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See **Distribution**

Dear Sir/Madam

GUIDELINES ON SUPERVISION OF STRUCTURAL STEELWORKS FABRICATED OFF-SITE LOCALLY OR OVERSEAS

Objective

- This circular is to –
- (a) remind the Qualified Persons (QPs) and Qualified Site Supervisors (QSS), of their supervisory duties under the Building Control Act; and
 - (b) provide guidance on the acceptable level of supervision for structural steelworks fabricated offsite/overseas.

Background

2 On 14 Jul 2008, BCA issued a circular advising the industry to use accredited steel fabricators, qualified and competent QSS, and SAC-accredited Independent Testing Agencies (ITA) to enhance the safety of structural steelworks. QPs were again reminded through a circular dated 2 Feb 2012 on the critical role the QSS play in assisting them in supervising structural steelworks, from materials inspection and testing to fabrication and erection.

3 As more projects adopt structural steelworks with key structural components being pre-fabricated off-site locally or overseas, there is a need for proper supervision plan to ensure that key structural elements are built in accordance with the provisions of Building Control Act ("BC Act"), Building Control Regulations and plans approved by the Commissioner of Building Control. In cases where the structural elements are subsequently delivered to the site complete with architectural covering/finishes, it is critical to ensure that the structural works of such structural elements, are carried out in accordance with the provisions of the BC Act, the building regulations and approved plans, including any terms and conditions

imposed by the Commissioner of Building Control, in the fabrication plants of such structural elements, before they are transported to the site.

QP and QSS's Duty under BC Act

4 We would like to remind supervising QPs and QSS that under section 7(1)(c) of the BC Act, **critical structural works** requiring the supervision of a QP, a QSS or a team of QSS working under a QP's control and direction, include:-

- (a) pre-welding and post-welding works for steel elements of key structural elements. Pre-welding works would include fit-up inspection, type of electrodes used, weld current, number of passes, suitably qualified welders. Post welding works would be inspection of weld quality, witnessing of NDT test, weld repair to be taken; and
- (b) preparation for installation of post-fix anchor bolts (eg. drill depth, edge distance, spacing etc.)

5 A QP must carry out this duty with reasonable care and by exercising due diligence. The attached "Guidelines on Supervision of Structural Steelworks Fabricated Offsite Locally or Overseas" in Annex A serves to set an acceptable level of reasonable care and the exercise of due diligence by QPs in supervising for such structural works. QPs are reminded that they must not rely totally on the ITA or QSS, and should visit the off-site/overseas fabrication plant to ensure the supervision plan has been implemented and to conduct regular spot checks. The ITA should not replace the role of the QSS.

6 The contents of Annex A are essentially a consolidation of our earlier circulars on the same. In particular, BCA will request the QP to submit a Supervision Plan before commencement of fabrication works and endorse Inspection Release Notes for the structural aspects of completed modules or components before shipment.

7 If you need further clarification on this matter, you may contact Er. Jonathan Kok at Tel: 68044650, or email: jonathan_kok@bca.gov.sg.

Yours faithfully



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ANNEX A

Aim

This document serves to provide guidance on acceptable level of supervision of structural steelwork fabricated off-site locally or overseas in order to meet the requirements under section 9(4) of the BC Act with respect to taking all reasonable steps and exercising due diligence in supervising and inspecting the structural steelwork.

Due diligence by supervising QP

2 For fabrication of structural steelwork off-site either locally or overseas, QPs are advised to specify in the contract specifications that the steel fabricator to be employed shall be accredited under the Structural Steel Fabricators Accreditation Scheme in the category appropriate for the project. Details of the Structural Steel Fabricators Accreditation Scheme and the list of accredited steel fabricators could be obtained at SSSS website at <http://www.ssss.org.sg>.

3 The supervising QP shall pay particular attention and exercise due diligence in ensuring that the quality of the offsite fabrication meets the design intent, specifications, and code requirements. To this end, suitably trained and experienced Qualified Site Supervisors (QSS) shall be appointed to assist the QP in supervising and inspecting the structural works. The QP should also specify that the steel fabricator engages a full-time SAC-accredited Independent Testing Agency (ITA) as part of its quality control process. The QP shall not delegate this duty completely to the QSS or ITA and should visit the off-site fabrication plant to ensure that the supervision plan has been implemented and to conduct regular spot checks.

4 Before commencement of fabrication works, the QP will be required to submit a **QP Supervision Plan** to BCA detailing the following:

- a) Details of QSS qualifications (for example, Registered Steelwork Supervisor by SSSS or equivalent, and track record of experience) to be stationed full-time or part-time at fabrication plant;
- b) Duties of the QSS when they are at the fabrication plant;
- c) Schedule of factory visits by QP, and by the QSS if they are not stationed full-time at the fabrication plant;
- d) Identification of QP/ QSS inspection hold points;
- e) Scope of Inspection and Testing such as:-
 - i) Material testing:
 - a) Materials specification viz. product standards, source, FPC
 - b) Sampling frequency for material tests
 - c) Types of mechanical and chemical tests to be done
 - ii) Fabrication:
 - a) Types and frequency of pre-welding checks
 - b) Types and frequency of post-welding tests

- f) Quality records to be kept on site for spot check by BCA (eg. Factory Production Control certificates, Material Testing Certificates, sample material testing results, weld tests results, QP-endorsed inspection release notes etc).

Qualified Site Supervisors (QSS)

5 QPs who are supervising major structural steelwork shall ensure that the QSSs they appoint are experienced and suitably trained in supervising such works. The Singapore Structural Steel Society (SSSS) conducts the Steelworks Supervisors (StS) Course that QSSs could attend to gain in-depth knowledge and competency in this specialised field. QPs could look up the list of SSSS Registered Steelwork Supervisors to see if their QSSs have attended the StS Course at this link at the SSSS's web-page:

http://www.ssss.org.sg/index.php?option=com_wrapper&view=wrapper&Itemid=64

6 Role of QSSs in supervision of structural steelwork shall be as follows.

(a) Material inspection and testing

- (i) Check that Material Test Certificates (MTCs) are submitted by the builder for all structural steel products;
- (ii) Check that valid Factory Production Control (FPC) Certificates are submitted by the builder for all structural steel materials and products designed as "Class 1" to BC1 as indicated on BCA approved structural drawings;
- (iii) Countercheck that tag/printing on raw material tally with heat numbers indicated on MTC;
- (iv) Check material standard and grade for all structural steel products including bolts, shear studs, welding consumables etc comply with material standards and steel grades specified in approved plans (steel material standards and grades from Certified List in Appendix A of BC1);
- (v) Check dimensions and thickness of members to tally with approved plans;
- (vi) Check physical defects for any heavy rusting, pitting, warping and bending;
- (vii) Check that steel material designed as "Class 2" are tested by at least batch/lot in accordance with BC1 and
- (viii) Select in consultation with the QP(Supervision) and ITA, representative samples of structural steel members, bolts etc for testing at a laboratory accredited under the Singapore Accreditation Council Lab Accreditation Scheme (SAC-SINGLAS)

(b) Fabrication and erection

- (i) pre-welding works
 - Verify fit-up inspection records (edge preparations eg. bevelling, gaps between welded components within tolerances, provision of proper backing for welding, etc);
 - Verify correct welding electrodes according to approved structural plans are used, handled and stored properly to avoid deterioration (eg. through moisture effects etc) and
 - Verify that approved welding procedure specifications (eg. weld current, number of passes etc.) are followed by qualified welders
- (ii) post welding inspection and non-destructive testing (NDT) of welds
 - Inspect after welding works are completed to ensure correct weld type, length & size (eg. throat thickness for fillet welds) and inform QP(Supervision) if there are any visual signs of welding defects and
 - Review NDT test results carried out by accredited labs[and ensure QP(Supervision) is informed of any weld failure and remedial actions taken
- (iii) bolting works
 - Ensure correct type, size & grade (certified grade to “Appendix A” of BC1) of bolt, ensure holes drilled within tolerances, supervise installation and tightening (eg. high strength friction grip bolts to be tightened using appropriate method and tightened to correct torque)
 - Before installation of post-fix anchor bolts onto concrete, to ensure proper preparation of the structural substrate such as sufficient drill depth into structural substrate, edge distance and spacing
- (iv) shear studs for composite construction
 - Ensure correct size, steel grade (certified to BC1) and spacing according to approved structural plans
- (v) structural configuration and setting out
 - Inspect the steel frame for compliance with approved structural drawings like overall length, overall height, spacing between members & angle, including bracing, member configuration and connection details and
 - Check correct positioning of holding down or anchor bolts and inform QP(Supervision) if they are out of tolerance and based on QP’s instructions, ensure remedial actions are taken and
 - Where in-situ concrete toppings are required on steel frames, check the thickness of the concrete is in accordance with approved plans to ensure no over-cast
- (vi) Trial assembly
 - Check that the connections (bolts and plates) between modules can match and fit within specified tolerance
- (vii) Witnessing of prototype testing of complex or unconventional joints.

Independent Testing Agency (ITA)

7 ITA(s) accredited as Type A¹ Inspection Body under SAC accreditation scheme for Inspection Bodies (Structural Steelwork) should be appointed by the steel fabricator to ensure compliance with design intent, specifications and code requirements. ITA personnel are to be stationed full-time at the fabrication plant. Their scope of work should include:

- (a) Developing inspection and testing plan (ITP) in accordance with code and project specifications. ITP should cover scope of inspection, acceptance criteria, actions for dealing with non-conformity, release/ rejection procedure etc.;
- (b) Verifying that steel material conform to Class 1 or Class 2 under BC1:2012 (Design Guide on Use of Alternative Structural Steel)
- (c) Reviewing fabricator's welding procedure qualification, welder performance qualification, welder qualification records, Quality Manual, Fabrication Manual, Erection Manual and other QA/QC documents
- (d) Maintaining record of qualified welders according to approved welding procedures prior to commencement of steelwork fabrication;
- (e) Conducting inspections and tests² on materials of fabricated items prior and after fabrication;
- (f) Conducting inspections and tests² on welds of fabricated steelwork at specified frequency;
- (g) Inspecting surface preparation and cleaning of steel substrate prior to painting;
- (h) Conducting adhesion tests of protective paints and dry film thickness.
- (i) Post-galvanizing inspection and maintenance of photographic record if cracking is identified.
- (j) Items (a) to (h) shall be submitted to the QP/QSS for record.

Inspection Release Note (IRN)

8 The QP or QSS (signatory to be decided by the QP) shall endorse on the Inspection Release Note (IRN) for the structural aspects of pre-fabricated modules to be released for shipment after verifying the documented records of:

- Material inspection and testing
- Galvanizing and protective treatment
- Fabrication and testing

¹ Type A Inspection Body provides third party inspection services.

² Tests, whether destructive or non-destructive, must be carried out by testing bodies accredited with SINGLAS or Mutual Recognition Agreement (MRA) scheme under the Singapore Accreditation Council (SAC). For more information, refer to www.sac-accreditation.gov.sg

References:

BCA Circular “Advisory on Measures to Enhance Safety of Structural Steelwork” dated 14 Jul 2008

BCA Circular “Design and Material Specifications to be shown on Drawings on Structural Steelwork” dated 3 Jan 2011

BCA Circular “Role of Qualified Site Supervisors (QSSs) in the Supervision of Structural Steelworks” dated 2 Feb 2012

BCA Circular “Implementation of BC 1:2012 “Design Guide on Use of Alternative Structural Steel to BS 5950 and Eurocode 3” dated 1 Apr 2013

ACES/IES “Steelworks Supervision Guide” (2012)