AASHTO/NSBA Steel Bridge Collaboration

G 1.1 - 2000

Shop Detail Drawing Review/Approval Guidelines

AASHTO/NSBA Steel Bridge Collaboration

Preface

This document is a standard developed by the AASHTO/NSBA Steel Bridge Collaboration. The primary goal of the Collaboration is to achieve steel bridge design and construction of the highest quality and value through standardization of the design, fabrication, and erection processes. Each standard represents the consensus of a diverse group of professionals

It is intended that Owners adopt and implement Collaboration standards in their entirety to facilitate the achievement of standardization. It is understood, however, that local statutes or preferences may prevent full adoption of the document. In such cases Owners should adopt these documents with the exceptions they feel are necessary.

Disclaimer

The information presented in this publication has been prepared in accordance with recognized engineering principles and is for general information only. While it is believed to be accurate, this information should not be used or relied upon for any specific application without competent professional examination and verification of its accuracy, suitability, and applicability by a licensed professional engineer, designer, or architect.

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AASHTO Publication No.: NSBASDDRAG-1-OL

AASHTO / NSBA Steel Bridge Collaboration

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Table of Contents

Section 1
Definitions

Terms used in this document are in accordance with the AASHTO/NSBA Steel Bridge Collaboration standards. Terms that are specifically significant to this document are defined below.

1.1 Contract

The "Contract" includes the design plans, the Owner's standard specifications, supplemental specifications and special provisions, as well as material specifications and associated industry standards referenced by the Contract, such as AASHTO, AWS, and ASTM. The Contract is a binding agreement between the Owner and the Contractor, and any changes must be acknowledged and accepted by both parties.

1.2 Shop Detail Drawings

"Shop Detail Drawings" are produced by the Fabricator (or the Fabricator's representative) and define how material is to be prepared, assembled, finished, and /or erected. Shop drawings and erection drawings are types of Shop Detail Drawings. Shop Detail Drawings typically also include general notes.

1.3 Fabricator

This document addresses the review of drawings that define and detail fabrication procedures, materials, dimensions, tolerances and testing. In this document, "Fabricator" refers to the facility(ies) performing such shop activities as cutting, welding, drilling, punching, cleaning and painting of structural steel. "Fabricator" also includes any agents of the Fabricator, such as those who prepare Shop Detail Drawings. In some cases the Fabricator may also be the Contractor, but usually, the Fabricator subcontracts to the Contractor.

1.4 Owner

In this document, "Owner" refers to the entity paying the Contractor to fulfill the terms of the Contract. The Owner encompasses the following: those preparing the Contract documents, including the "Designer" responsible for the structure's adequate design; those with the authority to review and approve the Shop Detail Drawings, herein referred to as the "Approver"; and those representing the Owner during construction, commonly called the "Engineer". The Designer, Approver and Engineer may be employees of either the Owner or professional firms contracted for the work

1.5 Contractor

The Contractor is responsible for proper completion of all tasks required by the Contract. Subcontractors, including fabricators, erectors, and field painters may be utilized by the Contractor, but the Contractor retains responsibility for all material, operations and the final product. The Contractor may permit direct subcontractor interaction with the Owner to expedite the project, but subcontractors must inform the Contractor of any proposed modifications to Contract requirements accepted by the Owner. The Contractor may permit or reject the changes.

1.6 Approval

The Owner's approval of the Fabricator's Shop Detail Drawings is a verification that the drawings appear to be consistent with the Contract documents. "Approval" does not relieve the Fabricator of the responsibility for the accuracy of dimensions on Shop Detail

Drawings or for complete submittals satisfying applicable Contract requirements, nor does it permit deviations from the Contract without the Owner's documented consent.

1.7 Principal Controlling Dimensions, Material and Connection Properties

The following principal controlling dimensions, material and connection properties are essential items for reviewing all Shop Detail Drawings:

- Length of span, i.e. the horizontal distance between bearings, pin centerlines or other points of support
- Thickness and width of plates in primary members and splices
- Primary dimensions and/or weight per foot of rolled shapes
- Diameter, specification and grade of mechanical fasteners (bolts, nuts, studs, couplers, etc.) and coating if required (mechanical or hot dip galvanizing)
- All dimensions of machined pins, hangers and complex bearings
- Specification, grade and toughness testing requirements for steel components
- Elevation of seats and other supports for steel members
- Size of fillet and partial joint penetration welds; appropriate partial and complete joint penetration weld configurations

1.8 Construction Change

Modifications to Contract requirements, including design plans, specifications, and special provisions, after award to the Contractor shall be considered "Construction Changes". These may reflect alterations due to unanticipated site conditions, design plan errors, changes in project scope, Contractor related problems or Owner initiated changes. Corrections for Contractor related problems must be proposed in writing by the Contractor with all necessary details, calculations, material alterations, and/or other pertinent information for the Engineer's review and approval.

Section 2
Responsibilities

2.1 Fabricator

2.1.1 The Contractor and Fabricator are responsible for providing Shop Detail Drawings that accurately show the appropriate details, dimensions, material requirements and other requirements necessary to fabricate and erect components of the structure in conformance with the Contract documents.

2.1.2 If errors or discrepancies are discovered in the Contract documents, they must be brought to the Owner's attention.

2.1.3 The Fabricator must obtain the approval of the Contractor and the Owner before making any modifications to Contract requirements.

2.1.4 The Fabricator must ensure all material, geometry, and connections shown on the Shop Detail Drawings concur with the Contract, subject to the accuracy of the essential dimensions shown on the Contract documents and any required field-verified information supplied by the Contractor. The Contractor is responsible for the fit of the structure in the field.

2.2 Owner

2.2.1 It is the Owner's responsibility to review the Shop Detail Drawings to ensure that the Fabricator has correctly interpreted the intent of the Contract documents and that details properly reflect material and connection requirements.

2.2.2 Drawings will be returned with the Owner's stamp and/or signature indicating either approval, some type of conditional approval, or rejection.

2.2.3 Rejection, requiring Shop Detail Drawings to be revised and resubmitted, should only be used when drawings either deviate significantly from Contract requirements without the Engineer's prior approval, or are unacceptable due to incompleteness, legibility, or number of errors (see 5.1 on page 10).

2.2.4 The time required to review Shop Detail Drawings must be kept to a minimum to enable the Fabricator to schedule fabrication and complete production in a timely manner. Subject to Contract requirements, and unless otherwise agreed between the Owner and Fabricator, drawings for most structures should be returned within 3 to 4 weeks, though very complex structures can take longer. Partial submittals that include all inter-related drawings should be allowed if this is compatible with the situation and will expedite the project.

2.2.5 Construction Changes to the Contract are normally conveyed to the Contractor, but if changes will affect fabricated items, the Fabricator should also be notified concurrently.

2.3 Team Effort

The Contractor, Fabricator and the Owner are responsible for approaching the Shop Detail Drawing submittal, review, approval, and distribution process as a team effort in order to ensure accurate and timely construction of the structure.

2.3.1 All parties must cooperate and maintain open lines of communication so problems can be quickly addressed and resolved.

2.3.2 Verbal discussions and agreements are encouraged and should be quickly followed by written confirmation.

2.3.3 Efforts should be made to expedite information and drawing transmission, including use of e-mail, faxes and electronic file transfer when applicable.

2.3.4 Requests for Information (RFI's) should indicate the urgency of a reply. The Owner should provide a timely response or acknowledgement (explanation, decision, request for additional information, or estimate of time needed to evaluate), usually within two business days.

2.3.5 The Owner should be receptive to considering alternate fabrication methods or configurations proposed by the Fabricator that will result in improving or equaling the expected performance, maintenance and longevity of the structure. The Contractor's acceptance of any modifications that alter the finished product must be verified before submission to the Owner.

2.4 Professional Seal

Generally, Shop Detail Drawings do not require the stamp and signature of a registered Professional Engineer (PE). However, there are some circumstances where a PE stamp or seal is warranted. Contract requirements may also mandate this evidence of a PE's review.

2.4.1 Shop Detail Drawings may require a PE seal if the Fabricator has proposed significant changes to the design of the structure. All changes to the design of the structure proposed by the Fabricator require the Owner's and Contractor's approval, but not all changes need to be sealed by a PE. Standard practice is for the Owner to approve or reject changes proposed by the Fabricator, based on the anticipated effects on the structure and the Fabricator's justification for the alteration (constructability, reducing distortion or residual stresses, etc.). Fabricator proposed changes may require a PE seal when they significantly affect structural behavior, construction or performance.

2.4.2 Value-engineering proposals require a PE's seal and signature, and a formal submittal from the Contractor to the Owner with all calculations and justifications for the change.

Section 3
General Review Guidelines

3.1 Materials

The Owner will verify that structural materials conform to the contract documents, unless specific substitutions are approved.

3.1.1 Exceptions are permitted when the Fabricator has received prior documented approval from the Owner for substitutions of equivalent material type, plate thickness or member size to facilitate purchasing or fabrication. Such substitution should be allowed providing there is no additional cost to the Owner and changes will equal or exceed the Contract requirements. (see 2.3.5)

3.1.2 The Owner should permit equivalent substitutions for material less than 10 mm (3/8") thick that is not available in the specified material. Alternate structural quality materials such as ASTM A606 or A570, with corrosion resistance equal to adjacent material, should be permitted for shims and fills. Substituted material must satisfy specific required properties (yield, elongation, Charpy V-Notch (CVN) toughness).

3.1.3 Fills and shims do not usually require CVN testing.

3.2 Weld Symbols

3.2.1 Weld symbols on Shop Detail Drawings should be compatible with joints shown on the plans, but for groove welds the Fabricator may prefer joint preparations different than those indicated on the plans. Alternate weld details should be allowed as long as the weld satisfies the intent of the plans, does not violate fatigue constraints, and is in conformance with Contract documents.

3.2.2 Fabricators sometimes place Welding Procedure Specification (WPS) identification numbers in the weld symbol tail, indicating the procedure to be used. The WPS must be submitted for the Owner's approval, but for efficiency, this is usually done separately from the Shop Detail Drawing review and approval process. Therefore, the Approver does not usually review the weld identification numbers shown. During fabrication, the Owner's QA Inspector will ensure that appropriate WPSs, approved by the Owner, are used.

3.3 Format

Fabricators have different systems for detail drawing presentation, such as drawing order and designations, piece marking, location of dimensions and wording of notes governing shop procedures. The Owner should not review or mandate the format.

3.4 Submittal Procedures

Shop Detail Drawings should be submitted and returned by the most expeditious routing consistent with the Contract documents. The Owner should work with the Fabricator, the Contractor, and other related parties to establish the most effective procedures. Subject to concurrence by the Contractor and Owner, submission of review copies from the Fabricator directly to the Approver is optimal. If electronic files are acceptable, the Owner should define the routing, format and authentication method.

3.5 Number of Drawing Copies

The Contract documents should indicate the number of drawing copies needed for each step in the review, approval, and distribution process, and whether any reproducibles must be supplied to the Owner or other parties.

3.6 Reduced-Size Copies

To simplify handling, the use of reduced-size (11" x 17") copies may be permitted by the Owner for review and/or distribution. Clarity and legibility of details, notes and material lists must be maintained with any format utilized to avoid errors and provide a permanent record for future maintenance and structural evaluation. Adequate space must be provided for approval stamps on each drawing.

3.7 Accuracy

Steel fabrication details are normally shown to the nearest 1 mm (1/16"), but if details vary from plan dimensions by small amounts, the details should be approved unless a significant cumulative error results. Machined surfaces are an exception to this tolerance.

3.8 Drawings Not Required

Depending upon the Owner, some minor fabricated items, such as drains, pedestrian fencing and armor bars for compressible seal joints, may not require submittal of Shop Detail Drawings for review. The Fabricator should research the Contract documents or contact the Owner to determine any such policy and save preparation and review time.

Section 4
Approval Checklist

The following is a list of common items that should typically be checked on Shop Detail Drawings. Unusual designs may contain unique details that are beyond the scope of this guide and not fully covered here. The reviewer's judgment must prevail in determining the extent and depth of review on each project.

4.1 Principal Controlling Dimensions, Material and Connection Properties

The following principal controlling dimensions, material and connection properties shall be considered essential items for reviewing all Shop Detail Drawings:

- Length of span, ie. the horizontal distance between bearings, pin centerlines or other points of support.
- Thickness and width of plates in primary members and splices.
- Primary dimensions and/or weight per foot of rolled shapes.
- Diameter, specification and grade of mechanical fasteners (bolts, nuts, studs, couplers, etc.), and coating if required (mechanical or hot dip galvanizing).
- All dimensions of machined pins, hangers and complex bearings.
- Specification, grade and toughness testing requirements for steel components.
- Elevation of seats or other supports for steel members.
- Size of fillet welds and partial joint penetration welds; appropriate partial and complete joint penetration weld configurations

Note: 4.1 repeats 1.7 due to the importance of the items listed and their applicability to all subsequent subsections.

4.2 Web and flange plates of welded members and rolled beam stringers

- Shop butt weld splice locations
- Flange and web tapers and haunches (controlling dimensions only)
- Cover plate dimensions and termination details.
- Location of tension and compression zones in welded members

4.3 Stiffener and connection plates

- Width, thickness, material grade and if toughness testing required (curved bridge, floor beam connection, etc.)
- Weld size and termination details and bolting to web and flange details
- Appropriate spacing of intermediate stiffeners
- Avoiding interference with shop web and flange splice locations
- Fit and location of stiffeners
- Bolt hole edge distances and compatibility with diaphragm/cross frame connections.

4.4 Bolted Splices

- Length of flange splices, width and depth of web splices
- Number, size and spacing of bolts and holes in splice material
- Fill plates if necessary
- Proper bolt hole edge distances

4.5 Crossframes and diaphragms

- Number and spacing of connection plate bolts, and type of holes, especially for slip critical connections or details required for differential deflections.

- Length termination details and number of shop welds

4.6 Camber and/or mid-ordinate for cambered rolled beams or girder sections (spot check)

4.7 Elevation at center of span or segment, field-splice, abutment and pier ordinates on shop assembly diagrams

4.8 Number and spacing of bolts in floor beam and cross girder connections as well as special attachments (brackets, pot bearings, etc.)

4.9 General notes and detail sheets relative to cleaning and painting

- Corner preparation (if required for cut edges)
- Cleaning, required surface preparation (SP6, SP10, etc.) and profile depth (if specified)
- Shop Primer: type; manufacturer; wet or dry film thickness; verification of cure before shop application of subsequent coats (required); applicable restrictions on field contact (faying) surfaces; any requirements for pre-priming shop contact surfaces before assembly (e.g. inside boxes, shop bolted assemblies); and designation of any field weld areas to be left unprimed
- Top Coat(s): shop or field; type; manufacturer; wet or dry film thickness; intermediate coat cure times and/or recoating "window" (time) if specified by the Contract documents or paint manufacturer's data sheet; any blockout areas where shop topcoats are not permitted (e.g. field splices, diaphragm/cross frame connections, bearings)

4.10 Designation of material, tension zones and welds for Fracture Critical Members (FCM's), including applicable nondestructive testing

4.11 Material and material testing

- Material specified in accordance with the Contract documents
- Substitutions for material less than 10 mm (3/8") thick , especially fills and shims (see 3.1)
- Substitutions for material over 10 mm (3/8") (see 3.1)

4.12 Incorporation of all necessary revisions into the Shop Detail Drawings

- Errors or discrepancies in the Contract plans discovered during Shop Detail Drawing preparation or review

  Such errors must be conveyed to the Owner and the Contractor to determine and implement appropriate corrective actions. Depending on the extent and importance, Contract plan corrections or project modifications may be distributed by the Owner as Construction Changes or notification may be verbal, followed by written documentation to all parties.
- All Construction Changes that affect the Shop Detail Drawings

  Recent Construction Changes not incorporated into the Shop Detail Drawings do not usually justify rejection. Unless changes will drastically alter fabrication details, a copy of the Construction Change may be returned with "approved as corrected" Shop Detail Drawings in such circumstances. Note: Corrections noted on Shop Detail Drawings do not constitute "Construction Changes" and should not be used to informally effect Construction Changes.
- Fabricator-proposed modifications approved by the Owner and Contractor

These include deviations from the Contract requirements, substitutions of material or modifications to the Contract plan details, based upon the Fabricator's request (at no cost to the Owner), that have received prior approval from the Owner and Contractor.

4.13 Erection Framing Plan details

- Basic span lengths and, where appropriate, transverse girder spacing
- Pier and abutment identifications
- Orientation of structure (north arrow), skew(s), spot checks of curve or flare geometry if applicable
- Adjustments for special bearings, expansion joints or other items not adequately covered by the contract plans to compensate for temperature or other variables where applicable
- Piecemarks indicated for every element, and their relative location (end, side) is shown to clarify member orientation

4.14 Answer or acknowledge all appropriate questions noted on Shop Detail Drawings as "Engineer verify" (does not include "Contractor verify" or "Field verify" queries that must be resolved by others before final Shop Detail Drawing approval)

4.15 Compliance with Owner-specific or project-specific requirements that may supersede the requirements of this checklist

- Inclusion of Owner requirements for sheet title box information (contract number, bridge identification number , pay item, etc.)
- That standard title box notes (hole diameter, welding, paint, etc.) do not conflict with Contract requirements
- Proper notation of revision date(s) and number(s) on revisions after the first submission
- Miscellaneous project-specific items such as utility attachments, special connections or connection materials (pins, links, cables), and stage removal and construction
- Professional Engineer Seal if required.

4.16 Special needs for special structures, for example: special handling instructions or temporary fixtures for lifting, positioning and transportation; protection of critical components and connections; and dimensional controls required for shop and field assembly. "Special structures" include truss, cable stayed, suspension, tied arch and moveable (lift, swing, bascule) bridges.

Section 5
Return and Distribution of Drawings

5.1 Acceptance Levels

5.1.1 Acceptable Shop Detail Drawings should be "Approved" and expeditiously returned to the fabricator.

5.1.2 The Shop Detail Drawings should be conditionally accepted ("Approved as Noted", "Approved as Corrected", "Accepted Subject to Comments", etc.) if required corrections are limited and the Owner is satisfied that the drawings fundamentally satisfy the Contract. Examples of limited corrections include sporadic, minor dimensional errors and shop notes not fully consistent with specifications or special provisions. Conditional approval permits the Fabricator to proceed with limited fabrication (subject to availability of QA inspection or other Owner restrictions). Shop Detail Drawings must be corrected and copies returned to the Owner and full approval obtained before unrestricted fabrication begins.

5.1.3 Drawings should not be returned stamped " Rejected" or "Revise and Resubmit" unless the drawings cannot be "Approved" or "Approved as Corrected" due to nonconformance, poor quality (legibility, lack of adequate dimensions, details and/or notes, contradictory information, etc.) or other problems that may lead to significant shop errors. Only individual sheets with such errors or required modifications should be rejected. Other sheets may still be fully or conditionally accepted unless their required interaction with the rejected drawings precludes this possibility.

5.2 Approval Stamp

5.2.1 The Owner will stamp each drawing to indicate acceptance. The stamp indicates the Owner is satisfied that the Shop Detail Drawings generally conform to the intent and requirements of the contract documents, but the Fabricator and Contractor remain responsible for satisfying all Contract requirements.

5.2.2 If the Approver is a contractual agent of the Owner rather than an employee of the Owner, the stamped plans may be sent to the Owner if required for further acceptance and processing. If the structure will carry a railroad, rapid transit or other loads besides the Owner's, then "Approved" copies may be routed to such organizations for their concurrence and/or approval.

Commentary

C2 Owners (or their agents) review Shop Detail Drawings to "ensure that the Fabricator has correctly Interpreted the intent of the Contract documents and that details properly reflect material and connection requirements" (2.2.1). Regardless of the Owner's review and approval, the Contractor and the Fabricator are responsible for the accuracy of Shop Detail Drawings (2.2.1), the "Fabricator must ensure all material, geometry, and connections shown on the Shop Detail Drawings concur with the Contract" (2.1.4), and the "Contractor is responsible for the fit of the structure in the field" (2.1.4).

C2.3.5 Some examples of alternative methods or configurations that may be proposed include:

- use of weld joint configurations providing equivalent strength and fatigue resistance (see C4.1)
- increase of the thickness of connection plates or intermediate and longitudinal stiffeners to avoid welding problems
- relocation of flange and web butt welds or field splices slightly to miss adjacent
- details or facilitate use of plate lengths available from mills
- avoiding beveled plates by angling other connections
- reducing residual stresses and possible plate damage by avoiding highly restrained welds
- alteration of a weldment's configuration to permit access for fabrication
- use of two thinner fills instead on one heavier fill
- substituting either equivalent types of material or thicker material due to availability

The Approver may discuss proposals with the Designer and Fabricator to better understand the rationale and potential problems or benefits.

C3.4 Subject to concurrence by the Contractor and Owner, review copies are optimally sent directly to the Approver, avoiding delays associated with re-transmittals through other offices. If desired, the Contractor may concurrently receive "draft" or "for information only" copies, but care must be taken not to confuse these with later approved versions. At least two copies of all drawings are sent to the Approver so one set marked with any corrections or comments can be returned with instructions for subsequent submittals.

C4.1 The Owner should adequately check geometry to verify that the shop details generally conform to the intent of the design and permit proper assembly. Shop girder laydown diagrams should be selectively checked to insure the girder profiles are consistent with the plan configuration, including support locations. Spot checks among similar members may suffice, but if errors are found, more in-depth reviews are needed.

Longitudinal and lateral dimensions in the Contract plans are usually in the horizontal plane, but Shop Detail Drawings reflect true dimensions along the individual member and account for changes in slope, grade and camber corrections, so the Approver must consider this in the review. Small inconsistencies between the Approver's calculations and detail dimensions for such items as camber or sweep ordinates should not be noted for correction as fabrication tolerances in the Contract documents permit such deviations and they will not impede construction or affect performance.

Fillet welds are usually based on the minimum sizes permitted by Section 2 of the current AASHTO/AWS D1.5 *Bridge Welding Code* (BWC). The minimum required fillets are 6 mm (1/4") for material up to 20 mm (3/4") thick and 8 mm (5/16") for heavier plates, minimizing residual stress and distortion, especially on thin material. In areas of high shear or when two

plates must act together, larger fillet welds may be needed, and these should be specified on the plans. Flange to web welds begin and end beyond the limits of the completed member, so they are continuous, but stiffeners and connection plates have fillet welds terminating on webs and flanges. These welds should end about 6 mm (1/4") away from an edge (snipe, clip, etc.) to avoid a poor quality weld termination. Many configurations will provide complete joint penetration (CJP) and partial joint penetration (PJP) welds, and the Fabricator should be allowed reasonable latitude in selecting a joint. Preferred joint configurations are shown in Figures 2.4 and 2.5 of the BWC. If the plans necessitate a joint not prequalified by the BWC (e.g.: a fillet or CJP weld between two converging plates with a 25 degree included angle), alternates proposed by the Fabricator should be considered. (See C2.3.5)

C4.2 Some owners may also require: tension zones to be identified on flanges to clarify welding and NDE requirements; verification of minimum and maximum lengths between welded splices; or approval for butt welds not shown on the design plans. Unless otherwise stipulated, plate girder flange and web butt welds as well as nearby stiffener or connection plate attachment welds should be separated by at least 150 mm (6") to avoid adverse interaction of intersecting weld zones.

C4.3 Bearing stiffeners typically stipulate "mill to bear" at the flange attached to the bearing to insure direct, steel-to-steel load transfer. This may also be achieved by a "grind to bear" or "finish to bear", especially where stiffeners are not perpendicular to flanges. The opposite end of the bearing stiffener is normally "tight fit", thereby forcing the bearing end into intimate contact. The *Bridge Welding Code* establishes requirements for these fits, so they need not be further defined on the drawings. Intermediate stiffeners, connection plates and girder webs (even over bearings) do not require "mill to bear" or "tight fit". AASHTO requires bearing stiffeners supporting diaphragms or cross frames to be attached to the flanges, but this does not eliminate the requirement for a bearing fit at the supporting flange.

C4.4 Computer numerically controlled (CNC) equipment may be used in lieu of drilling, subpunching and/or reaming. The Approver should contact the Owner if the Fabricator proposes a method not specifically allowed by the Contract documents. When the Contract plans specify edge distances, the Fabricator may increase them (including at the girder ends) slightly, as long as splice plates neither encroach fillet welds nor interfere with adjacent material. This may avoid problems if a drill or plate is not exactly positioned. Since owners require rotational capacity (RC) testing of high strength bolt assemblies immediately before installation in the shop or field, bolt lists should reflect adequate additional bolts for testing, loss, etc. For slip-critical connections, bolt holes may be drilled or reamed in assembly to insure accuracy, but this may not always be possible or practical. CNC equipment, templates with hardened steel bushings, field drilling or reaming and other methods may be used in lieu of assembly if permitted by the Contract documents and accuracy and quality (holes not elongated) can be assured. This may include a limited number of check assemblies or comparative templates.

C4.5 Depending on the structure's cross section and the plan details, the Fabricator may have considerable latitude in detailing cross frames. The Approver should only verify that the proposed geometry and joining methods will satisfy the intent of the design. Unless critical to the assembly's structural performance, such items as the exact length and orientation of cross frame components, shapes of gusset plates, and whether rows of bolts are parallel to the girder web or the edge of the gusset may be left to the Fabricator's preference. If the plans stipulate slotted holes or other provisions to accommodate differential movement or to limit rotation of adjacent girders, the bracing must incorporate these considerations. Provisions to control differential

deflection or lateral movement (twist) during construction should be addressed on the Contract plans or agreed to between the Owner and Contractor.

C4.9 Unless superceded by Contract document requirements, surface preparation and coating application should be governed by the manufacturer's product data sheet instructions. All coats in a system (primer, intermediate and top) should come from the same manufacturer to insure compatibility and accountability. The shop coat manufacturer should be shown on the Shop Detail Drawings to insure the field coat(s) comply.

C5.1.2 If the Shop Detail Drawings appear to have misinterpreted the Contract plan requirements or if the Approver is uncertain regarding detailing methods (eg. camber presentation or cutting diagrams), the Approver should contact the detailer directly to avoid unnecessary markups or re-submittals. When errors are extensive, the review should be terminated and the drawings returned. The Approver may include recommendations to facilitate corrections of minor or occasional errors, but extensive corrections should not be provided. The Contractor/Fabricator remain responsible for drawing accuracy, even if suggested corrections are provided.