a diaphragm between the concrete beams above the pier. The concrete between the ends of the fascia beams is heavily cracked in both beam lines 1 and 6. The South face of the diaphragm is in good condition with no issues to note. However, the entire North face of the median pier diaphragm between Beams 2 and 3 was wet with minor deposits from the deck above. Approximately 20% of the entire north face is spalled or delaminated.

### Bearings

At the South Abutment, there is slight lift-off at the corner of the Beam 1 bearing. See Attachment B – photo 12. All of the bearings were leaned in the expansion direction 1” to 1¼” in 60-65 degree weather, indicating excessive bearing deflection.

At the North Abutment, there is slight lift-off at the bearings for Beams 1, 3, and 5. All of the bottom bearing plates at the North Abutment are heavily rusted with flaking and pitting. For an example of bearing plate deterioration, see Attachment B – photo 13. All of the bearings were leaned in the expansion direction 1¼” to 1½” in 60-65 degree weather, again indicating excessive bearing deflection. For an example of excessive bearing deflection, see Attachment B – photo 14.

### Approach Slab

The tops of approach slabs were sounded for delaminations. There is a fair amount of map cracking, but spalling is minimal and the overall top of approach slab condition is good. For typical conditions, see Attachment B – photos 15 and 16.

## Substructure

### Abutments

The substructure was rated as fair (NBIS Rating = 5) in the 2010 Structure Inspection Field Report. The substructure condition observed in this field inspection concurs with the previous rating. Approximately 17% of the South Abutment face and 10% of the North Abutment face is spalled or delaminated. The South Abutment has one injectable crack ( $\geq 1/16$ ”) and several hairline cracks. The North Abutment had only hairline cracks. All abutment cracks were vertical. For abutment elevations, see Attachment B – photos 17 and 18. The abutment backwalls were in worse condition. Approximately 45% of the South Abutment backwall and 40% of the North Abutment backwall was spalled or delaminated. The entire South Abutment backwall was observed to be wet during light rain. About half of the North backwall was wet during the light rain.

Debris was found along the entire South Abutment bearing seat length and along about 60% of the North Abutment bearing seat length. For an example of debris build-up, see Attachment B – photo 19. Debris was piled especially high between Beam 1 and the screen wall at both abutments, causing screen wall deterioration. See Attachment B – photos 20 through 22. Minor spalls were found on the North Abutment bearing seat between Beams 3 and 5.

### Pier

Other than minor dampness along the bearing seat, the median pier is in excellent condition, with no issues to report.

### Curtain Walls

At the southwest curtain wall, there is a 10' long x 3' wide x 3' deep washout exposing the wall underside, near the top of the slope. The wall underside is exposed for about 5 feet. Additionally, there is approximately 36 ft<sup>2</sup> of spalling near front of the wall. See Attachment B – photos 21 and 22. There is also cracking along the wall, but all cracks are less than 1/16" wide.

At the southeast curtain wall, there is an 18' long x 3' wide x 3' deep washout exposing the wall underside, near the top of the slope. The wall underside is exposed for about 12 feet. See Attachment B – photo 23. Additionally, there is approximately 9 ft<sup>2</sup> of spalling near the front top corner of the wall. See Attachment B – photo 24. There is also cracking along the wall, but all cracks are minor.

At the northeast curtain wall, there is approximately 25 ft<sup>2</sup> of spalling along the front edge of the wall and several feet of injectable cracks. At the northwest curtain wall, there is approximately 11 ft<sup>2</sup> of spalling and several feet of injectable cracks along the front edge.

## **Miscellaneous Bridge Elements**

### Slope Walls

There are some cracks and delaminations on the 23' long slopewall at the North Abutment but nothing of serious note.

### Lighting and Utility Attachments

There are no issues with the luminaires or utilities.

## **V. STRUCTURE EVALUATION**

The deck, parapets and expansion joints are in good to fair condition. The top of deck shows a significant amount of map cracking but a very small area (estimated to be less than 2%) of spalls and patching. The exact area of hollow areas is unavailable. The deck below the parapets shows rust stains as seen from the outer edge primarily on the east fascia. This is most probably due to rusting of the rebars within the deck. Less than 2% of the bottom of deck exhibited spalling and heavy leaching. The parapet itself revealed no defects. The deck underside at the expansion joints at the abutments showed spalling

due to the failure of the expansion joint seals. The failure of the joints is further evident by the wet abutment backwalls after a minor rainfall.

The superstructure below the bottom of deck should be rated at poor or fair, but not good. The defects of the beams could be classified into 4 categories. Beam 6 in Span 1 at the North Abutment has had 13 of its 32 prestressing strands become ineffective due to spalling and delamination in the bottom flange. A length of 5'-9" from the end of this beam is encased in concrete. The length of the defect in the bottom flange is about 4'-0" from the beam end. The second category of problems is beam flange ends in general. Spalls were observed in a total of 11 bottom flange locations at the 2 abutments. Spalls or delaminations also exist in a total of 3 locations at the pier. The third category is one location at the North Abutment where Beam 4 is spalled at the bottom flange and delaminated at the web. The last category is a separation of the fascia beams in Spans 1 and 2 that should have solid concrete between them at the pier. This problem exists in beam lines 1 and 6. In addition to beam defects, all the pier diaphragms on the Span 2 side contain spalls or delaminations. The defects itemized in the superstructure were caused by deck drainage runoff containing deicing salts.

Nine of the 12 elastomeric expansion bearings at the abutments were noted to be in the expanded, deflected position of 1" to 1 1/4" at a temperature of about 60° F. The six bearings at the North Abutment have steel bottom plates that are heavily rusted and are either flaking or pitted.

The vaulted (hollow) abutments were observed to have many problems. Approximately 40% to 45% of the backwalls are spalled or delaminated. Approximately 15% of the faces (front walls) are spalled or delaminated. This deterioration is due to deck drainage runoff containing deicing salts leaking thru the failed expansion joint seals. All 4 curtain walls are spalled and/or delaminated where they meet the back of the front walls. The 4 screen walls (mask walls) at the top front of the curtain walls are generally in poor condition and are elements to promote deterioration of the adjacent abutment seats and bearings. Furthermore, they serve no functional purpose. Debris was observed on the abutment seats and notably between the fascia beams and screen walls. Significant soil erosion has occurred in the sloped embankments adjacent to the southeast and southwest curtain walls to the point where the bottoms of those walls are exposed in specific areas.

The Pier is in very good to excellent condition.

## **VI. COST ESTIMATE AND REPAIR PRIORITIZATION**

This section defines the recommended repairs and the costs associated with those repairs. The repairs identified are intended for an effective period of 10 years. The repairs are listed in the order of importance.

### **Repair Recommendation #1 – Beam 6 End Repair**

The south end of this beam in Span 1 was previously repaired by encasing it with concrete for a length of 5'-9" from the south end. The proposed repair will focus on the bottom of the beam for a repair length of at least 4'-0'. It is anticipated that the bottom of the beam will be chipped to sound concrete and patched or formed with Polymer Modified Portland Cement Mortar. It is further anticipated that Fiber Wrap Repair will be wrapped around the bottom of the beam to provide additional strength to the repair. Beam replacement would be recommended if the life of the repair were to go further than 10 years.

### **Repair Recommendation #2 – Expansion Joint Replacement**

This repair applies to the expansion joints above the two abutments. Strips seal expansion joints are recommended. Full depth removal and replacement of the concrete deck end will be included to install the joints.

### **Repair Recommendation #3 – Abutment Screen Wall Removal**

These 4 small walls adjacent to the ends of the fascia beams are non-functional architectural features. They trap debris, promote deterioration of the beam ends and bearings, and are a hindrance in the repair of structural elements. The conditions of these walls range from satisfactory to poor.

### **Repair Recommendation #4 – Partial Depth and Full Depth Deck Repair**

This repair will apply to both the main and approach spans. The areas of full depth repair are anticipated to be relatively small.

### **Repair Recommendation #5 – Beam End Flange Repair**

At the abutments, 10 locations on bottom flanges will be coated with a rust arresting coating that has been used on previous Tollway repair contracts called Concrete Membrane Protection. At the pier, 3 locations on top flanges need to be repaired but by a method different than the bottom flange repairs. The repair may be combined with a Full Depth Deck Repair.

### **Repair Recommendation #6 – Beam End Flange & Web Repair**

This repair location is Beam 4 at the North Abutment. The anticipated repair is concrete encasement of the end 2 feet of the beam. This repair, however, will require a full depth deck repair above the beam end.

### **Repair Recommendation #7 – Fascia Beam End Repair**

These locations are the beam ends that meet over the pier on beam lines 1 and 6. The beam ends and filled joints are in poor condition. The repair will consist of

concrete encasement on the fascia side only for a length on each beam line of about 5 feet.

**Repair Recommendation #8 – Soil Erosion Repair at Abutments**

This repair will be performed at the southeast and southwest curtain walls. This repair will consist of filling the exposed void under the curtain walls with concrete, covering the embankment void with geotechnical fabric and then adding riprap or aggregate.

**Repair Recommendation #9 – Structural Repair of Concrete, Abutment Back Walls**

Both backwalls will be repaired with this standard repair procedure.

**Repair Recommendation #10 – Structural Repair of Concrete, Curtain Walls**

This four curtain walls will be repaired with this standard repair procedure.

**Repair Recommendation #11 – Structural Repair of Concrete, Pier Diaphragms**

Both faces of the diaphragms will be repaired with this standard repair procedure.

**Repair Recommendation #12 – Structural Repair of Concrete, Abutment Front Walls**

Both front walls will be repaired with this standard repair procedure.

**Repair Summary**

<b>Priority Ranking</b>	<b>Entity Responsible for Repair Cost</b>	<b>Repair Description</b>	<b>Cost</b>
1			
2			
3			
4			

## ATTACHMENT A

### **Location Map**



## Location Map

Annie Glidden / DeKalb West Road over Ronald Reagan Memorial Tollway (I-88)

Municipality: DeKalb

**County:** DeKalb

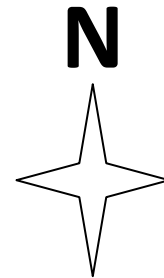
**Route:** Annie Glidden / DeKalb West Road

**Contract No.:** RR-10-5614

**Structure No.:** 1131 (Tollway), 019-9907 (IDOT)



## **Location Map**



Annie Glidden / DeKalb West Road over Ronald Reagan Memorial Tollway (I-88)

**Municipality:** DeKalb

**County:** DeKalb

**Route:** Annie Glidden / DeKalb West Road

**Contract No.:** RR-10-5614

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ATTACHMENT B  
**Structure Photos**

Structure No. 1131  
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**Photo 1: Northbound Top of Deck, looking South from the North Expansion Joint**



**Photo 2: Southbound Top of Deck, looking South from the center of structure**

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**Photo 3: South Span Deck Underside, Looking North toward the Median Pier**



**Photo 4: North Span Deck Underside, Looking South toward the Median Pier**

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**Photo 5: Spalling & Delaminations along the bottom 1' of East Parapet, about 20' long**

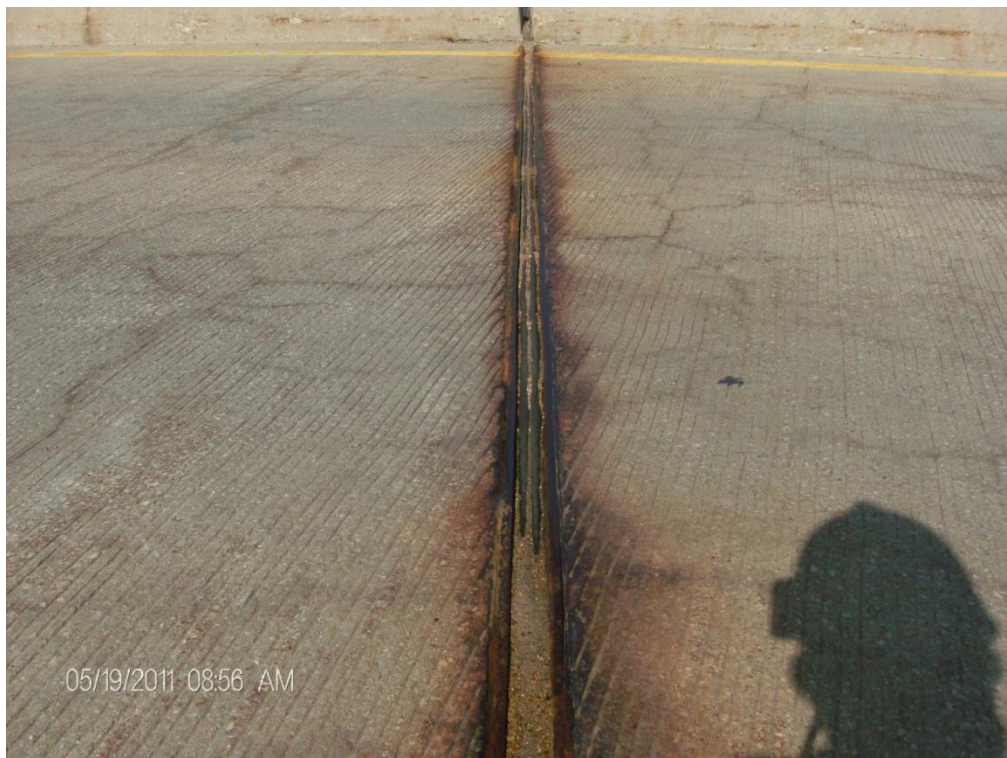


**Photo 6: Typical East Parapet condition, Span 1**

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**Photo 7: SB Expansion Joint at South Abutment**



**Photo 8: NB Expansion Joint at North Abutment**

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**Photo 9: Concrete End Encasement at South Abutment, Beam 2**



**Photo 10: Beam 3 bottom flange delamination at the South Abutment**

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**Photo 11: Beam 6 Spalling & Delamination at the South Abutment**



**Photo 12: Slight lift-off of Beam 1 Bearing corner at South Abutment**

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**Photo 13: Heavy rusting & flaking at Beam 4 Bearing, North Abutment**



**Photo 14: Beam 1 North Abutment bearing expanded about 1½" in 65° weather**

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**Photo 15: NB side of South Approach**



**Photo 16: NB side of North Approach**

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**Photo 17: South Abutment Elevation**



**Photo 18: North Abutment Elevation**

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**Photo 19: Debris build-up between Beams 3 and 4 at the North Abutment**



**Photo 20: Excessive debris between Beam 1 and screen wall at the South Abutment**

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**Photo 21: Southwest Curtain Wall Elevation**



**Photo 22: Spalling and deterioration at the Southwest Curtain Wall and Screen Wall**

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**Photo 23: 18' long x 3' wide x 3' deep washout at the Southeast Curtain Wall**



**Photo 24: Spalling on Southeast Curtain Wall**

ATTACHMENT C  
**Structure Inspection Field Report**

ATTACHMENT D  
**Cost Estimates**



ATTACHMENT E  
**Abbreviated Existing Bridge Plans**

