2. Existing Conditions

Bridge plans and a detailed description of existing conditions with site photographs can be found in the Structure Concept Report (FIGG, December 2001). Below are highlights of the information contained in that report as well as an updated description of conditions based on the latest CDOT inspection report dated March 18, 2002. A copy of the latest CDOT Structure Inspection Inventory (SIA) Report is included in Appendix E.

2.1 Existing Bridge Configuration

The existing 4th St. Bridge, structure number K-18-Z, was constructed in 1958 and is approximately 1068 feet long and 68 feet wide. The bridge superstructure is constructed of built-up riveted steel plate girders with a cast-in-place mildly reinforced concrete deck (non-composite). Lead based paint was used for corrosion protection. The substructure bents are multiple column and bent cap construction. There are seven spans ranging in length from 117 feet to 202 feet. The structure is divided into three continuous units: a two-span unit over the Arkansas River and floodwall, a three-span unit across the Union Pacific Railroad yard (UPRR), and a two-span unit over the Burlington Northern Santa Fe Railroad yard (BNSF). The maximum span length over the Arkansas River is 202 feet, over the UPRR, 182 feet, and over the BNSF, 117'-5". The existing configuration results in five piers in the Pueblo Yard, and one pier on the western bank of the Arkansas River.

Overhead electric lines cross the bridge at both the east and west ends. Underground gas lines exist in the railroad yard and east approach fill. Gas, electric and communications lines run on the bridge outside of the edge girders. Storm water runoff from the west approach is collected in a sewer system which daylights at the west abutment on the north side of the bridge. Outfall from the pipes has caused significant slope erosion.

2.2 Rating and Classification

The existing bridge has a Sufficiency Rating of 24 out of a possible 100 (SIA, 2002). The sufficiency rating is a function of the structural adequacy, safety, serviceability, functional obsolescence, and public use of the bridge. The overall structural condition was rated as "meets the minimum tolerable limits to be left in place as is," and the bridge has been classified as "Structurally Deficient" (SD).

The SD classification is based on substantial substructure pier deterioration, which is described as "poor with advanced section loss, deterioration, spalling, and/or scour." Joint failure and leakage have caused significant concrete and reinforcing deterioration of the substructure piers. Loss of concrete cover has led to corrosion of column and bent cap reinforcing steel, including the full section loss of some primary and secondary bars.

Substandard horizontal under-clearance is described in the latest CDOT rating report (SIA, 2002) as "basically intolerable requiring high priority of replacement." This is due

to the close proximity of railroad tracks to existing bridge piers. Recently, an empty railroad flatcar traveling at slow speed derailed and struck a pier causing damage, illustrating the importance of adequate clearance between the centerline of track and the face of an adjacent pier. The minimum existing horizontal clearance is 8'-3" from the centerline of UPRR Yard Track 21 to the face of Pier 5. This pier is located adjacent to the Arkansas River Floodwall. Table 2.1 shows existing horizontal clearances for each pier, the majority of which are less than 25'-0", the current railroad, AREMA, and AASHTO requirement when crash walls are not provided (18'-0" with crash walls). Inadequate horizontal clearance to the railroad tracks is a major concern as it relates to the safety of the traveling public and railroad personnel.

Table 2.1 Existing Horizontal Clearances in Railroad Yard

Pier	Horizontal Clearance Face of Pier to Centerline Track *
1	27'-6"
2	11'-0"
3	10'-6"
4	11'-9"
5	8'-3"
6	N/A (River Pier)

*Clearances shown are per project survey data, August 2001.

2.3 Structural Condition

As stated above, field conditions described in the latest inspection report (SIA, 2002) result in an overall Sufficiency Rating of 24 and a Structurally Deficient classification. The report describes the overall structural condition as "meets the minimum tolerable limits to be left in place as is."

2.3.1 Substructure

The substructure condition is rated as "poor with advanced section loss, deterioration, spalling, and/or scour." The substructure is deteriorating rapidly as loss of concrete has led to the corrosion of major and minor reinforcing steel in the piers. The substructure is stable for scour, indicating that there are no scour issues with Pier 6 located in the Arkansas River channel.

2.3.2 Superstructure

The superstructure and deck conditions are rated as "satisfactory with some minor deterioration of the structural elements." Spotted corrosion is occurring on the steel bridge girders and on the rocker bearings and expansion joint components. Areas of

flaking lead paint on the girders raises environmental concerns as well as corrosion issues. There is a significant build-up of sand on the abutment seats, and the slopes in front of both abutments are eroding due to poor drainage and slope protection. Signs of corrosion on the steel elements shows the beginnings of what can be a rapid deterioration of the superstructure.

2.3.3 Load Rating

The latest inspection report indicates that there is inadequate load carrying capacity compared to the original and current standards of design. The bridge was originally designed for an HS20 vehicle load (36 tons), which was the standard at the time of construction. The State of Colorado now requires that new bridges be designed for an HS25 or HL-93 vehicle load (45 tons), to reflect the heavier truck traffic common today. Inventory and Operating level load rating, as reported in the latest inspection report, is summarized in Table 2.2 below. The table shows that the bridge deck and the girders in spans 3 through 5 have 65% and 75% of the capacity of the original HS20 design loading at inventory level. This equates to 52% and 60% of current vehicle design load requirements.

Table 2.2 Existing Bridge Load Rating Results

Structural Member	Deck Slab	Unit 1 Girders Spans 1 and 2	Unit 2 Girders Spans 3 –5	Unit 3 Girders Spans 6 and 7
Inventory (tons)	23.3	49.9	27.0	47.0
Operating (tons)	38.9	83.2	45.1	78.3

2.4 Alignment and Profile

Bridge and approach geometry are substandard by today's design requirements. The down grade of the bridge from west to east combined with tight curvature on the east end have been blamed for unsafe driving conditions especially in inclement weather. Similarly, the reverse curve on the west approach has been identified as undesirable and somewhat of a safety concern for motorists. The structure profile provides adequate vertical clearance to the Loop Ramp roadway and top of railroad tracks below.

2.5 Bridge Cross Section

The existing 68-foot wide cross section carries four lanes of traffic as well as pedestrians and bicyclists in a narrow 4-foot sidewalk on each side. In an effort to increase safety after initial construction, vehicle barriers were added to both sides of the bridge to separate the sidewalks from the travel lanes, and a double W-beam traffic barrier was added in the median strip. Subsequently, travel lanes were reduced to 11-feet and shoulders to approximately 2-feet.

2.6 Summary of Existing Conditions

Advanced deterioration of the substructure coupled with inadequate horizontal under-clearance between piers and adjacent railroad tracks have resulted in a bridge Sufficiency Rating of 24 out of 100. Load capacity of the bridge is 52% to 60% of current design standards. Cover and section loss of the concrete piers and bent caps have led to significant deterioration of primary and secondary reinforcing in these elements. Continuation and acceleration of this deterioration is anticipated to shorten the expected life of the structure. Inadequate horizontal clearance to the railroad tracks is a major concern as it relates to the safety of the traveling public and railroad personnel. Clearances in the yard are significantly below the minimum requirements established by AASHTO, AREMA, and the affected railroads.

As discussed in the Structure Concept Report (FIGG, 2001), rehabilitation in conjunction with widening would result in substantial cost with only minor improvements to the existing conditions. Safety issues surrounding the lack of horizontal under-clearance could not be addressed. Therefore, as stated in the Structure Concept Report, replacement of the structure with a new bridge built to current design and safety standards has been chosen as the appropriate construction alternate.

Figures 2.1 through 2.8 illustrate the existing conditions discussed above. Additional site photographs are included in the Structure Concept Report.

Figure 2.1 Pueblo Yard Looking North

Figure 2.2 Pueblo Yard Looking South

Figure 2.3 Bent 1 Concrete and Reinforcing Deterioration

Figure 2.4 Bent 5 Concrete and Reinforcing Deterioration

Figure 2.5 Proximity of Pier 5 to UPRR Yard Track 21 and Floodwall

Figure 2.6 Storm Sewer Outfall at West Abutment

Figure 2.7 Erosion at West Abutment

Figure 2.8 Erosion at East Abutment