CISC STEEL BRIDGE CERTIFICATION STANDARD

Third Edition - 2018

Complex Steel Bridges and Simple Steel Bridges

Canadian Institute of Steel Construction

cisc icca
QUALITY CERTIFIED
STEEL BRIDGES

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PREFACE

The Canadian Institute of Steel Construction (CISC) is Canada's voice for the steel construction industry, providing leadership in design and construction efficiency, quality and innovation. The CISC promotes dialogue, collaboration and commerce between industry stakeholders, advancing the benefits of steel to the consulting community, builders and buyers, academia and government. The CISC represents a diverse community of steel manufacturers, fabricators and constructors, engineers and architects, owners and developers, and educators and students, offering a wide span of products and services to enhance capabilities and grow businesses.

The CISC has prepared this Standard in recognition of its interest in meeting the quality requirements of its customers. It is designed to assess the Fabricator's Quality System and provide a level of assurance that the company performing the fabrication has processes and personnel in place to better enable it to conform to the contractual and regulatory requirements. This Standard addresses the special processes and requirements of steel fabrication for highway and railroad bridge structures. Please note that this Standard is not a product certification standard.

The Standard is based on the belief that quality awareness is an integral part of all production processes. By promoting a "pride in workmanship" attitude in employees, product quality will be maintained in the most economical manner.

This Standard shall be used by bridge Fabricators who wish to have their operations CISC Certified.

Note: CSA S6 Canadian Highway Bridge Design Code now requires bridge Fabricators to have a bridge-specific audited and certified quality management system. CISC Bridge Certification is recognized by CSA S6-14 as meeting this requirement.

1. SCOPE AND GENERAL REQUIREMENTS

1.1 Bridge Certification Categories

1.1.1 Complex Steel Bridges: bridge superstructures or other components consisting of spliced rolled sections and welded plate girders (for example built-up three-plate girders, trapezoidal box girders, closed box girders, orthotropic deck bridges, large or non-preassembled trusses, arches, bascule bridges, cable-supported bridges, moveable bridges, and bridges with a particularly tight curve radius).

1.1.2 Simple Steel Bridges: unspliced rolled sections (no built-up girder or plate fabrication according to, or similar to, those listed in clause 1.1.1)

1.2 Complex Steel Bridges

A Fabricator wishing to certify its fabrication plant to CISC Complex Steel Bridges shall meet the following:

i. General Requirements for CISC Steel Bridges (refer to clauses 2 through 8).

ii. The Fabricator shall have welding procedures for Submerged Arc Welding (SAW) process and any other processes that are required by the contract specifications and the requirements of CSA W47.1, CSA W59, and AWS D1.5 as applicable.

iii. The Fabricator shall have a documented fracture control plan complying with CSA S6 or AWS D1.5 as applicable to the work being undertaken. Refer to Appendix B for minimum requirements.

iv. Initial Certification: The Fabricator shall demonstrate the ability to fabricate a welded plate girder to the contract specifications.

   a) For an initial certification, the Fabricator shall either fabricate a mock-up girder in accordance with Appendix A or use an in-production girder(s) as the basis for evaluation.

   b) The requirements of Appendix A shall be met if opting for an in-production test. Multiple girders may be used and tested to fulfill all the requirement specified in Appendix A.

   c) The inspection of the mock-up girder or in-production girder for initial certification shall be arranged by the Fabricator within 2 months prior to, or 1 month after, the certification audit.

   d) If the Fabricator does not continuously certify one or all of its plants on an annual basis, it is considered as an initial certification, and a mock-up or in-production test will be required at that plant for certification.

v. Continuous Certification

   a) A Fabricator that maintains continuous (annual) CISC Bridge certification under this category shall fabricate and test either a mock-up girder or in-production test(s) every 5 years for each certified plant. The inspection for the 5-year mock-up may be performed within 7 months prior to the audit to be valid. It is the responsibility of the Fabricator to track and submit the 5-year test to the CISC within the period specified.

vi. The Fabricator shall employ only third-party inspectors from a CSA W178.1 certified inspection organization for the purposes of clauses 1.2 (iv) and 1.2 (v). The Inspection organization shall provide a full inspection report(s) of all inspection elements found in Appendix A and a final signed letter acknowledging that the inspected girder(s) met the requirements of the CISC Mock-Up in accordance with Appendix A and CSA S6.

vii. A CISC Member plant may qualify for CISC Complex Steel Bridges if certified to AISC Advanced Bridges with the Fracture-Critical Endorsement. Some conditions apply.

1.3 Simple Steel Bridges

1.3.1 A Fabricator wishing to certify its fabrication plant to CISC Simple Steel Bridges shall meet the following:

i. General Requirements for CISC Steel Bridges (refer to clauses 2 through 8).

ii. The Fabricator shall have welding procedures that are required by the contract specifications and the requirements of CSA S6, CSA W47.1, CSA W59, and AWS D1.5 as applicable.

iii. A CISC Member plant may qualify for CISC Simple Steel Bridges if certified to AISC Simple Bridges. Some conditions apply.

iv. A Fracture-Critical Endorsement is an available extra add-on option in order to meet project requirements with fracture-critical members.

1.4 Fracture-Critical Endorsement for Simple Steel Bridges (Optional)

i. Fabricators engaging in the fabrication of fracture-critical steel bridges are required to have the Fracture-Critical Endorsement.

ii. The Fabricator shall have a documented fracture control plan complying with CSA S6 or AWS D1.5 as applicable to the work being undertaken.

1.5 Certification is plant-specific, and therefore the Quality Systems developed by the Fabricator shall define the scope of application with respect to departments or systems included at the production location.

1.6 Companies with multiple fabrication bridge plants controlled under one management team (including quality) may be audited as one location. All plants require process certification auditing for compliance to this Standard (i.e. no sampling). Multiple plants may be all Complex, all Simple or a combination of the two. Complex plants must meet the requirements of clauses 1.1.1 and 1.2.

1.7 If the Fabricator subcontracts all or a portion of the steel bridge fabrication, the subcontracted Fabricator must be CISC Bridge Certified with the applicable certification for the type of bridge (refer to clause 1.1).

1.8 CISC Certification is an annual audited program. The Fabricator is responsible for planning, scheduling and conducting the certification audit up to 3 months prior to the anniversary date in order to maintain CISC Certification.

COMMON CORE QUALITY REQUIREMENTS

2. NORMATIVE REFERENCE

This standard has been prepared using the most current published editions of the following codes and guidelines:

i. CSA S6
ii. CSA W59
iii. CSA W47.1
iv. CISC Code of Standard Practice for Structural Steel
v. CSA S16
vi. CSA W178
vii. SSPC for surface preparation and coatings
viii. AREMA for Rail Bridges

ix. AASHTO - LRFD Bridge Construction Specifications
x. AASHTO/AWS D1.5
xi. Appropriate Provincial Ministry Specifications
xii. ISO 9001
xiii. ASTM A6

3. TERMS AND DEFINITIONS

The following terms and definitions apply to this standard or are commonly used in the industry. The Fabricator may choose to include industry-specific, or company-specific terms and definitions in this section.

Corrective Action

An action taken to eliminate the cause of a detected nonconformity or other undesirable situation.

Defect

The non-fulfillment of a requirement that is recognized and corrected while in current process. For example, a misplaced cleat detected at the fit checking stage which is directed back to the fitting station for proper relocation may be considered a defect and not a non-conformity.

Document

Information and its supporting medium used to define and/or establish quality requirements.

Erection Diagrams

General arrangement drawings showing the principal dimensions and elevations of the steel structure, sizes of the steel members, piece marks, size (diameter) and type of bolts, bolt installation requirements, elevations of column bases, all necessary dimensions and details for setting anchor rods, and all other information necessary for the assembly of the structure

Erection Procedure

An engineered procedure outlining the construction methods, erection sequence, erection and temporary bracing requirements, and other engineering details necessary for shipping, handling, erecting, and maintaining the stability of the structural steel work

FCM

Fracture-Critical Material

LPT

Liquid Penetrant Testing

Nonconformity

The non-fulfillment of a requirement

Objective Evidence

Data supporting the existence or verity of something

Preventive Action

Action to eliminate the cause of a potential nonconformity or other undesirable potential situation

Quality Assurance

The establishment of measures to prevent problems and the demonstration that such measures are taken and are effective, providing confidence that the quality requirements will be fulfilled

Quality Control

Activities aimed at determining whether results obtained through an activity conform to stated objectives for this activity. The results are measured and then compared with a pre-established objective for this activity.

Quality Management System

A system to establish the policy and objectives required to direct and control an organization with respect to quality and to achieve those objectives

Quality Objective

An aim or goal related to improvement in the quality system

Quality Policy

Overall intentions and direction of an organization related to quality as formally expressed by senior level management

RT

Radiographic Testing

Record

A statement of results achieved or providing evidence of activities performed

Root Cause

The initial and main reason why an event occurs. In corrective action, it is the removable factor leading to the elimination of future nonconformity.

UT

Ultrasonic Testing

4. QUALITY SYSTEM REQUIREMENTS

4.1 General Requirements

The Fabricator shall develop a Quality System that shall establish, document, implement, and maintain processes necessary to provide assurance that finished products conform to contract specifications in accordance with the requirements of this standard.

While some of the work may be subcontracted, it is the Fabricator's responsibility to monitor all sub-contractor operations, methods and quality system to ensure they are in conformity with this standard and all relevant Standards and Specifications.

4.2 Quality Manual and Work Procedures

The written Quality System Manual shall be supported with applicable written work procedures and sample documents.

4.3 Control of Documents

4.3.1 General

The Fabricator shall establish and maintain procedures for approval, issue, and maintenance of the documents and data required for the operation of the Quality System. Required documentation shall include, but may not be limited to, the following:

a) Contract drawings, specifications, and amendments
b) Detail and erection drawings

c) Welding documentation as required by CSA W47.1 and other relevant standards
d) Purchase orders
e) Material traceability
f) Quality control plans and quality records including inspection test plans and inspection records
g) Documented procedures and records required by this standard

4.3.2 Erection Diagrams and Shop Details

4.3.2.1

The Fabricator, or his assigned representative, shall prepare shop details and erection diagrams from Certified-for-Construction contract documents. Preparation, use, and approval of these documents shall conform to the CISC Code of Standard Practice, and Provincial and Territorial Engineering Association guidelines, where applicable.

4.3.2.2

Revisions to detail drawings/data shall be dealt with in the same manner as the originals, or as agreed upon with the Customer. Revisions shall be clearly identified on the drawings.

4.3.2.3

Current issues of appropriate documentation shall be available at all points of use. Provision must be made to ensure that obsolete drawings/data are removed from all points of use.

4.3.2.4

A shop drawing control system shall be maintained.

4.3.3

The Fabricator shall control the documentation required for procured and subcontracted items.

4.3.4

The Fabricator shall ensure that all required documentation is reviewed for adequacy prior to release.

4.3.5

The Fabricator shall define the retention period for documentation, including consideration for requirements of specific contracts and governing legislation.

4.4 Control of Quality Records

4.4.1

The Fabricator shall establish and maintain a system for the identification, collection, and storage of the records determined to demonstrate conformance to the requirements and effective operation of the Quality System. All quality records shall be maintained for a minimum of 7 years. Required records shall include, but may not be limited to, the following:

a) Contract drawings, specifications, and amendments
b) Erection and detail drawings and electronic models (including as-builts if applicable)
c) Mill test reports
d) Purchase orders
e) Inspection and test records
f) Material traceability records as specified by CSA S6, AASHTO, and project / contractual requirements
g) Calibration records for measuring and inspection equipment
h) Bolt conformity certificates

i) Welding consumable records
j) Welding procedure records and documents including those for fracture-critical, if used
k) Shipping and receiving reports
l) Non-conformity, corrective action, and preventive action reports
m) Certified welding Inspectors, welding operators and welders certifications

4.4.2

All records required by the contract specifications shall be available for review by the customer or his representative.

4.4.3

The Fabricator shall control the records required for all procured and subcontracted items.

4.4.4

The Fabricator shall define retention periods for records beyond those specified in 4.4.1 with consideration for requirements of specific contracts and governing legislation.

5. MANAGEMENT RESPONSIBILITY

5.1 Management Commitment

Management is responsible for ensuring that:

a) A documented statement is in place that describes the Fabricator's Quality Policy with respect to commitment and quality objectives, signed by the most senior official in the organization.

b) All employees are made fully aware of their authority and role in the Quality System as described in section 5.3.1.

c) A Quality System that conforms to the requirements of this standard is implemented.

d) A senior-level management representative is appointed to ensure that the requirements of the Quality System are maintained and reported.

e) A quality system internal audit by the Fabricator is carried out at a minimum interval of one year.

f) The Quality System is reviewed at a senior management level at a maximum interval of one year, or more frequently, to ensure its continuing suitability and effectiveness.

g) Adequate resources are provided to carry out the Quality System, including performance and verification of work.

h) Employees performing the work are competent.

i) Necessary changes are implemented to ensure a compliant and safe product.

5.2 Organization

5.2.1

The Fabricator shall define an organizational structure, which includes the following functions as applicable:

	QUALITY CONTROL
	QUALITY ASSURANCE
	ENGINEERING
	PRODUCTION
MANAGEMENT	DRAFTING
	PURCHASING
	SALES / ESTIMATING
	PROJECT MANAGEMENT
	RECEIVING
	SHIPPING

5.2.2

The structure identified in 5.2.1 represents a typical organizational structure. Departments may vary from company to company, and more than one function may be held by one person. Any of the functions noted may be subcontracted. The company must have a system for controlling subcontracted services and activities.

5.3 Responsibility and Authority

5.3.1

Each employee is responsible for the quality of his or her own work and carries an equally important share in the effectiveness of the quality assurance process.

5.3.1.1

All employees are responsible to ensure that the work performed by them conforms to a standard of workmanship required by the company in accordance with the applicable contract requirements.

5.3.2

Management is responsible for ensuring that responsibility and authority is defined for carrying out the following:

a) ensuring that all product quality verifications are carried out on a continuous basis

b) dealing with non-conformities and ensuring that the specified dispositions are carried out on a continuing basis

c) communicating with the customer's appointed inspection representative(s)

d) carrying out the work in accordance with the applicable codes and standards

e) ensuring that all welding and welding inspection conform to the latest requirements of CSA Standards S6, W47.1, W59, CGSB, ISO 9712 and AWS D1.5 as applicable

f) dealing with non-conformities of a technical nature in accordance with the applicable codes and standards

g) ensuring that all production personnel understand the contract requirements pertinent to their assignment

h) providing sufficient notice and making proper arrangements for required inspection

i) ensuring that all contract requirements, including revisions, are conveyed to the relevant departments and incorporated into the detail drawings and other fabrication data

j) purchasing all items in accordance with the contract requirements, including revisions, and obtaining the required documentation.

6. RESOURCE MANAGEMENT

The Fabricator shall identify the personnel and the corresponding level of education, training, skills, and experience required in order to ensure that work affecting product quality is carried out in the required manner and such records are kept on file and updated as required.

6.1 Personnel

6.1.1 Welders, welding operators, tack welders, welding supervisors, and welding engineers shall be qualified to the requirements of the latest issue of CSA standard W47.1.

6.1.2 The Fabricator shall employ or retain a professional engineer with experience in CSA S6, AASHTO, or AWS D1.5 as applicable.

6.1.3 The Fabricator shall have personnel specifically trained to evaluate and coordinate design in accordance with CSA S6, AASHTO, or AWS D1.5 as applicable.

6.1.4 The Fabricator shall have personnel specifically trained to purchase material to the requirements of CSA S6, AASHTO, or AWS D1.5 as applicable.

6.1.5 The Fabricator shall employ or retain personnel qualified to inspect to the contract specifications of CSA S6, AASHTO, AWS D1.5, W178.2, CGSB, and ISO 9712 as applicable.

6.1.6 The Fabricator shall employ or retain personnel certified as a Level III NDE administrator in accordance with CGSB as applicable.

6.1.7 The Fabricator shall employ or retain personnel certified as a Level II visual inspector as applicable.

6.1.8 The Fabricator shall employ or retain personnel certified to a Level II in MPI, UT, and/or RT as applicable.

6.1.9 The Fabricator shall verify and record the certification of all NDE personnel retained or employed.

6.2 Infrastructure and Equipment

6.2.1 The Fabricator shall determine, provide, and maintain the infrastructure and equipment needed to achieve conformity to product requirements. Infrastructure and equipment includes as applicable:

a) buildings, workspace and associated utilities
b) process equipment (both hardware and software)
c) supporting services, such as transport or communication

6.2.2 The Fabricator shall have adequate facilities to perform assembly work under conditions.

6.2.3 The Fabricator shall have process equipment that is adequate to meet the customer's requirements which shall include as applicable:

a) cutting and drilling equipment
b) material handling equipment
c) inspection equipment made available for RT, UT, and LPT inspection
d) welding equipment

6.3 Reference Material

The Fabricator shall have the most current published edition of the following reference materials made available (refer to the edition specified in contract documents). In addition, other versions or documents that may be specified in contract specifications shall be available.

i. CSA S6
ii. CSA W59
iii. CSA W47.1
iv. CISC Code of Standard Practice
v. CSA S16
vi. CSA W178
vii. SSPC Volumes I and II (for paint)
viii. AREMA for Rail Bridges (as required by the contract documents)
ix. AASHTO – LRFD Bridge Construction Specifications
x. AASHTO/AWS D1.5
xi. Appropriate Provincial Ministry Specifications (as required by the contract documents)
xii. Others as applicable by the project Specifications and other Standards

7. PROCESS MANAGEMENT

7.1 QC Planning

7.1.1

The Fabricator shall determine the procedures, documentation, records and resources required to ensure that products meet the contract specifications.

7.2 Contract Review

7.2.1

The Fabricator shall have a system in place to ensure that contract requirements are reviewed, incorporated into the work and communicated to the appropriate personnel responsible for production and quality control.

7.2.2

The Fabricator shall ensure that the necessary expertise, personnel, equipment, and plant resources are available to meet the contract requirements.

7.2.3

The Fabricator shall ensure that all additions and revisions to contract requirements are duly communicated to the necessary personnel, and incorporated into the work.

7.3 Purchasing

7.3.1

Purchase orders shall clearly describe the goods and services being ordered. The descriptions shall include the following information as applicable to the product being purchased:

a) Quantity
b) Unit of measure
c) Product name
d) Manufacturer's description
e) Size and length
f) Material specification
g) Special properties (e.g. impact category, FCM requirements)
h) Finish

i) Inspection instructions
j) Special packaging or shipping instructions
k) Applicable standards
l) Scope of work
m) Attachments to the purchase order
n) Tolerances

7.3.2

For subcontracted work, the Fabricator is responsible for ensuring that the final product meets the contract specifications.

7.3.3

Specifications, drawings, process requirements, inspection instructions and other relevant technical data shall accompany the purchase order if applicable.

7.3.4

Purchase orders shall clearly specify the written documentation that shall be provided to verify conformance with purchase orders.

7.3.5

Fracture-critical material and specifications shall be specifically identified on purchase orders.

7.4 Drafting

7.4.1

All Fabricator drawings and electronic documents shall be approved prior to use, unless stated otherwise in the contract documents.

7.4.2

Drafting procedures shall be adequate to meet the requirements of CSA S6, AASHTO, and AWS D1.5 as applicable.

7.4.3

Fracture-critical material shall be identified on all advance bills and shop details.

7.4.4

Fracture-critical welds shall be identified on detail drawings.

7.5 Receiving

7.5.1

Incoming materials shall be matched against receiving slips and purchase orders.

7.5.2

Nonconformities that are identified at the receiving stage shall be dealt with in accordance with Section 8.1, Control of Nonconformity.

7.5.3

Materials shall not be used or processed until they have been inspected and approved for use.

7.6 Material Verification

7.6.1

The Fabricator shall be able to verify by mill certificate and heat number, the material specification of all items in stock and incorporated into the work (100% traceable).

7.6.2

Where individual pieces, lots, and batches are restocked, a traceable identification system shall be implemented and maintained.

7.6.3

The Fabricator shall ensure that all bolts, washers, nuts and assemblies purchased and received meet the material specifications identified in CSA S6 and AASHTO as applicable. The Fabricator shall ensure that all bolts are 100% traceable by batch number and have corresponding Test Certificates from the producer.

7.7 Control of Workmanship

7.7.1

All employees shall be made aware of their responsibilities under Section 5.3.1 of this standard as they apply to workmanship.

7.7.2

Workmanship and tolerances shall conform to the applicable clauses in the latest editions of CSA Standards S6, W59, S16, AASHTO, AWS D1.5, and to the CISC Code of Standard Practice as applicable.

7.7.3

Fabricators performing welding shall be certified in accordance with the requirements of CSA Standard W47.1 and AWS D1.5 as applicable.

7.7.4

The Fabricator shall ensure that manufacturing operations are carried out under controlled shop conditions. Controlled shop conditions shall include all conditions that affect product quality and the achievement of contract specifications.

7.7.5

All tools and equipment used shall be suitable for performing the work and shall be in proper working order.

7.7.6

The Fabricator shall provide adequate procedures to ensure proper fit-up in the field that meets the contract specifications, CSA S6, AASHTO and AWS D1.5 as applicable.

7.7.7

The Fabricator shall provide adequate procedures to ensure bolting meets the requirements of CSA S6 and contract documents.

7.8 Product Verification

The Fabricator shall verify conformance to the contract requirements.

7.8.1

The Fabricator shall define inspection points and inspection record requirements to verify 100% conformance to the contract requirements, including the following:

a) Examination of material for size, conformance to dimensional tolerances, and surface condition or defects

b) Examination of assemblies for overall dimensions, and location and orientation of holes and detail components

c) Verification that welding is carried out according to contract requirements and in accordance with the company's welding standards.

d) All welds are to be 100% visually inspected by the Fabricator and records maintained. Personnel performing the in-house inspection shall meet the requirements defined in the applicable Standard and by the project specifications (if applicable). The Fabricator shall provide records of competency for in-house personnel performing visual inspection.

e) If the Fabricator is responsible for NDE examination, the Fabricator shall ensure that it is performed as specified by the project specification or performance standard(s) by certified NDE technicians. Refer to the project specifications CSA S6, AASHTO and AWS D1.5 for applicable NDE inspection certification standard. Records of all NDE tests and examinations are to be maintained.

f) Examination of surface preparation and finish.

7.8.2

Any additional inspection requirements noted in the contract documents shall be identified and implemented.

7.8.3

The Fabricator shall provide access to and cooperation with the customer's designated representative for inspection of the work as required. Unless specific provisions are included in the contract documents, such inspections shall be scheduled so as not to impede the progress of production.

7.8.4

The Fabricator shall ensure that all verification has been performed in conformance with contract requirements and this Standard.

7.8.5

All test records specified above are maintained in accordance with Section 4.4.

7.8.6

The Fabricator shall trace welds to the welders who produce them.

7.9 Customer-Supplied Products

7.9.1

Upon receipt, the Fabricator shall examine all items for compliance with the customer-supplied documentation and to detect nonconformities.

7.9.2

The Fabricator shall promptly report to the customer any item found to be damaged, incomplete, or otherwise unsuitable.

7.9.3

Unless otherwise specified, it is the responsibility of the customer to ensure that items supplied by the customer conform to the contract requirements.

7.10 Storage, Loading, and Shipping

7.10.1

The Fabricator shall maintain procedures to ensure that all items are properly prepared, handled, and/or packaged for storage and shipping to prevent damage to products.

7.10.2

The Fabricator shall ensure that items loaded correspond to the shipping bill.

7.10.3

The Fabricator shall maintain records of all items that have been shipped.

7.11 Control of Measuring and Inspection Equipment

7.11.1

The Fabricator shall maintain documented written procedures to define the frequency and methods of checking, testing, and/or calibration of measuring and inspection equipment in accordance with standards.

7.11.2

The Fabricator shall ensure that the equipment is suitable for the work and capable of measuring within the required tolerances.

7.11.3

The Fabricator shall ensure that new equipment, stored equipment, and repaired equipment are checked before use.

7.11.4

The Fabricator shall ensure that the calibration status is controlled by physical marking or other means.

7.11.5

The Fabricator shall ensure that calibration records for measuring and inspection equipment are maintained.

7.11.6

The Fabricator shall calibrate welding machines every three months for FCM work, or every twelve months otherwise, and record the results of the calibration.

8. MEASUREMENT, ANALYSIS, AND IMPROVEMENT

8.1 Control of Nonconformity

8.1.1

The Fabricator shall establish a written documented procedure to deal with nonconformities in order to ensure that only products that meet the contract requirements are released.

8.1.2

The Fabricator shall define the:

a) Authority for disposition of nonconformities
b) Need for nonconformity reporting
c) Method of identifying nonconformities to prevent unintended use

8.1.3

The Fabricator shall ensure that all nonconformities are dealt with in one of the followings ways:

a) In consultation with the customer, the item may be judged to be acceptable for its intended use "as is".

b) The item may be reworked or repaired by an acceptable procedure that conforms to the contract requirements. In this instance, items must be re-inspected prior to release.

c) The item may be rejected and/or returned to stock for re-use as allowable, or to the subcontractor/supplier as applicable.

d) The item may be scrapped.

8.1.4

Records of the results and disposition of nonconformities shall be maintained in accordance with the requirements of Section 4.4.

8.2 Corrective Action

8.2.1

The Fabricator shall maintain a system for the implementation of corrective action. Procedures for corrective action shall include directives for investigation of the cause, recommendations to prevent recurrence, and follow-up.

8.2.2

The Fabricator shall determine the level of corrective actions required, considering the magnitude of the problems and the associated risks.

8.3 Preventive Action

8.3.1

The Fabricator shall maintain a system for the implementation of preventive action, and establish a procedure to deal with preventive action initiatives.

8.3.2

The Fabricator shall determine the level of preventive action required, considering the magnitude of the problems and the associated risks.

8.4 Analysis of Data

8.4.1

In accordance with Section 7.8, the Fabricator shall define inspection points and inspection record requirements to verify conformance to the contract requirements.

8.4.2

The Fabricator shall define critical inspection points, and collect and analyze relevant data pertaining to those critical inspection points employing suitable and defined statistical techniques. This will be completed at suitably defined intervals.

8.4.3

The Fabricator shall establish improvement objectives, where necessary, in accordance with the analyzed data and other defined sources of data. Other sources of data may include, but are not limited to Non-conformance Reports and Corrective Actions at a minimum.

APPENDICES

APPENDIX A

Mock-Up or In-Production Bridge Girder Requirements

Regardless of past experience, a Fabricator seeking Initial Certification for Complex Steel Bridges shall be required to prove competency capability to fabricate a 3-plate girder by either completing the mock–up bridge girder as prescribed below or by having a similar girder or girders in production inspected.

The Fabricator shall create a general note sheet, girder detail, and shop assembly drawings and then build a mock-up bridge girder. Shop and assembly drawings shall be prepared and submitted to the assigned inspector and auditor for the documentation audit prior to the scheduling of an on-site inspection and audit. Representative Mill Test Reports, Certificates of Compliance, and other applicable documentation specific to the mock–up bridge girder will be required at the time of the on-site inspection. The personnel responsible for, and performing, the work will demonstrate the understanding necessary for effective implementation of the requirements of codes and standards. All aspects of this exercise shall be performed in accordance with CSA S6 and CSA W-59.

The applicability of an in-production girder shall be the decision of the CISC. The Fabricator shall coordinate the timing of girder fabrication with the CSA W178.1 certified inspection organization.

Instructions for the Mock-Up Bridge Girder Exercise

The exercise will include producing drawings of a typical bridge girder and the actual fabrication of a mock-up bridge girder to demonstrate fabrication knowledge and skills. The exercise will include the following features:

1. Create a shop assembly drawing of a two-span bridge. The length of each span is 27 m. The elevation of the left abutment is set at 0 mm. The elevation of the pier is + 900 mm and the elevation of the right abutment is + 600 mm. The bridge is five girders long, consisting of two end girders, one girder over the pier and an additional girder in each span between the end girder and the pier girder. The assembly drawing shall include information normally used by a drilling crew to lay out the girders to check for proper positioning prior to drilling the splices or checking the fit of the splices for field welding. The assembly drawing will be submitted to the auditor for review prior to fabrication of the mock-up bridge girder.

2. Create a detailed shop fabrication drawing and a general note sheet for the girder at the left abutment. This will be the mock–up bridge girder. It shall be at least 3.0 m in length. The web shall be a minimum of 1000 mm in height. The detailed shop fabrication drawing and general note sheet will be submitted to the auditor for review prior to fabrication. Fabrication drawings shall conform to CSA S6, Clause 10.23 and Annex A10.1

3. For this exercise, the mock–up bridge girder will be detailed and fabricated in accordance with the general notes and hold points included below:

3.1 Material: The assembly and detail drawing will show all flanges, webs and splice plate materials conforming to CSA Grade 350AT, Category 2 or 3. Stiffeners shall conform to CSA G40.21M Grade 350A. The actual material used for the fabrication exercise is the Fabricator's choice (i.e. any available weldable grade material may be used for the fabrication of the mock-up bridge girder).

3.2 Weld symbols on the fabrication drawings shall reference CWB approved weld procedures. Procedures shall specify matching electrodes, compatible with the base metal. The deposited weld metal shall meet the requirements of Table 10.13 in CSA S6.

3.3 The bottom flange and lower half of the web are considered to be Fracture-Critical Members. Regardless of the actual camber detailed on the assembly drawing, the mock–up bridge girder detail shall include a camber of at least 12 mm.

3.4 The bottom and top flanges will be detailed of material no less than 25 mm thick and 300 mm in width.

3.5 The bottom flange will include a full-penetration butt weld splice that meets the requirements of CSA W59. Plate material may be the same thickness on each side of the bottom flange splice. The detail drawing will identify the joint design specified in the WPDS.

3.6 The top flange will include a full-penetration butt weld splice with a thickness transition of at least 12 mm meeting the transition requirements of CSA W59, Clause 12.

3.7 The web material thickness shall be no less than 9 mm. The web will include a full penetration butt weld splice where the material is the same thickness and meets the requirements of CSA W59.

3.8 Web-to-top flange welds will be detailed as 8 mm fillet welds. The web-to-bottom flange weld will be detailed as 10 mm fillet welds, meeting the requirements of CSA W59.

3.9 Detail two full-length intermediate stiffeners that are at least 9 mm thick. The stiffeners shall be placed at approximately the mid-point of the girder, one on each side of the web. One stiffener shall be 90 degrees to the web and the other shall be 60 degrees to the web. One stiffener shall have a mill-to-bear condition at the bottom flange. All stiffener welds shall meet the minimum size requirements of CSA W59 and shall be, as a minimum, 6 mm fillet welds.

3.10 At one end of the mock girder, a bolted field splice shall be prepared for either the top or bottom flange with a minimum of 12 holes in the flange for 7/8 inch diameter, ASTM A325 bolts. The splice plates shall be a minimum of 12 mm thick and include both top and bottom plates with a 5 mm shim.

3.11 Quality control and internal NDT (if performed) shall be performed in accordance with Annex A10.1 of CSA S6 and CSA W59, Clause 12.

General Notes

1. The submerged arc process (except tacking) shall be used for flange-to-web welds. The welds shall be continuous, using mechanized or automatic equipment.
2. Welding (except tacking) of the stiffeners will be performed using the FCAW, MCAW or SAW process in accordance with CSA W59.
3. All welds shall be in accordance with the applicant's CWB approved procedures.
4. The applicant shall submit the bridge drawings, notes, and visual and NDE reports directly to the CISC.

Knowledge and Skill Demonstrated (Mock-Up Feature)	Fabrication and Inspection Instructions	S	U	Hold Points
Full-penetration butt splice RT NDE (Bottom flange)	The bottom flange splice shall be welded prior to the on-site inspection. Bottom flange weld shall be 100% RT. Radiographic test results shall be available at the beginning of the on-site inspection.			None
Full-penetration butt splice with transition UT NDE VT NDE (Top flange)	The top flange weld preparation and tacking shall be completed prior to the start of the on-site inspection. The top flange full-penetration butt weld is to be 100% UT.			The third-party inspector will observe the joint preparation and fit-up, and make observations of the root pass and at other points throughout the welding process as determined during the on-site audit/inspection. The third-party inspector is to witness the UT.
Full-penetration butt splice UT NDE (Web)	The web splice weld and UT shall be completed prior to the on-site inspection. The accompanying UT results shall be available during the on-site audit.			None
Fillet Weld (Flange-to-web)	The flange-to-web welds shall be 100% MT for the length of the girder.			The fit up, tacking and welding of the web to the top and bottom flange fillet welds will be witnessed by the inspector. The third-party inspector is to witness the MT.
Mill to bear fitting Fillet welding (Stiffeners)	The stiffeners shall not be welded prior to the on-site audit. Use SAW or FCAW to weld the stiffeners.			The fit-up, tacking and welding of the stiffeners shall be witnessed by on-site inspector.
Match-marking (Splice plates)	Fabricate splice plates for a flange. Assure that the splice plates are tied to their specific location in the assembly by the use of a match-marking procedure.			The bolting operation shall be witnessed by the third-party inspector.
Fastener assembly validation Pretension joint bolt installation (Bolted field splice)	Fabricate splice plates for a flange. Assure that the splice plates are tied to their specific location in the assembly by the use of a match-marking procedure.			The third-party inspector will witness the installation of ASTM A325 bolts, using the Turn-of-Nut method.
Camber and lay-down assembly procedure	QA/QC and shop fitters plus supervision shall demonstrate an understanding of the measurements required and have a recording form created to record camber readings.			The third-party inspector will witness personnel making a camber measurement on the girder. The third-party inspector will verify that the applicant has the space for the lay-down to occur for typical size bridge girders.
Final inspection	A final Quality Control inspection will be performed by the Fabricator at the time of the audit. All Inspection and NDE reports will be required at that time.			Final Quality Control Inspection will be witnessed by the third-party inspector and auditor if requested.

APPENDIX B

Fracture-Critical Requirements

Scope

The provisions of this Appendix apply to:

1. Fabricators seeking certification in the category of Complex Steel Bridges
2. Fabricators seeking certification in the category of Simple Steel Bridges with Fracture-Critical Endorsement

Reference Standards

CSA S6 – Clause 10.23

AWS D1.5 – Section 12

Fracture Control Plan

Fabricators shall have a documented Fracture Control Plan (FCP) compliant with the requirements of CSA S6 and/or AWS D1.5, as applicable to the work being undertaken at the facility. The FCP shall specify how the requirements of the applicable standard(s) are to be addressed at the Fabricator's facility. As a minimum, the FCP shall contain the following elements:

i. Drafting Standards: the FCP shall specify the manner in which Fracture-Critical Members (FCMs), including attachments, and Fracture-Critical Welds (FCWs) are to be identified on shop drawings, bills of materials, etc.

ii. Purchasing: the FCP shall include the procedure for identification of FCMs on purchasing documents and shall stipulate how the specific requirements for FCMs, including CVN test requirements, will be communicated to material suppliers.

iii. Material Traceability: the FCP shall include procedures for maintaining the traceability of materials incorporated into FCMs. It shall include a system for the retention of records that identify heat numbers of materials and their corresponding mill test certificates.

iv. Welding Requirements: the FCP shall include procedures for ensuring that welding consumables and weld procedures satisfy the requirements of the applicable standard, including CVN toughness requirements.

v. Inspection Procedures: the FCP shall include inspection procedures applicable to FCWs

vi. Non-Conforming Product: the FCP shall include provisions for critical and non-critical repairs to FCWs

The auditor shall evaluate the Fabricator's FCP for compliance with the applicable standard(s).

Training

The Fabricator shall provide evidence that drafting, purchasing, quality control, welding and inspection personnel have received training, as it applies to their duties, in the company's FCP. At least one individual, in each department, shall receive training. Training shall be updated at least annually, unless it can be shown that the company has undertaken fracture-critical work within one year of the last training period.

Competency – Complex Bridge Certification

As part of a Fabricator's initial certification, the auditor shall witness the implementation of the Fabricator's FCP for the mock-up or in-production bridge girder specified in Appendix A. For the exercise, the bottom flange and web of the girder shall be considered fracture-critical.

Shop drawings, fabrication, welding, and inspection and repairs shall be in accordance with the Fabricator's FCP. Mock purchase orders shall be created for FCMs, as needed, to demonstrate adherence to the purchasing procedures stipulated in the FCP.

The auditor will verify compliance with the FCP and applicable standards.

The Fabricator shall demonstrate continuing competency by fabricating fracture-critical bridge components at least once every five years. Records shall be made available to the auditor. Alternatively, the Fabricator may perform a fracture-critical exercise on a non-fracture-critical bridge girder, treating the bottom flange and web as fracture-critical. The exercise shall be performed at least once every five years. Records of the exercise, including mock purchase orders of fracture-critical material, shall be made available to the auditor.

Competency – Simple Bridge Certification

As part of a Fabricator's initial certification, the auditor shall witness the implementation of the Fabricator's FCP for the fabrication of in-production *primary* bridge elements at the Fabricator's facility. The elements may be hot-rolled beams or truss weldments. For the exercise, the primary beams or the bottom chords of a truss shall be considered fracture-critical.

Shop drawings, fabrication, welding, and inspection and repairs shall be in accordance with the Fabricator's FCP. Mock purchase orders shall be created for FCMs, as needed, to demonstrate adherence to the purchasing procedures stipulated in the FCP.

The auditor will verify compliance with the FCP and applicable standards.

The Fabricator shall demonstrate continuing competency by fabricating fracture-critical bridge components at least once every five years. Records shall be made available to the auditor. Alternatively, the Fabricator may perform a fracture-critical exercise on a non-fracture-critical *primary* bridge element, treating the primary beams or bottom chords of a truss as fracture critical. The exercise shall be performed at least once every five years. Records of the exercise, including mock purchase orders of fracture-critical material, shall be made available to the auditor.

CANADIAN INSTITUTE OF STEEL CONSTRUCTION
INSTITUT CANADIEN DE LA CONSTRUCTION EN ACIER

CISC Steel Bridge Certification Standard

Amendment #1 – Mock-Up Requirements

Date: February 27, 2023

1.1 The Mock-Up Girder requirements as per clause 1. and clause 2. of Appendix A of the CISC Steel Bridge Certification Standard, Third Edition 2018 shall be replaced as follows:

1. Use project sample drawings C-001, C-002, C-003, C-004, and C-005 (attached) to create a shop assembly drawing of girder line 1. The length of each span is 27m. The elevation of the left abutment is set at 0mm. The elevation of the pier is +900mm and the elevation of the right abutment is +600mm. The bridge is five girders long, consisting of two end girders, one girder over the pier and an additional girder in each span between the end girder and the pier girder. The assembly drawing shall include information normally used by a drilling crew to lay out the girders to check for proper positioning prior to drilling the splices or checking the fit of the splices for field welding. The assembly drawing will be submitted to the CISC for review prior to fabrication of the mock-up bridge girder.

2. Create a detailed shop fabrication drawing and a general note sheet for the first girder of girder line 1 (west abutment to F.S. #1). This will be the mock-up bridge girder. It shall be at least 3.0m in length. The web shall be a minimum of 1000mm in height. The detailed shop fabrication drawing, and general note sheet will be submitted to the auditor for review prior to fabrication. Fabrication drawings shall conform to CSA S6, Clause 10.23 and Annex A10.1. Note, the actual mock-up plate thicknesses may differ from those detailed as permitted by clause 3 (plate minimum thicknesses).

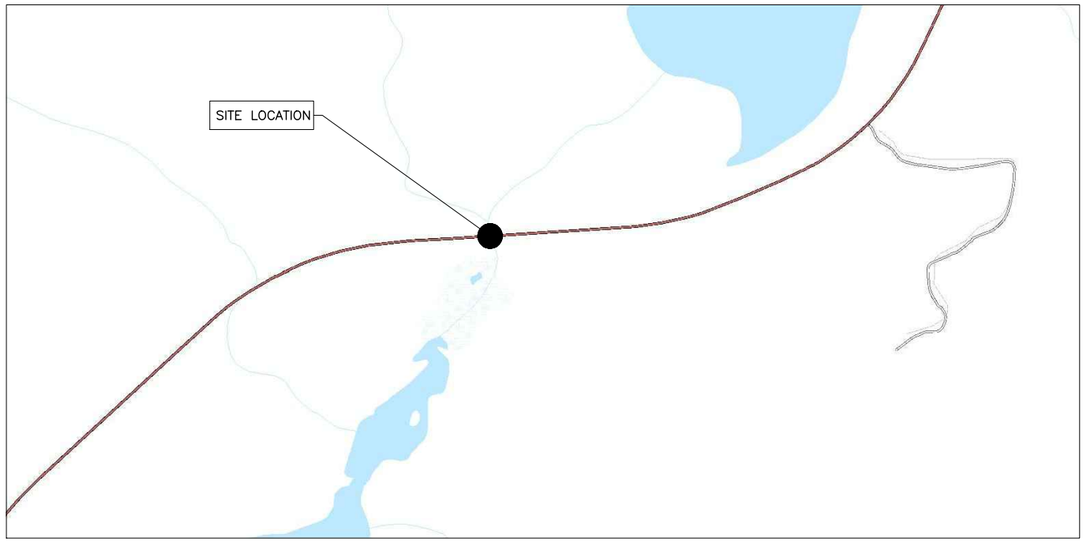
Disclaimer

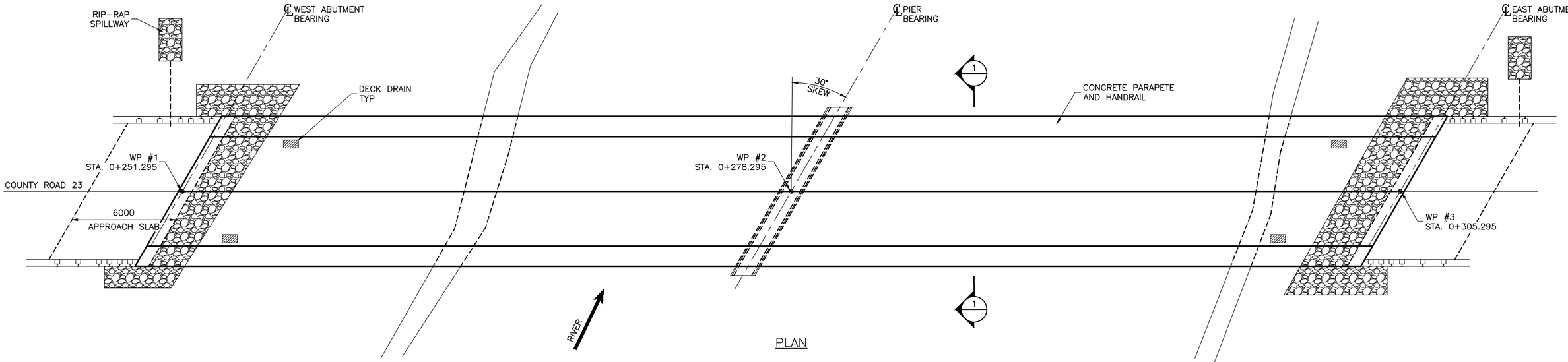
The drawings C-001 to C-005 inclusive are only for the purpose of detailing the sample mock-up girder for certification. There are not intended to reflect any real bridge design nor do they necessarily provide all necessary details.

COUNTY OF WELLWOOD

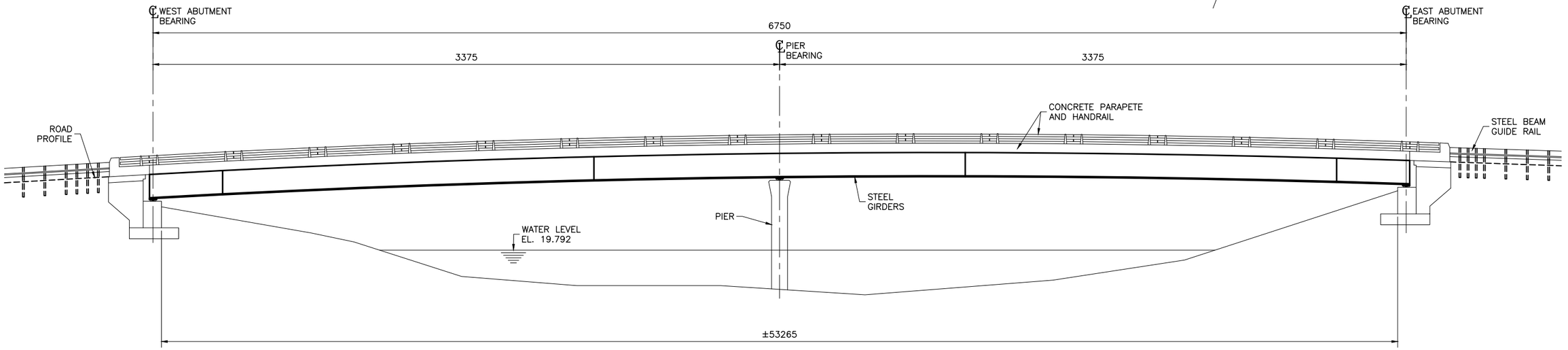
CISC ACCREDITATION BRIDGE (No. 3000050835)

CONTRACT No. 202B-001-3789

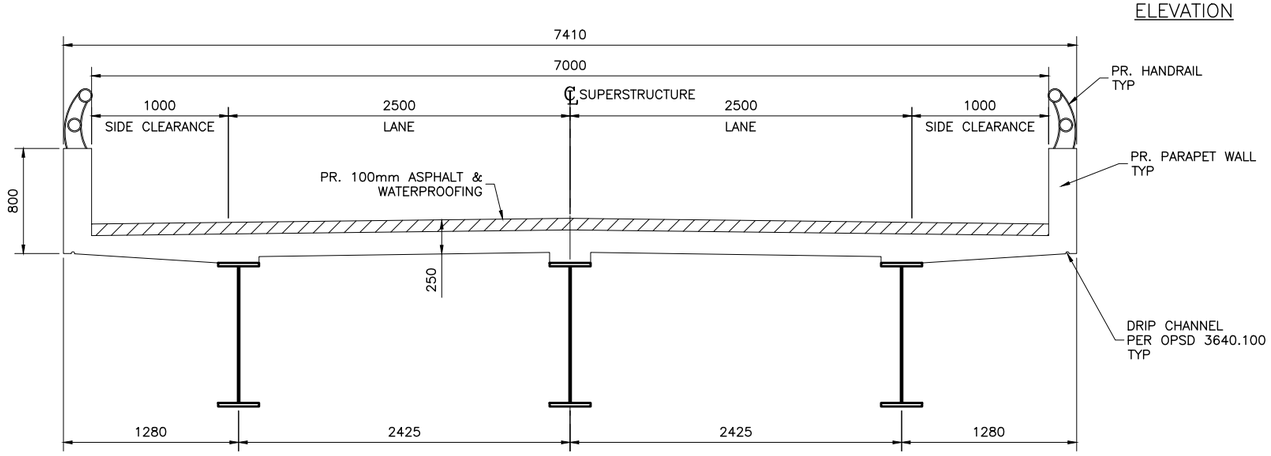




PLAN



ELEVATION



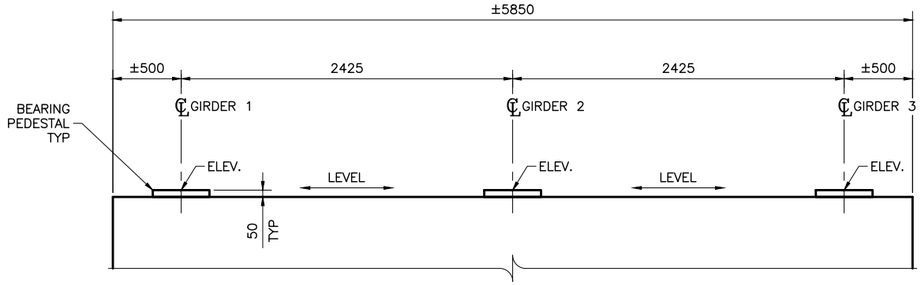
1 SECTION – PROPOSED SUPERSTRUCTURE

No.	Issue / Revision	Date	Auth.
⚠	Issued for Construction	JAN. 2023	RA

Drawing Title
CISC ACREDITATION DESIGN
GENERAL ARRANGEMENT

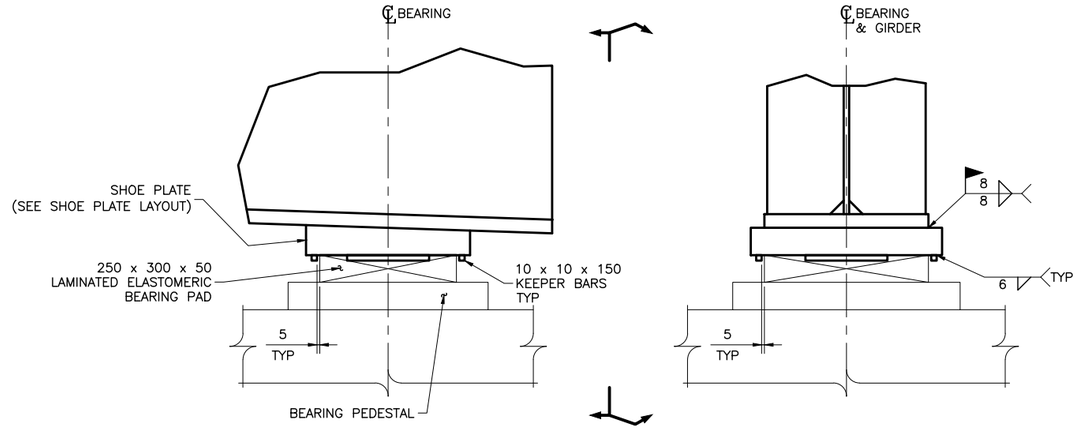
Drawn	Checked	Date	Revision No.	Drawing No.
SM	RA	JAN. 2023	⚠	C-001

Project No. 3000050835
Contract No. 202B–001–3789

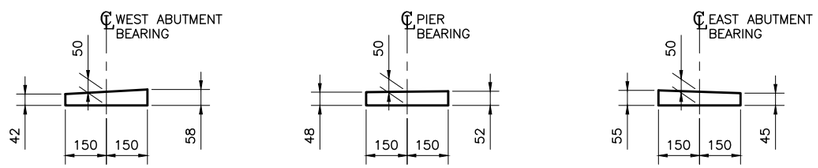


BEARING ELEVATIONS VIEW

BEARING SEAT ELEVATION (TOP OF PEDESTAL)	
WEST ABUTMENT	219.000
PIER	219.900
EAST ABUTMENT	219.600



TYPICAL BEARING DETAIL



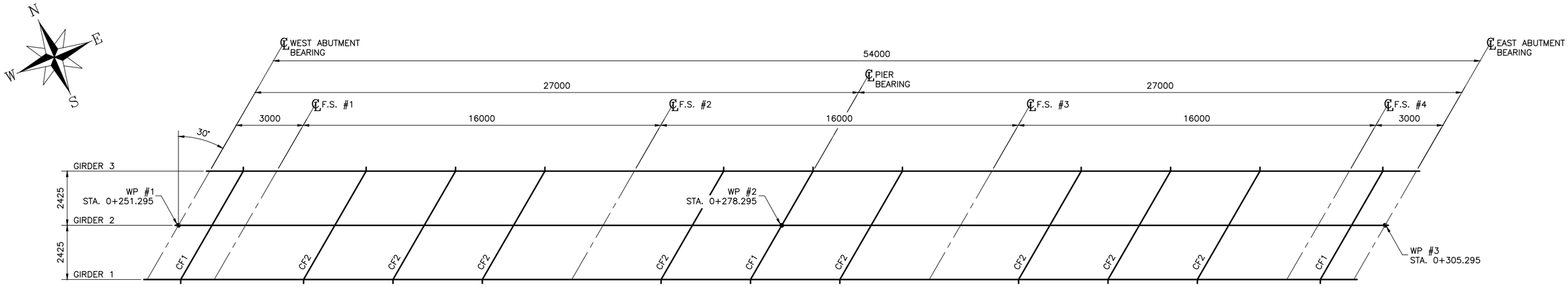
SHOE PLATE LAYOUT (PL 300 X 350)

No.	Issue / Revision	Date	Auth.
⚠	Issued for Construction	JAN. 2023	RA

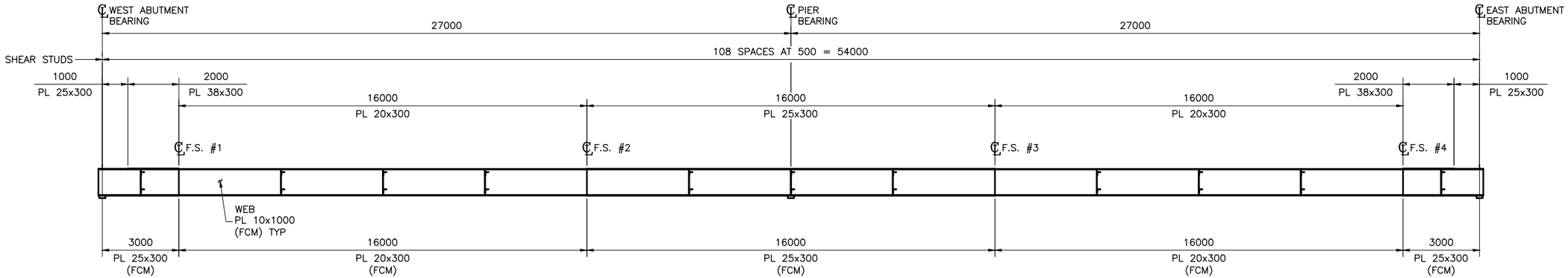
Drawing Title
CISC ACREDITATION DESIGN
ABUTMENT & PIER LAYOUT

Drawn	Checked	Date	Revision No.	Drawing No.
SM	RA	JAN. 2023	⚠	C-002

Project No.	Contract No.
3000050835	202B-001-3789



PLAN – STRUCTURAL STEEL LAYOUT



ELEVATION – GIRDER

STRUCTURAL STEEL NOTES:

1. ALL STRUCTURAL SHALL CONFORM TO THE FOLLOWING:

   –GIRDER WEBS & FLANGES, SPLICE PLATES: CSA G40.21M GRADE 350AT IMPACT TEST ZONE 3.

   –GIRDER STIFFENERS, SHOE PLATES, CROSS FRAME BRACES: CSA G40.21M GRADE 350A.

2. WELDING AND COMPLETED WELDS SHALL CONFORM TO THE REQUIREMENTS OF CSA W47.1, CSA W59 AND CSA S6.

3. ALL LENGTHS SHOWN ARE IN THE HORIZONTAL PLANE AND MEASURED AT 20°C.

4. THE CONTRACTOR SHALL ENSURE THE STABILITY OF ALL COMPONENTS DURING HANDLING, TRANSPORTATION AND ERECTION AND UNTIL THE STRUCTURAL STEEL IS IN ITS FINAL LOCATION WITH ALL PERMANENT BRACING, CONNECTIONS AND SUPPORTS IN PLACE AND CONCRETE IN THE DECK HAS REACHED 75% OF ITS SPECIFIED STRENGTH.

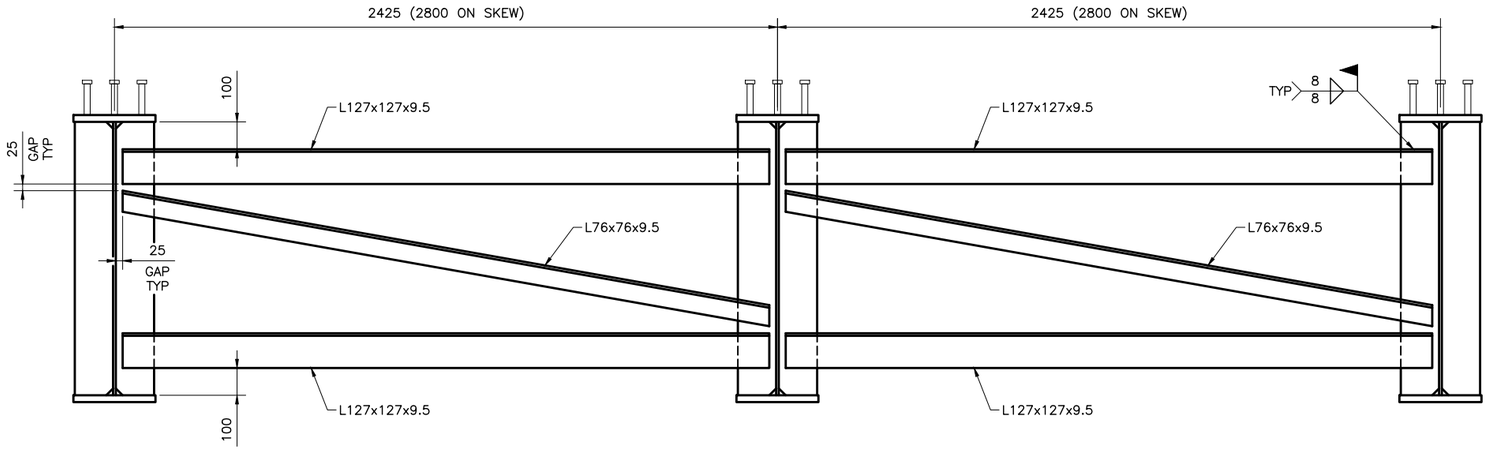
5. RELAXED CAMBER ORDINATES INCLUDE AN ALLOWANCE FOR GIRDER SELF–WEIGHT, CONCRETE DECK, SUPERIMPOSED DEAD LOADS AND PROFILE OF ROAD.

No.	Issue / Revision	Date	Auth.
⚠	Issued for Construction	JAN. 2023	RA

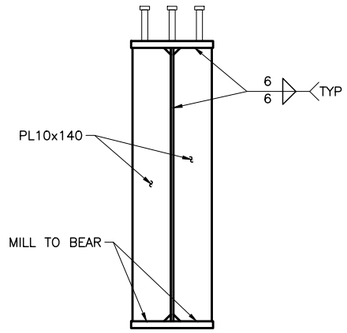
Drawing Title
CISC ACREDITATION DESIGN
STRUCTURAL STEEL LAYOUT

Drawn	Checked	Date	Revision No.	Drawing No.
SM	RA	JAN. 2023	⚠	C-003

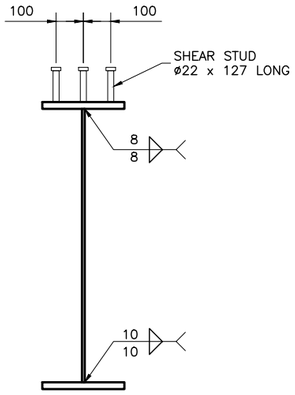
Project No. 3000050835
Contract No. 202B–001–3789



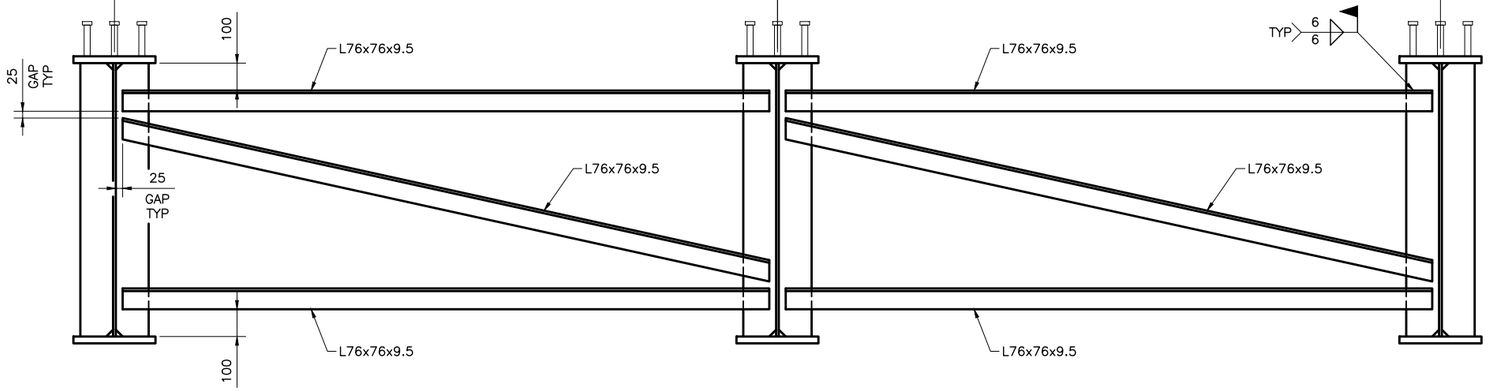
CROSSFRAME SECTION – CF1
NEAR ABUTMENTS & PIER



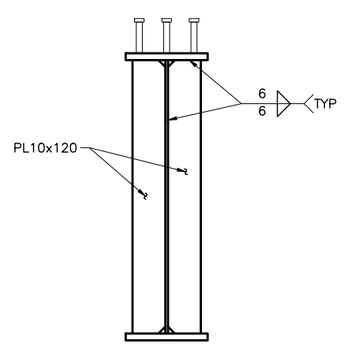
CF1
STIFFENER DETAIL



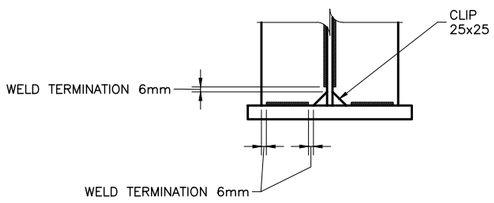
TYPICAL GIRDER
SECTION



CROSSFRAME SECTION – CF2
INTERMEDIATE



CF2
STIFFENER DETAIL



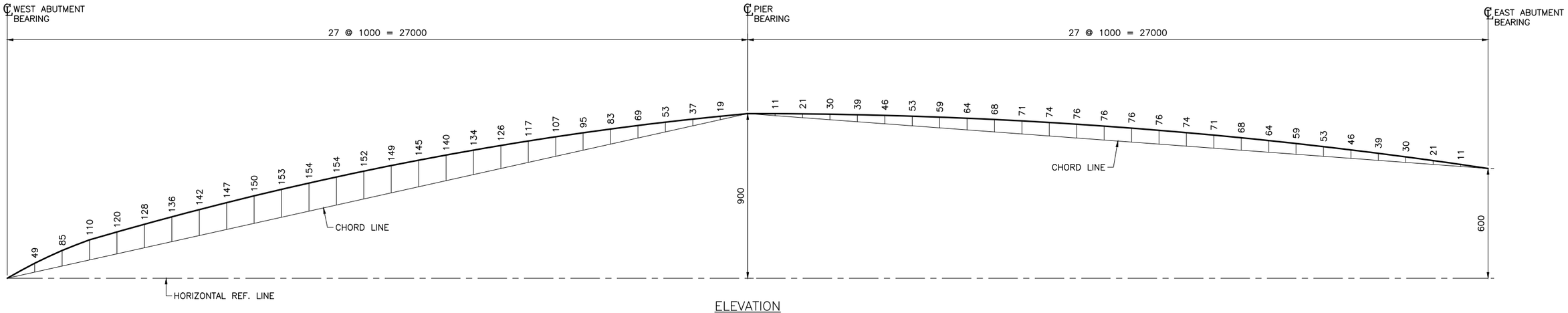
TYPICAL STIFFENER DETAIL

No.	Issue / Revision	Date	Auth.
⚠	Issued for Construction	JAN. 2023	RA

Drawing Title
CISC ACREDITATION DESIGN
STRUCTURAL STEEL DETAILS

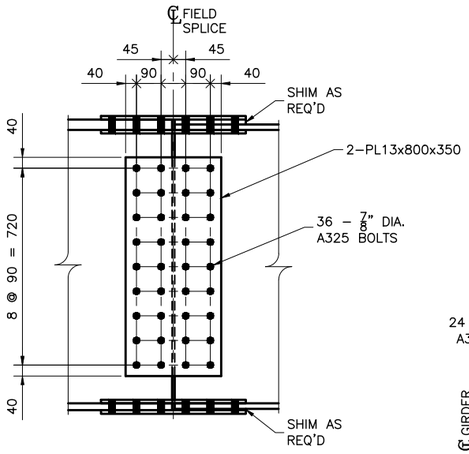
Drawn	Checked	Date	Revision No.	Drawing No.
SM	RA	JAN. 2023	⚠	C-004

Project No.	Contract No.
3000050835	202B-001-3789

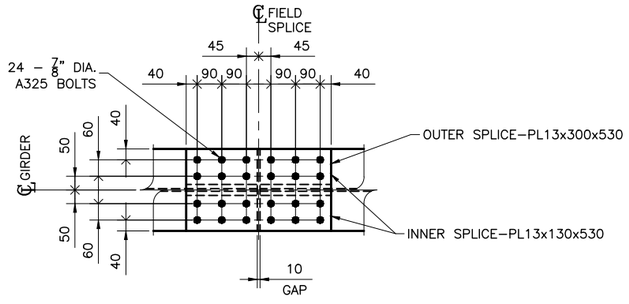


ELEVATION
RELAXED CAMBER DIAGRAM

NOTE: CAMBER DIAGRAM BASED ON 'NO LOAD' CONDITIONS.



TYPICAL ELEVATION
FIELD SPLICE



TYPICAL FLANGE
FIELD SPLICE

FIELD SPLICE INSTALLATION NOTES:

1. ALL BOLTS BROUGHT TO SLIP CRITICAL CONDITION BY TURN–OF–NUT METHOD.
2. ALL THREADS EXCLUDED FROM SHEAR PLANES.

No.	Issue / Revision	Date	Auth.
⚠	Issued for Construction	JAN. 2023	RA

Drawing Title
CISC ACREDITATION DESIGN
STRUCTURAL STEEL DETAILS

Drawn	Checked	Date	Revision No.	Drawing No.
SM	RA	JAN. 2023	⚠	C-005

Project No. 3000050835
Contract No. 202B–001–3789