INDIANA DEPARTMENT OF TRANSPORTATION

INTER-DEPARTMENT COMMUNICATION

232-6775

August 29, 2006

DESIGN MEMORANDUM No. 06-07
POLICY CHANGE

TO: **All Design, Operations, and District Personnel, and Consultants**

FROM: ***/s/ Anthony L. Uremovich***
Anthony L. Uremovich
Design Resources Engineer
Production Management Division

SUBJECT: **High-Performance Structural Steel**

COMPLEMENTS: ***Indiana Design Manual*** **Section 64-2.01(01)**

EFFECTIVE: **January 10, 2007, Letting**

The procedure described in the referenced *Indiana Design Manual* section should be followed, but will not be revised at this time.

Recurring Special Provision 711-B-165, attached hereto, should be called for beginning with the January 10, 2007, letting, and through the August 22, 2007, letting. Beginning with the September 6, 2007, letting, the recurring special provision will be incorporated into the INDOT *Standard Specifications*. The provision will then no longer be required to be called for in specific contracts.

[F:\Des\Signed\0607-ta.doc]

HIGH-PERFORMANCE STEEL

The Standard Specifications are revised as follows:

SECTION 711, AFTER LINE 15, INSERT AS FOLLOWS:

Where grade HPS 70W (HPS 485W) or grade HPS 50W (HPS 345W) steel is shown on the plans, the high performance steel shall be in accordance with 910.02(c).

SECTION 711, AFTER LINE 34, INSERT AS FOLLOWS:

Fabrication of high performance steel shall be in accordance with the AASHTO Guide Specifications for Highway Bridge Fabrication with HPS 70W Steel, an addendum to ANSI/AASHTO/AWS D1.5M/D1.5:2002, except as modified herein.

SECTION 711, AFTER LINE 48, INSERT AS FOLLOWS:

Only fabricators meeting the requirements of the AISC Quality Certification Program, "Major Steel Bridges (Cbr)" with "Fracture Critical Members Endorsement (F)", or approved equal, may be used to fabricate girders using high performance steel. Prior to approval for fabrication, the results of the latest AISC certification review shall be made available to the Engineer to determine if items critical to successful fabrication meet the needs of the specific work.

SECTION 711, BEGIN LINE 91,DELETE AND INSERT AS FOLLOWS:

711.08 Mill Test Reports

Prior to, or concurrent with, the fabrication, ~~four copies~~ *a copy* of *the* mill test report~~s~~ shall be furnished. If the manufacturer's mill test reports are not available, tests shall be made

SECTION 711, AFTER LINE 138, INSERT AS FOLLOWS:

Short term application of heat to high performance steel for purposes of heat curving, heat straightening, camber and sweep adjustment, or for other reasons is limited and shall not exceed 1100°F (590°C). Heat applications shall be in accordance with Department approved procedures.

SECTION 711, AFTER LINE 399, INSERT AS FOLLOWS:

(c) Welding of High Performance Steel

All welding on high performance steel shall be in accordance with the ANSI/AASHTO/AWS D1.5M/D1.5 Bridge Welding Code, hereinafter referred to as the Bridge Welding Code, except as modified herein and by the AASHTO Guide Specifications for Highway Bridge Fabrication with HPS 70W Steel, an addendum to the 2002 Edition of the Bridge Welding Code.

Only submerged arc welding, SAW, and shielded metal arc welding, SMAW, processes will be permitted. Consumable handling requirements shall be in accordance with the Bridge Welding Code, Section 12.6.5 and 12.6.6, when using reduced preheat as described in Table 3 of the Guide, except that SAW consumables for matching weld metal shall meet the hydrogen control level of H4 in accordance with Section 12, Article 12.6.2. Consumable handling requirements shall meet the provisions of The Bridge Welding Code, Section 4, when using the preheat requirements of Table 4.4, except that the diffusible hydrogen level must never exceed H8. SMAW consumables may meet diffusible hydrogen levels of either H4 or H8 except the higher preheat and interpass temperatures

as noted in Table 3 of the AASHTO Guide Specifications for Highway Bridge Fabrication with HPS 70W Steel shall apply to H8 conditions.

Filler metals used to make single pass fillet welds for web to flange applications which join HPS 70W steel plates, HPS 70W to grade 50W plates and for attaching stiffeners and connection plates to grade HPS 70W (HPS 485W) webs and flanges, shall be in accordance with the Bridge Welding Code, Table 4.1 for ASTM A 709, grade 50W (ASTM A 709M, grade 345W) base metal. Filler metals for single pass 5/16" fillet welds need not meet the requirements for exposed bare applications.

Filler metals used for all complete penetration groove welds joining grade HPS 70W (grade HPS 485W) plate to ASTM A 709, grade HPS 50W (A 709M, grade HPS 345W) or grade 50W (grade 345W) plate shall conform to the requirements for welding Grade 50W base metal.

Filler metals used for all complete penetration groove welds joining grade HPS 70W (grade HPS 485W) plates to grade HPS 70W (grade HPS 485W) plates shall conform to the requirements for HPS 70W (HPS 485W) base metal as follows:

1. *Submerged Arc Welding process:*

   Wire - LA85 by Lincoln Electric Company
   Flux - MIL800HPNi by Lincoln Electric Company

2. *Shielded Metal Arc Welding process*

   *Matching - E9018MR**
   *Undermatching - E7018MR**

* *The designator 'MR', for moisture resistant coating, is required for all SMAW electrodes used for welding HPS 70W [HPS 485W] steels.*

The Contractor may request approval of alternate consumables for matching weld strengths in lieu of the above filler metals for SAW. The request for approval shall include documentation of successful welding and shall also include diffusible hydrogen tests, both in accordance with the Bridge Welding Code.

All welding procedures shall be qualified in accordance with the Bridge Welding Code Section 5, Qualification. In general, the provisions of Article 5.12 shall apply. Qualification tests shall measure strength, toughness and ductility, with results evaluated in accordance with Article 5.19. If specified on the plans, additional tests shall measure the Charpy V-notch toughness of the coarse grained area of the heat affected zone, HAZ. The notch in the specimens shall be carefully located in the coarse grained area of the HAZ, as determined by macro-etching the specimens prior to machining and testing. The toughness requirement for the HAZ shall be the same as the weld metal.

All procedure qualification tests shall be ultrasonically tested in accordance with the requirements of the Bridge Welding Code, Section 6, Part C. Evaluation shall be in accordance with Table 6.3, UT Acceptance – Rejection Criteria – Tensile Stress.

Indications found at the interface of the backing bar may be disregarded regardless of the defect rating.

A representative of the Department must witness all welding procedure qualification tests.

Results of the welding procedure qualification tests and final welding procedure specifications shall be submitted to the Engineer for review and approval.

In general, post weld heat treatment will not be required. The use of such post weld heat treatment will require additional qualification testing.

Wherever magnetic particle testing is done, only the yoke technique will be allowed, as described in Section 6.7.6.2 of the Bridge Welding Code, modified to use alternating current only.

SECTION 711, BEGIN LINE 978,DELETE AND INSERT AS FOLLOWS:

711.72 Method of Measurement

~~Plain structural~~ *Structural* steel shapes, fabricated steel, steel castings, iron castings, bolts, pins, rollers, rockers, anchor bolts, and threaded rods will be measured by the pound (kilogram). If the Schedule of Pay Items includes a lump sum item for structural steel, all

SECTION 711, BEGIN LINE 1000, INSERT AS FOLLOWS:

711.73 Basis of Payment

The accepted quantities of ~~plain~~ structural steel shapes, fabricated steel, steel castings, iron castings, bolts, pins, rollers, rockers, anchor bolts, and threaded rods will be paid for at a contract lump sum price if the Schedule of Pay Items includes a lump sum pay item for structural steel. Changes from the estimated quantities shall be in accordance

SECTION 910, AFTER LINE 192, DELETE AND INSERT AS FOLLOWS:

(c) High Performance Steel

High performance steel, HPS, shall be in accordance with ASTM A 709 (A 709M). In addition to the conditions listed in Section 6.7 of ASTM A 709 (A 709M), high performance steel may be furnished as hybrid/mixed design structural components using high performance steel plates in combination with high strength, low alloy steel plates and shapes, for welded or bolted applications in bridge construction.

The impact testing requirements for HPS in accordance with 10.1 and 10.2 of ASTM A 709 (A 709M) shall meet temperature zone 2.

SECTION 910, LINE 193, DELETE AND INSERT AS FOLLOWS:

~~(c)~~ *(d)* Charpy V-Notch Toughness Tests

SECTION 910, LINE 210, DELETE AND INSERT AS FOLLOWS:

~~(d)~~ *(e)* Mill Test Reports

SECTION 910, LINE 214. DELETE AND INSERT AS FOLLOWS:

~~(e)~~ *(f)* High Strength Bolts, Nuts, and Washers

SECTION 910, LINE 277, DELETE AND INSERT AS FOLLOWS:

~~(f)~~ *(g)* Bolts other than High Strength Bolts

SECTION 711, BEGIN LINE 789, DELETE AND INSERT AS FOLLOWS:

(b) Bolts, Nuts, and Washers

Bolts, nuts, and washers shall be in accordance with ~~910.02(e)~~ *910.02(f)*. All galvanized nuts shall be lubricated with lubricant containing a visible dye. Black bolts shall be oily to the touch when installed. Weathered or rusted bolts shall be cleaned and lubricated prior to installation.

SECTION 711, BEGIN LINE 942, DELETE AND INSERT AS FOLLOWS:

711.66 Bolted Connections Using Other Than High Strength Bolts

Bolts for these connections shall be in accordance with ~~910.02(f)~~ *910.02(g)*.

SECTION 910, BEGIN LINE 210, DELETE AND INSERT AS FOLLOWS:

~~(d)~~ *(e)* Mill Test Reports

Mill test reports for structural steel shall be in accordance with 711.08 and 916 and shall include Charpy-Impact test data as set out in ~~910.02(c)~~ *910.02(d)*.

SECTION 910, BEGIN LINE 225, DELETE AND INSERT AS FOLLOWS:

2. Assembly of Structural Steel in Bridges

High strength bolts, nuts, and washers used in the assembly of structural steel in bridges, excluding shoes and bearing assemblies, shall be provided in accordance with ~~910.02(e)1~~ *910.02(f)1* and the following additional requirements.