

PERMANENT CHANGES TO PROJECT DATED SPECIAL PROVISIONS

REVISION OF SECTION 509 LOCK-PIN AND COLLAR FASTENERS

DATE	AUTHOR	DESCRIPTION OF CHANGE
10/24/94	DLD	This specification was for a specific test application and is provided here for information only.
9/29/1999	M.Nord	Converted to Microsoft Word 97 SR-2 Revised the specification references to conform with the <i>1999 Colorado DOT Standard Specifications for Road and Bridge Construction</i> as follows: On page four, changed 509.41 to 509.33 because Basis of Payment is now 509.33.

REVISION OF SECTION 509
LOCK-PIN AND COLLAR FASTENERS

Section 509 of the Standard Specifications is hereby revised for this project as follows:

Subsection 509.01 shall include the following:

High strength steel lock-pin and collar fasteners shall be used in unit #5N for all high strength bolts (those required to conform to the requirements of AASHTO M164 (ASTM A325)) specified.

Subsection 509.08 shall include the following:

The steel lock-pin and swaged collar fastener system shall conform to the materials, manufacturing, chemical composition and mechanical requirements (in full size tests) of AASHTO M164 (ASTM A325). The shank diameter and the bearing area under the head and swaged collar shall not be less than those provided by a bolt and nut of the same nominal dimensions prescribed in the requirements for "Heavy Hexagonal Structural Bolts" and for "Heavy Semi-Finished Hexagonal Nuts" given in ANSI Standard B 18.2.1 and B 18.22, respectively. Each fastener shall provide a shank body of sufficient diameter to provide tensile and shear strength equivalent to or greater than the bolt specified; shall have a cold forged head on one end of the type and dimensions specified, a shank length suitable for material thickness fastened, locking grooves (all annular rings) on the opposite end. Each fastener shall provide a steel locking collar of proper size for shank diameter used, which by means of suitable installation tools, is cold swaged into the locking grooves forming a head for the grooved end of the fastener after the pull groove section has been removed. The steel locking collar (the collar shall be of the flanged type) shall be a standard product of an established manufacturer of lock-pin and collar fasteners. The pin shall be specifically marked to identify the manufacturer.

The fasteners after installation shall conform to the following hardness requirements:

Hardness Number

<u>Brinell</u>		<u>Rockwell C</u>	
Min.	Max.	Min.	Max.
248	311	24	33

-2-

REVISION OF SECTION 509
LOCK-PIN AND COLLAR FASTENERS

All washers shall be hardened steel washers conforming to the requirements of AASHTO M293 (ASTM F436). The washers shall be specifically marked to identify the manufacturer.

Pin proof load tests (ASTM F606 Method 1) are required. Minimum frequency of tests shall be as specified in AASHTO M164 (ASTM A325) paragraph 9.2.4.

Wedge tests on full size pins (ASTM F606 paragraph 3.5) are required. If pins are to be galvanized, tests shall be performed after galvanizing. Minimum frequency of tests shall be as specified in AASHTO M164 (ASTM A325) paragraph 9.2.4.

Subsection 509.13 shall include the following:

The Contractor shall provide the engineer with:

- (1) Mill Test Reports for all mill steel used in the manufacture of the lock-pin, flanged collars and hardened washers. The Mill Test Reports shall indicate where (city and state) the steel was melted and manufactured. (All materials shall be of domestic origin as well as all subsequent processing.)
- (2) The lock-pin and collar Manufacturer's Certified Test Report with the following:
 - (a) The location where all of the lock-pin, collars and hardened washers were manufactured.
 - (b) A statement that all the fasteners provided meet the requirements of this specification and the applicable requirements of AASHTO M164.
 - (c) Results of the tests required in Subsection 509.08.

Delete subsection 509.28(d) and replace with the following:

- (d) All field connections shall be made with high-strength bolts which include direct tension indicators. Direct tension indicators shall be either washer type direct tension indicators, tension control bolts or high strength steel lock-pin and collar fasteners.

REVISION OF SECTION 509
LOCK-PIN AND COLLAR FASTENERS

Subsection 509.28(f) shall include the following:

The Contractor shall require a representative of the lock-pin and collar manufacturer to be on the project to train the steel erector's personnel in the proper installation of the fastener system. This representative shall be thoroughly familiar with the lock-pin and collar system and the required installation procedures and equipment.

Installation and tightening of each connection shall be done in the following manner:

- (1) Splice connections shall not be tightened until the entire continuous length of girder is in place on the substructure. One half the holes shall be filled with lock-pins and collars. Field splice elevations shall be verified prior to tightening. A hardened washer per ASTM F436 maybe used under the pin head for joint thickness adjustment so that the installed fastener conforms to the Dimension "B", (See attached table).
- (2) Fasteners in all holes of the connection shall be initially brought to a snug tight condition (as defined in the attached table) progressing systematically from the most rigid part of the connection to the free edges in a manner that will minimize realization of previously tightened fasteners. The snug tight condition shall be verified on the calibration device prior to achieving the required final clamping force when testing for acceptance.
- (3) After all fasteners in the connection are snug tight, they shall be fully tightened, progressing systematically from the center most rigid part of the connection to its free edge.

After installation and tightening is completed each installed fastener shall be pinged with a hammer for soundness. Loose or rejected fasteners shall be removed and replaced with a new fastener. Each fastener shall be visually inspected in accordance with the attached table.

Subsection 509.28(h) shall include the following:

The Contractor shall provide a direct tension measurement device (Skidmore-Wilhelm Calibrator or an acceptable

REVISION OF SECTION 509
 LOCK-PIN AND COLLAR FASTENERS

equivalent) for acceptance testing of the fasteners on the project and it shall have been certified by a testing laboratory within the last 6 months.

A representative sample (randomly selected by the engineer) of three fasteners of each diameter, length and lot shall be tested by the Contractor in the tension measuring device.

The assemblies shall be snug clamped to approximately the value indicated in the following table prior to final clamping. If any fastener fails to meet the required minimum tension (a pin tail brakes off before achieving the final clamping force) listed in the following table, the lot shall be rejected.

<u>PIN DIAMETER</u> <u>(Inches)</u>	<u>SNUG CLAMPING(1)</u> <u>(Kips)</u>	<u>FINAL CLAMPING(2)</u> <u>(Kips)</u>
3/4	5	29
7/8	7	41
1	9	54
1 1/2	14	108

- (1) Partially swaged collar, pintail still attached to pin.
- (2) Fully swaged collar, pintail pulled off.

Subsection 509.33 shall include the following:

All costs for lock-pins, flanged collars, hardened washers, testing, reports, technical representative, installation tools and hydraulic power supplies shall be included in Item 509, Structural Steel.