DRAFT

SH 96A (4th St.) Bridge Over the Arkansas River
CDOT Project No. STA 0961-008/13141

BRIDGE DESIGN CRITERIA
As of April 27, 2001

A. Design Specifications

1. American Association of State Highway and Transportation Officials AASHTO LRFD Bridge Design Specifications" Second Edition, 1998 with Interims through 2000.

2. Colorado Department of Transportation (CDOT) Bridge Design Manual, May 1992 Edition with revisions through 1998 and Technical Memorandums 1 through 28.

3. Colorado Department of Transportation (CDOT) Computer Aided Drafting Manual, January 1996 Edition with revisions through 2000.

4. Colorado Department of Transportation (CDOT) Bridge Rating Manual, 1995 Edition

5. American Association of State Highway and Transportation Officials "Guide Specifications for Design and Construction of Segmental Concrete Bridges" Second Edition, 1999.

B. Design Method

1. Superstructure

   The superstructure shall be designed for applicable strength, service, extreme event and fatigue limit states as defined by the load groups in the LRFD Specifications.

2. Reinforced Concrete Substructure

   The substructure shall be designed for the applicable strength and extreme event limit states as defined by the load groups in the LRFD Specifications and checked for the crack control provisions in Section 5.7.3.4 of the Specifications.

3. Foundation Elements

   Foundation elements shall be designed for the applicable strength, service and extreme event limit states as defined by the load groups in the LRFD Specifications.

C. Design Loads

1. Permanent Loads (DC, DW, EH, EV, ES, EL)

   a. Unit Weight of Reinforced Concrete: 150 pcf
   b. Unit Weight of Soil: 120 pcf
   c. Horizontal Earth Pressure in Accordance with Geotechnical recommendations
   d. Initial Wearing Surface: 35 psf (Worst Case of 3" Bituminous Wearing Surface)
   e. Future Wearing Surface: 15 psf (50 psf Total)

2. Live loads (LL, IM, CE, BR, LS)

   a. HL-93 with Impact (Design Truck or Tandem with Design Lane Load)
   b. Colorado Permit Vehicle simultaneously with adjacent HL-93 Lanes (Strength II Load Group)

3. Wind Loads (WS, WL)

   In Accordance with "AASHTO LRFD Bridge Design Specifications"

4. Thermal Forces (TU, TG, FR)

   a. Mean Temperature: 50 °F
   b. Thermal Coefficient: 0.000006 / °F
   c. Seasonal Variation:
      - Temperature Rise: 70 °F Steel Structures
      - 30 °F Concrete Structures
      - Temperature Fall: 80 °F Steel Structures
      - 40 °F Concrete Structures
   d. Temperature Gradient: In Accordance with "AASHTO LRFD Bridge Design Specifications", Zone 1

5. Creep and Shrinkage (CR, SH, FR)

   In Accordance with "AASHTO LRFD Bridge Design Specifications"

6. Fatigue

   Fatigue Load Frequency: 4,400 trucks per day

7. Extreme Events (EQ, CT)

a. Earthquake Effects in Accordance with "AASHTO LRFD Bridge Design Specifications", Seismic Performance Zone 1

b. Vehicular Collision Forces in Accordance with "AASHTO LRFD Bridge Design Specifications"

D. Materials

1. Superstructure Concrete

   a. Prestressed Concrete: Class S, f'c=8500 psi maximum
   b. Reinforced Concrete: Class D, f'c=4500 psi

2. Structural Steel

   AASHTO M 270 (ASTM A 709), Grade 50

3. Substructure Concrete

   a. Abutments, Piers and Footings: Class D, f'c=4500 psi
   b. Drilled Shafts: Class BZ, f'c =4000 psi

4. Driven Piles

   AASHTO M 270 (ASTM A 709), Grade 36

5. Reinforcing Steel

   a. ASTM A615 Grade 60
   All reinforcing steel above the footings, including the column dowel bars shall be epoxy coated.
   b. Concrete Cover (Unless Shown Otherwise in the Plans):

   Superstructure:

1.	Top of Deck:	2 in.
2.	Bottom of Deck:	1 in.
2.	Pretensioned Elements:	1 in.
3.	Other Exterior Surfaces	2 in.
4.	Other Interior Surfaces	1 ½ in.

   Substructure:

1.	Surfaces Cast Against Forms	2 in.
2.	Surfaces Cast Against Earth	3 in.

6. Prestressing Steel

a. Strand: ASTM A-416, Seven wire Grade 270, Low Relaxation

Prestressing Parameters:

Strand Size	0.5” or 0.6” Diameter
Apparent Modulus	28,000 ksi
Maximum Jacking Stress	203 ksi (75% of Ultimate)
Maximum Anchoring Stress	189 ksi (70% of Ultimate)
Anchor Set	3/8 in.
Friction Coefficient	0.25
Wobble Coefficient	0.0 (External Tendons) 0.0002 (Internal Tendons)

b. Bars: ASTM A722, Grade 150

Maximum Anchoring Stress	105 ksi (70% of Ultimate)

E. Allowable Stresses

1. Superstructure

a. Prestressed Concrete

Temporary Stresses before Losses:

Compression: 0.6 f’ci (Pre-Tensioned Components)
0.55f’ci (Post-Tensioned Components)

Tension: $0.0948 \sqrt{f'ci} \leq 0.2$ (ksi) ($3\sqrt{f'ci}$) (pretensioned)

$0.0948 \sqrt{f'ci}$ (ksi) ($3\sqrt{f'ci}$) (post-tensioned with bonded mild reinforcing)

0 tension (post-tensioned without bonded mild reinforcing)

Stresses at Service Limit State:

Compression: 0.45 f’c Dead Load Plus Prestressing, ϕ_w 0.6 f’c All Other Load Cases. ϕ_w as per Section 5.7.4.7 of the LRFD Specification.

Tension:	0.0948 √ f'ci (ksi) (3√ f'ci) (pretensioned or with bonded mild reinforcing)
	0 tension (post-tensioned without bonded mild reinforcing)

b. Reinforced Concrete

Designed for the applicable strength and extreme event limit states as defined by the load groups in the LRFD Specifications and checked for the crack control provisions in Section 5.7.3.4 of the Specifications.

c. Structural Steel

Designed for the applicable strength and extreme event limit states as defined by the load groups in the LRFD Specifications and checked for the service limit state provisions of Section 6.5.2 and the fatigue and fracture provisions in Section 6.6 of the Specifications.

2. Reinforced Concrete Substructure

Designed for the applicable strength and extreme event limit states as defined by the load groups in the LRFD Specifications and checked for the crack control provisions in Section 5.7.3.4 of the Specifications.

3. Foundation Elements

In Accordance with Geotechnical Investigation Recommendations.

E. Miscellaneous Criteria

1. Due consideration shall be given in the design of all structures to widening with a single 12' lane in each direction. Widening shall assumed to occur towards the inside median.