



To: <p style="text-align: center;">SUPERSEDED BY <u>EB 05-030</u> EFFECTIVE <u>05/10/05</u></p>		New York State Department of Transportation ENGINEERING BULLETIN	EB 05-024
Expires one year after issue unless replaced sooner			
Title: NYSDOT STEEL CONSTRUCTION MANUAL AMENDMENT			
Distribution: <input checked="" type="checkbox"/> Manufacturers (18) <input checked="" type="checkbox"/> Local Govt. (31) <input checked="" type="checkbox"/> Agencies (32) <input type="checkbox"/> Surveyors (33) <input checked="" type="checkbox"/> Consultants (34) <input checked="" type="checkbox"/> Contractors (39) _____ ()	Approved:  G.A. Christian, Deputy Chief Engineer Structures	4/8/05 Date	

ADMINISTRATIVE INFORMATION: NYS STEEL CONSTRUCTION MANUAL AMENDMENT

- Effective Date: This Engineering Bulletin (EB) is effective upon signature.
- Superseded Issuances: No issuances are superseded by this EB.
- Disposition of Issued Materials: The guidance issued by this EB will reside in the *NYS Steel Construction Manual (SCM)*.

PURPOSE: The purpose of this EB is to issue revised *NYS Steel Construction Manual*, Article 204, *Steel Erection*, and Section 14, *Storage, Transportation & Erection*.

TECHNICAL INFORMATION: This EB issues new requirements for steel erection procedures. Contractors will be required to submit girder stability calculations signed by a Professional Engineer licensed to practice in New York State with all steel erection plans. Modified sections of the SCM are indicated by a vertical line in the right hand margin.

IMPLEMENTATION: Because of the immediate need to implement the change to the SCM, the following implementation schedule is required:

1. For contracts submitted for lettings before May 19, 2005, the changes issued by the revised SCM pages will be made by Order-on-Contract.
2. Beginning with Contracts submitted for lettings on May 19, 2005, and before September 8, 2005, the changes issued by the revised SCM pages will be made by amendment.
3. Beginning with Contracts submitted for the letting of September 8, 2005, the changes issued by the revised SCM pages will be included in contract proposals by designers.

INSTRUCTIONS TO THE FIELD: For on-going contracts, the Engineer is directed to assess the remaining work and determine if it is beneficial to implement the change in consultation with the Metals Engineering Unit, Structures Division, and subject to negotiating a reasonable cost for the order-on-contract with the Contractor.

TRANSMITTED MATERIALS: The revisions to the SCM Article 204 (replacement pages 11-14B) and Section 14 (replacement pages 159-162) are attached for insertion into the SCM.

BACKGROUND: Structural steel erection of bridges is the process of transporting, handling and assembling the steel bridge components in a safe and efficient manner to result in a structure that meets all the geometric and structural requirements of the contract documents. Contractors select their erection methods based on the availability of equipment and/or personnel and develop erection procedures to validate their methods.

EB 05-024 Page 2 of 2

The *Standard Specification* and the *NYS Steel Construction Manual (SCM)* clearly indicate that the Contractor is responsible for the stability of the structure during erection. Erection procedures prepared by the Contractor are submitted to the Department as part of the Department's quality assurance program. While the Contractor proposed erection methods may provide for a buildable structure, they may be unacceptable from the Department's perspective due to conflicts with accepted bridge design practice or the level of risk acceptable to the Department. These risks include the safety of construction workers and the public, delays affecting the project schedule and the traveling customers, damage to the girders and/or the introduction of unanticipated secondary stresses to the steel system. The Department QA review helps to ensure that the risk of physical harm to workers and to the public is minimized and that the structure will safely deliver the uninterrupted service life intended during project development.

The Department's Structural Steel Quality Assurance Program, provided for in the SCM, documents the quality actions of the Department, contractors, fabricators and erectors. The attached amendment modifies the SCM to bring it more in line with National standards such as the *AASHTO LRFD Bridge Construction Specifications* and the proposed *AASHTO/NSBA Bridge Erection Guide Specification*.

CONTACT: Questions regarding this EB should be addressed to Paul Rimmer at (518) 457-4526, or primmer@dot.state.ny.us.

203.13 Lateral Bracing and Diaphragm Connections. In general lateral bracing and diaphragms shall be bolted to the girder as shown on the Plans. Oversize holes will be allowed for these connections, provided:

- a) They occur in only one component of the bolted connection.
- b) The holes in the girder flange or stiffener/connection plate are made standard size.
- c) The locations of the oversize holes are indicated on the Shop Drawings.
- d) The exposed oversize holes are covered with a hardened washer.
- e) There is no field reaming of oversize holes without the approval of the DCES.

Bolt holes in the flange of a girder shall be a minimum of 6 inches, preferably 12 inches, from a groove welded flange splice. The dimensions of bolt holes shall conform to Articles 613 & 614.

203.11 Bearing Sole Plates. When the steel is to be erected to a grade of five or less, it will not be necessary to machine the top of the sole plate to a compensating bevel unless otherwise noted on the Plans. No machining of the top of the sole plate will be required if the surface is plane and true as described in Article 612, Machining of Contact Surfaces.

203.12 Curved Girders. When the Contract Plans specify welded plate girders with horizontal curvature, the girders shall be fabricated using heat-curving procedures in accordance with Section 15 or by oxygen cutting the flanges to the required radius prior to assembly to the web. The camber data for welded plate girders shall be provided by the DCES.

The horizontal curvature and camber, if specified, for rolled beams, shall be fabricated using only heat-curving procedures in accordance with Section 15.

203.13 Bolt Spacing and Edge Distance. The minimum distance between centers of fasteners shall not be less than the following:

For 1-1/8 inch fasteners.....	4 inches
For 1 inch fasteners	3-1/2 inches
For 7/8 inch fasteners	3 inches
For 3/4 inch fasteners	2-1/2 inches
For 5/8 inch fasteners	2-1/4 inches

The minimum distance from the center of any fastener to the edge of a plate shall be:

For 1-1/8 inch fasteners.....	2 inches
For 1 inch fasteners	1-3/4 inches
For 7/8 inch fasteners	1-1/2 inches
For 3/4 inch fasteners	1-1/4 inches
For 5/8 inch fasteners	1-1/8 inches

In the flanges or legs of rolled sections the minimum edge distance shall be:

For 1-1/8 inch fasteners.....	1-3/8 inches
For 1 inch fasteners	1-1/4 inches
For 7/8 inch fasteners	1-1/8 inches
For 3/4 inch fasteners	1 inch
For 5/8 inch fasteners	7/8 inch

For sealing, the maximum spacing of fasteners along the free edge of a plate shall be 4 inches plus four times the thickness of the thinner plate, but not more than 7 inches.

The maximum distance from any edge shall be eight times the thickness of the thinnest outside plate, or section but shall not exceed 5 inches.

204. ERECTION PROCEDURES

204.1 General. The Contractor shall submit a detailed structural steel erection procedure to the DCES and to the Regional Director for each structure in the Contract. These procedures shall meet all the drawing requirements of Article 202, Shop Drawings and shall include the required information in Articles 204.2 [drawings] and 204.3 [calculations]. Copies of the drawings shall also be sent for comments to any railroad company or public agency affected by the proposed erection procedure. These drawings must be received at least 30 days prior to the proposed beginning of erection. The Regional Director's office will review any portion of the erection procedure that affects the maintenance of traffic, modifies the existing pavement, or the flow of water and shall verify actual site conditions with what is shown on the erection plans. All comments or revisions required by DCES, Regional office, railroad company, or public agency shall be incorporated in the final submission, which shall then be reviewed by the DCES.

In addition to the requirements of the SCM the lifting procedures shall meet all of the requirements of NYSDOT Standard Specifications Section 107.05 P Lifting.

Distribution of copies of the reviewed erection procedure drawings shall be made as described in Article 202.7, except distribution to the Shop Inspection Agency is not required.

204.2 Required Information [Drawings]. Erection drawings shall be prepared by a Professional Engineer registered to practice in New York State. The following minimum information shall be placed on the erection drawings for each individual structure. Erection procedures for similar structures or twin bridges may be shown on the same sheet.

- a) Title block with contract number, project identification number (PIN)
- b) Project and contract name and county in which the work is to be performed, together with the contractor's name and address, fabricator's and sub-fabricator's name and address as appropriate, bridge identification number (BIN), and the fabricator's unique shop order number or purchase number for the work detailed on the sheet.
- c) Plan of the work area showing support structures, roads, railroad tracks, canals or streams, utilities or any other information relative to erection, including lifting and release of the member.
- d) Erection sequence for main members and secondary members (crossframes, diaphragms, lateral bracing, portals, etc.), noting use of holding cranes or temporary supports, falsework, and bents. The erection sequence shall describe the procedure required to stabilize each member during the pick and upon release of the crane.
- e) Delivery location of each girder.
- f) Location of each crane for each pick.
- g) Capacity chart for each crane and boom length used in the work. Cranes lifting over active railroad facilities shall have a minimum lifting capacity of 150 percent of the lift weight.
- h) Pick point location(s) on each member.
- i) Lifting weight of each member (including clamps, spreader beams, etc.).
- j) Lift and setting radius for each pick (or maximum lift radius).
- k) Description of lifting devices or other connecting equipment.

- l) Girder tie-down details or other method of stabilizing erected girders. All diaphragms or temporary bracing between adjacent girders shall be connected consistent with the requirements of Section 14 before release of the crane. All requests for revisions to this requirement must be supported by the necessary engineering calculations and submitted with the erection procedure.
- m) Bolting requirements, including the minimum number of bolts and erection pins required to stabilize members during the erection sequence.
- n) Blocking details for stabilizing members supported on expansion bearings and on bearings that do not limit movement in the transverse direction.
- o) The method and location of temporary support for field spliced or curved girders, including shoring, falsework, holding cranes, stiffening trusses, guys, etc. The State will examine, but not approve details of temporary supports. The design, erection, and stability of these supports shall be the sole responsibility of the Contractor. Calculations for falsework and temporary details signed by a NYS Licensed Professional Engineer shall be submitted for DCES review.
- p) Offsets necessary to adjust expansion bearings during erection to provide for temperature variance and dead load rotation when appropriate.

The following notes shall be placed on the Erection Drawings.

- 1) No crane will be operated in a manner that will exceed its rated capacity at any radius as specified by the crane manufacturer.
- 2) The table or chart prepared by the crane manufacturer to describe the maximum lift at all conditions of loading shall be posted in each crane cab in clear view of the operator.
- 3) The Contractor shall be responsible for verifying the weight of each lift and for insuring the stability of each member during all phases of erection, including lifting and release of the member.
- 4) Members shall be subject to only light drifting to align holes. Any drifting that results in distortion of the member or damage to the holes will be cause for rejection of the member.
- 5) Field reaming of holes shall not be performed unless required by the Contract Documents or approved by the DCES.
- 6) The final alignment and profile of the erected steel shall conform to the requirements of the Contract Documents. Measurements shall be made by the Contractor as described in Articles 1212, 1213, and 1214 of the New York State Steel Construction Manual.
- 7) When the structure utilizes a Geosynthetic Reinforced Earth substructure, cranes or crane outriggers shall not be placed within limits specified on the plans during erection.

204.3 Required Information [Calculations]. The following calculations shall be prepared by a New York State Registered Professional Engineer and provided for each structure submitted:

- a) Calculations to verify the structural integrity and stability of the girders during transportation and erection until completion of the bridge assembly.
- b) Design calculations indicating the load capacity and stability of temporary supports for the structure and the crane.
- c) Calculations to indicate the capacity of Contractor fabricated rigging including but not limited to lift beams, spreader beams and beam clamps. Submit manufacturer's certification or catalog cuts for pre-engineered devices.
- d) An analysis of the substructure when crane footprint causes a surcharge loading on the structure.
- e) Surcharge loading to underground facilities should be avoided. An analysis of underground utilities and buried structures when the crane footprint causes a surcharge on such facilities.

205. REPAIR PROCEDURE DRAWINGS

205.1 General. Written repair procedures including full-size drawings as necessary to fully describe the deficiencies and the proposed repair shall be prepared by the Contractor (Fabricator) and submitted to the Deputy Chief Engineer (Structures) for approval, in accordance with Article 726.

205.2 Required Information. When written repair procedures are required for the repair of defects, repair procedure drawings shall be prepared to show the defect in plan view, elevation and section as necessary to adequately locate and describe the defect and the proposed repair. A space shall be provided on the sheet for the inspector's signature to show that he has inspected the defect and has found that the drawings accurately describe the defect as it appears prior to repair. The proposed repair procedure shall be described in detail including at least the following information, listed in a proposed sequence of operation:

- a) The area of the steel adjacent to the defect shall be cleaned by grinding to expose the surface boundaries of the defect.
- b) Plan views and sections of the excavations of defects shall be shown. All air carbon arc gouging shall be followed by grinding to remove carbon pick-up and to remove surface irregularities.
- c) Magnetic particle testing shall be performed in accordance with Section 18 to insure that the limits of the defects have been completely removed prior to welding the excavation.
- d) All preheat and interpass temperatures shall be shown. When required, peening, post heat, and stress relief heat treatment procedures shall also be described.
- e) Run-off tabs and back-up bars shall be shown in detail. They shall be removed after welding and all surfaces shall be finished flush by machining or grinding.
- f) The welding procedure specification shall be shown.
- g) Nondestructive testing procedures shall be performed at the completion of the repair. The methods and procedures shall be described on the repair drawing.
- h) A space shall be provided for the Inspector's signature indicating the work has been acceptably completed in accordance with the approved repair procedure.

205.3 Sample Repair Drawing. An example of a repair drawing prepared to show a typical repair of a base metal crack is included in Appendix B of this Manual.

206. TRANSPORTATION DRAWINGS

206.1 General. All members, both straight and curved, shall be shipped and stored with their webs vertical unless otherwise approved by the DCES. Transportation drawings must be prepared by the Contractor (Fabricator) and submitted to the DCES for approval whenever members must be shipped on their sides. Transportation drawings may also be required for members shipped with their webs vertical when there is doubt about the intensity of stress induced by the procedures used to handle, transport or store the members. Any curved member shipped with a cantilever overhang of more than 25 feet shall require transportation drawings.

206.2 Required Information. Transportation drawings shall include at least the following information:

- a) The drawings may be sketch sheets or full size shop drawings as necessary to fully describe the procedures.
- b) Calculation sheets shall be included to show the dead load plus impact stresses induced by the loading and transportation procedure. Impact stresses shall be at least 200% of the dead load stress. The total load including impact shall be not less than 300% of the dead load.
- c) The location of all support points shall be shown. Supports shall be detailed to be under the flanges regardless of the member's orientation.
- d) Tie-downs (types and locations) shall be shown. A sufficient number shall be used to provide redundancy so that if any one tie-down fails, the member will remain stable.
- e) Temporary stiffening trusses or beams shall be shown if they are necessary to provide temporary support (stiffness) to the member during shipping.
- f) Details of a four-way articulating bolster are to be furnished for each truck transporter to insure that truck movements will not produce unnecessary stress in the attached structural steel.

207. HEAT CURVING DRAWINGS

207.1 General. Drawings shall be prepared by the Contractor (Fabricator) and submitted to the DCES for approval whenever beams or girders are to be heat curved with the web in the horizontal position or when external preloads are to be applied (see Section 15, Heat Curving, Cambering, and Straightening). The drawings shall show the location of all supports, amount and location of external loads (if used), typical heat patterns and other information to describe the work. Calculation sheets shall be included to show the stresses induced in the member by the loading method.

SECTION 14
STORAGE, TRANSPORTATION, & ERECTION

1401. STORAGE OF MATERIALS

Structural material shall be stored above the surface of the ground on platforms, skids, or other supports, and shall be protected as far as practical from surface deterioration and kept free from accumulations of dirt, oil, or other foreign matter. No material shall, at any time, be dropped, thrown, or dragged on the ground. Girders and beams shall be handled and stored with their webs vertical and shall be adequately shored, braced, and/or clamped to resist any lateral forces which might occur. Long members such as columns and chords shall be supported at a sufficient number of intermediate locations to insure that there is no damage from deflection. Permanent distortion resulting from improper handling or storage will be cause for rejection.

Any damage incurred during storage at the shop shall be corrected by the Fabricator prior to acceptance for shipment by the Inspector. All fabricated material stored by the Contractor at the jobsite or other approved location will be subject to inspection by the Engineer and any corrective action required as the result of damage during storage shall be performed by the Contractor.

Repairs to damaged structural steel shall be done in accordance with procedures approved by the DCES.

1402. TRANSPORTATION

1402.1 Marking for Shipping. Erection pieces with computed weights exceeding three tons shall have the lifting weight to the nearest one-half ton marked thereon. Bolts and rivets of one length, nuts and washers shall be packaged separately by diameter. Pins, small parts, and small packages of bolts, rivets, washers, and nuts shall be shipped in boxes, crates, kegs, or barrels. The gross weight of any package shall not exceed 300 pounds. A list and description of the contained material shall be plainly marked on the outside of each shipping container. Shipping containers for high strength fasteners shall have the manufacturer's control lot numbers marked on the outside.

The weight of all tools and erection material shall be kept separate.

1402.2 Shipping. The loading, transportation, unloading and storage of structural material shall be conducted so that the metal will be kept clean and free from injury by rough handling.

Structural members shall be suitably supported and braced so that they will not be subjected to stresses in excess of those provided for in the design.

The method of shipment and requirements for transportation drawings shall conform to Article 206.

1403. ERECTION OF STRUCTURAL STEEL

1403.1 General. The Contractor's proposed structural steel erection procedure shall be described on erection drawings submitted to DCES for review. These drawings shall meet all provisions of Article 204, and when necessary, conform to the requirements of the Standard Specification section entitled "Work Affecting Railroads."

Pedestrians shall be protected at all times and no erection work shall be done over traffic on roadways, bikeways, waterways, and railroads. No erection work shall begin prior to the review of the erection procedure by the DCES and affected railroads and review of the traffic maintenance procedure by the Regional Director of Transportation. This review shall not be considered as relieving the Contractor of the responsibility for the safety of his method or equipment used, or for the responsibility of carrying out the work in accordance with the requirements of the Contract documents.

1403.2 Falsework. Curved girders and long span straight girders shall be stabilized with falsework, temporary braces, or holding cranes until a sufficient number of adjacent girders are erected with all diaphragms and crossframes connected to provide the necessary lateral stability. All trusses shall be erected on falsework unless otherwise approved by the DCES. The falsework shall provide for proper camber and alignment and shall be properly designed, constructed, and maintained for the loads which will be imposed upon it. When erecting trusses, the falsework shall be left in place until all connections are bolted and accepted by the Engineer unless otherwise provided in the erection procedure. Care shall be taken in the use of falsework and other temporary supports to insure that the temporary elevation of structural steel provided by the falsework is consistent with the deflections that will occur as the structure is completed.

Bridge railings shall not be bolted or welded in their final position until the falsework has been removed.

1403.3 Field Connections. Bolting or welding procedures necessary to complete the erection of the structure shall be shown on the erection drawings. The procedures shall include the sequence and method for connecting main members and secondary members. For stringer and girder spans, the following minimum information shall be included in the notes, modified as necessary to conform to design and erection requirements for each structure:

Splices and field connections of main stress carrying members shall be made with a minimum of 50% of the holes filled with approved high strength bolts and full size erection pins before the external support systems are released. At least one-half of this percentage shall be bolts, tightened to specification requirements. The bolts and pins shall be installed uniformly throughout the connection except that erection pins shall be used in the extreme corners of all main connections.

Members to be assembled on the ground before erection shall be blocked to their proper no load profile and 100% of the approved high strength bolts shall be installed and tightened to specification requirements before erecting the member.

All diaphragms and crossframes shall be installed as the work progresses unless the Contractor shows by calculation and the DCES approves a lesser amount as sufficient to stabilize the member. All diaphragms between adjacent girders shall be connected before release of the crane or other lifting device unless modifications have been requested and approved consistent with Article 204. When applicable, the number and location of diaphragms and crossframes needed to insure lateral stability of the members during all phases of the erection procedure, including during the lifting and upon release of the member, shall be shown on the erection drawings.

Between the first two lines of straight girders, each diaphragm or cross frame to girder connection shall be made with at least 50% of the holes filled with approved high strength bolts. The bolts shall be tightened until there is no gap between the connected parts. After the first two lines are erected and stabilized, diaphragms or crossframes installed between subsequent lines of girders may have each of their connections made with a minimum of two approved high strength bolts installed in each connection unless a greater number of bolts is required for stability. The bolts shall be tightened until there is no gap between the connected parts.

Between all lines of curved girders, each diaphragm or crossframe to girder connection shall be made with at least 50% of the holes filled with approved high strength bolts. The bolts shall be tightened until there is no gap between the connected parts.

If surfaces which are to be connected by field bolting or field welding have been painted or become rusted or contaminated with any foreign material that would make these connecting procedures unacceptable, the Contractor shall clean the surfaces at no additional cost to the State. A tight coating of light rust will be permitted on faying surfaces of bolted joints. No rust will be permitted at the fusion boundaries of groove welds.

Bolting procedures shall be in conformance with Section 10.

Erection bolts shall be the same nominal diameter and shall conform to the same specification as the final bolts. Cylindrical erection pins shall be the same size as the hole.

1403.4 Repair of Damaged or Misaligned Steel. All damaged or misaligned structural steel shall be straightened or corrected by procedures approved by the DCES. The method of repair proposed by the Contractor shall be submitted on a standard shop drawing for approval of the DCES prior to beginning the work. Approval, when granted, shall not relieve the Contractor of his responsibility for the successful completion of the work.

1403.5 Field Reaming and Drifting of Holes. Members shall be subject to only light drifting to align holes. Any members subjected to drifting that results in distortion of the member or elongation of the holes will be rejected.

Main members and secondary members with oversize holes shall not be field reamed without approval of the DCES.

Secondary members which have holes punched full size may be subjected to limited field reaming when approved by the DCES. If approved, reaming shall not elongate holes by an amount greater than 1/16 inch for 75% of the holes in any erection sub-assembly and 1/8 inch for the remaining 25% of the holes in the erection sub-assembly, i.e., diaphragm, lateral brace, etc.

The DCES may approve additional reaming of secondary members provided adequate edge distances and fastener spacing are maintained and the next larger size fastener is used. The edge distances shall be considered the same for either a rolled or planed edge.

Field reaming producing results exceeding the limits previously described, will be cause for rejection of the member.

1403.6 Adjustment of Pin Nuts. All nuts on pins shall be properly tightened and locked as specified on the plans or approved by the DCES. The pins shall be aligned in the holes so that the members shall take full and even bearing upon them.

1404. REMOVAL OF RUST AND STAINS FROM CONCRETE

All rust and other stains shall be removed from concrete surfaces in accordance with the requirements of the Standard Specification entitled *Structural Concrete*. This requirement shall apply for cleaning all new concrete as well as for cleaning all existing concrete stained or damaged by the Contractor's operations. If the Contractor elects to reduce concrete staining and rusting of surfaces which must be cleaned, he may, at no additional cost to the State, spray unpainted portions of steel members with an approximately one mil thick coat of commercial lacquer that has been given a slight coloration that will denote its presence. This lacquer coating may remain on all surfaces which are to be imbedded in, or are to be in contact with, concrete. The lacquer must be removed from all contact surfaces of bolted connections, from within three inches of a welded joint, and from areas that will subsequently be covered by field painting.

1405. FIELD INSPECTION

All erection shall be subject to the inspection of the Engineer-in-Charge, who shall be given all facilities required for a thorough inspection of the work. Materials and workmanship subject to shop inspection are identified by the acceptance stamp of the Shop Inspector as described in Article 303.7. Materials and workmanship not required to be shop inspected shall be inspected by the Engineer. Certified copies of the results of tests conducted by the manufacturer shall be furnished to the Engineer in accordance with the requirements of the specification for that item.

1406. FIELD REPAIR

All repairs to structural steel shall be subject to approval by the DCES.