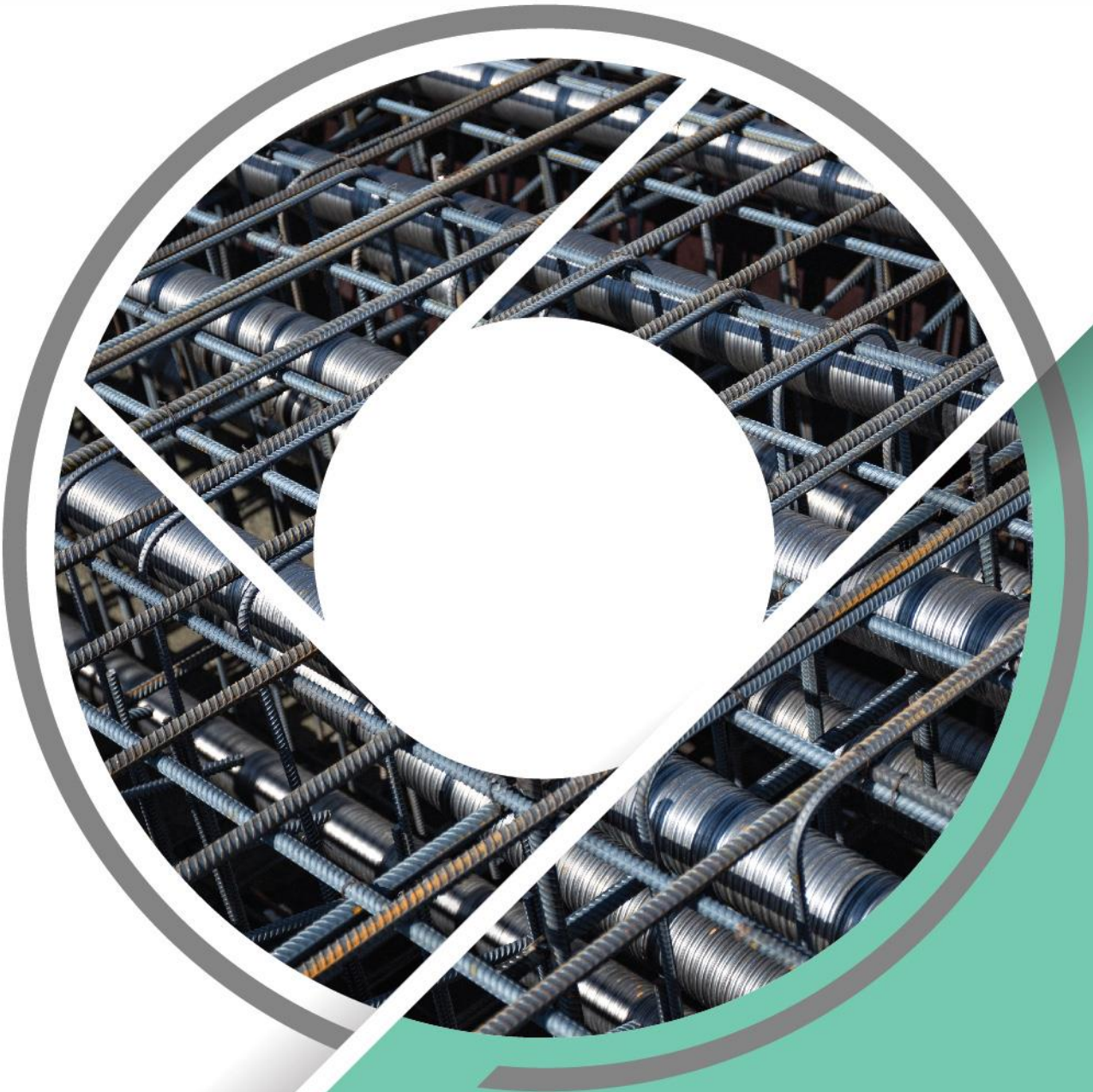
CONSTRUCTION INDUSTRY COUNCIL
建造業議會

BIM

Reference Materials - Standard Rebar Shape Codes for Offsite Prefabrication



2022

Disclaimer

Whilst reasonable efforts have been made to ensure the accuracy of the information contained in this publication (Reference Materials), the CIC nevertheless encourages readers to seek appropriate independent advice from their professional advisers where possible. Readers should not treat or rely on this publication as a substitute for such professional advice for taking any relevant actions.

Enquiries

Enquiries about this publication may be made to the CIC Secretariat at:

38/F, COS Centre

56 Tsun Yip Street, Kwun Tong, Kowloon

Hong Kong

Tel: (852) 2100 9000

Fax: (852) 2100 9090

Email: bim@cic.hk

Website: www.cic.hk

Copyright Notice

The List of Standard Rebar Shape Codes for Offsite Prefabrication compiled in this publication will only become truly useful if as many companies adopt it as possible. To that extent, it may be freely distributed and used in any format necessary, provided credit is given to the CIC.

Document Revision Tracking

Issue Date	Notes
July 2022	First Issuance

Table of Contents

Preface

The Construction Industry Council (CIC) is committed to seeking continuous improvement in all aspects of the construction industry in Hong Kong. To achieve this aim, the CIC forms Committees, Task Forces and other forums to review specific areas of work with the intention of producing Alerts, Reference Materials, Guidelines and Codes of Conduct to assist participants in the industry to strive for excellence.

The CIC appreciates that some improvements and practices can be implemented immediately whilst others may take more time for implementation. It is for this reason that four separate categories of publication have been adopted, the purposes of which are as follows:

Alerts	The Alerts are reminders in the form of brief leaflets produced quickly to draw the immediate attention of relevant stakeholders to the need to follow some good practices or to implement some preventive measures in relation to the construction industry.
Reference Materials	The Reference Materials are standards or methodologies generally adopted and regarded by the industry as good practices. The CIC recommends the adoption of the Reference Materials by industry stakeholders where appropriate.
Guidelines	The Guidelines provide information and guidance on particular topics relevant to the construction industry. The CIC expects all industry stakeholders to adopt the recommendations set out in the Guidelines where applicable.
Codes of Conduct	The Codes of Conduct set out the principles that all relevant industry participants should follow. Under the Construction Industry Council (Cap 587), the CIC is tasked to formulate codes of conduct and enforce such codes. The CIC may take necessary actions to ensure compliance with the codes.

If you have read this publication, we encourage you to share your feedback with us. Please take a moment to fill out the Feedback Form attached to this publication in order that we can further enhance it for the benefit of all concerned. With our joint efforts, we believe our construction industry will develop further and will continue to prosper for years to come.

Abbreviation

ACEHK	The Association of Consulting Engineers of Hong Kong
AECO	Architectural, Engineering, Construction and Operations
BIM	Building Information Modelling
BD	Buildings Department
CEDD	Civil Engineering and Development Department
CIC	Construction Industry Council, Hong Kong
DEVB	Development Bureau
HKCMA	Hong Kong Construction Materials Association
Rebar / rebar	steel reinforcing bar
SCCT	Standing Committee on Concrete Technology
TC	Technical Circular issued by the Development Bureau

In this publication, requirements are expressed in sentences in which the principal auxiliary verb is “should”. Recommendations are expressed in sentences in which the principal auxiliary verb is “shall”. The use of the auxiliary verb “can” indicates that something is technically possible and the auxiliary verb “may” indicates permission.

1 Introduction

1.1 Background

The Development Bureau (DEVB) promulgated a Technical Circular ("TC") (Works) No. 1/2016 entitled "Quality Assurance for Use of Off-site Prefabricated Steel Reinforcing Bar Products in Public Works Contracts" in 2016. The TC was issued to ensure the quality of the prefabricated steel reinforcing bar ("rebar") products produced in the offsite rebar prefabrication yards. An approval system for the yards would be established and a new "List of Approved Steel Reinforcing Bar Prefabrication Yards for Public Works" ("the List") will be set up and maintained by the Civil Engineering and Development Department ("CEDD") according to the TC. CEDD is responsible to approve applications from offsite rebar prefabrication yards for admission to the List, and also monitor the operation and regulate the performance of the yards on the List.

In early 2018, DEVB conducted a review with relevant departments with a view to assuring the quality of prefabricated rebar products as well as aligning the quality supervision and testing requirements that are varied in different Government projects. The enhancement measures such as allowing laboratories managed by the Housing Authority to carry out testing of the prefabricated rebar when the Public Works Laboratories cannot undertake it were incorporated in the policy of a new TC (Works) No. 10/2018. This new TC supersedes TC (Works) No. 1/2016 that had been cancelled thereafter.

While the new TC set out many requirements to ensure quality production of offsite rebar prefabrication, it has not restricted the use of specific standard for the shape code of the rebar. In Hong Kong, the approved rebar prefabrication yards namely VSC Construction Steel Solutions Limited, SW Construction Limited, Golik Steel (HK) Limited (Tai Po Plant) and Golik Steel (HK) Limited (Tsing Yi Plant) all used the same standard shape codes of BS8666[1] for their machines. However, the standard shapes provided in BS8666 could not cover all the rebar shapes commonly used in Hong Kong. Therefore over the years, in addition to the standard shape codes in BS8666, these prefabrication yards have created their own shape codes to facilitate production of rebar with the required shapes not covered in BS8666. Since these additional codes are created independently, most of them are different among the prefabrication yards even for the same shapes. This have caused problems such as the confusion of which shape codes to use in communication and hence the production of rebar by the prefabrication yards.

[1] British Standard BS8666:2005 "Scheduling, dimensioning, bending and cutting of steel reinforcement for concrete. Specification"

In 2019, the former chairman of the Rebar Processing Solutions Committee of the Hong Kong Construction Materials Association Limited (HKCMA), Mr. Kelvin LAU approached the CIC to initiate a dialogue to solve the problem by standardising the rebar shape codes among the prefabrication yards. The CIC welcomed the idea as offsite rebar prefabrication is a specific level of offsite construction that is one of the important areas promulgated by the Construction 2.0: Time to Change published by the DEVB. After separate communications with the DEVB, CEDD and the Standing Committee on Concrete Technology (SCCT), it was concluded that the ownership of such standardisation should be taken by a suitable organisation. After thoroughly considered the situation, the CIC decided to take lead in developing and maintaining a list of standard rebar shape codes for offsite prefabrication as Reference Materials for the construction industry.

The CIC believed that such standardisation is a good starting point to promote digitalisation in the construction industry by incorporating the standard rebar shape codes commonly used in Hong Kong into Building Information Modelling (BIM) authoring tools to facilitate standardised rebar detailing in structural design as well as offsite prefabrication. The CIC may form a Task Group under the Task Force on BIM Standards when necessary to regularly review the list of standard rebar shape codes for offsite prefabrication and devise plans to promote its use.

There are BIM publications issued by the CIC and other organisations which form a comprehensive collection to suit various industry's needs. The hierarchy of these publications are illustrated in Figure 1 below:

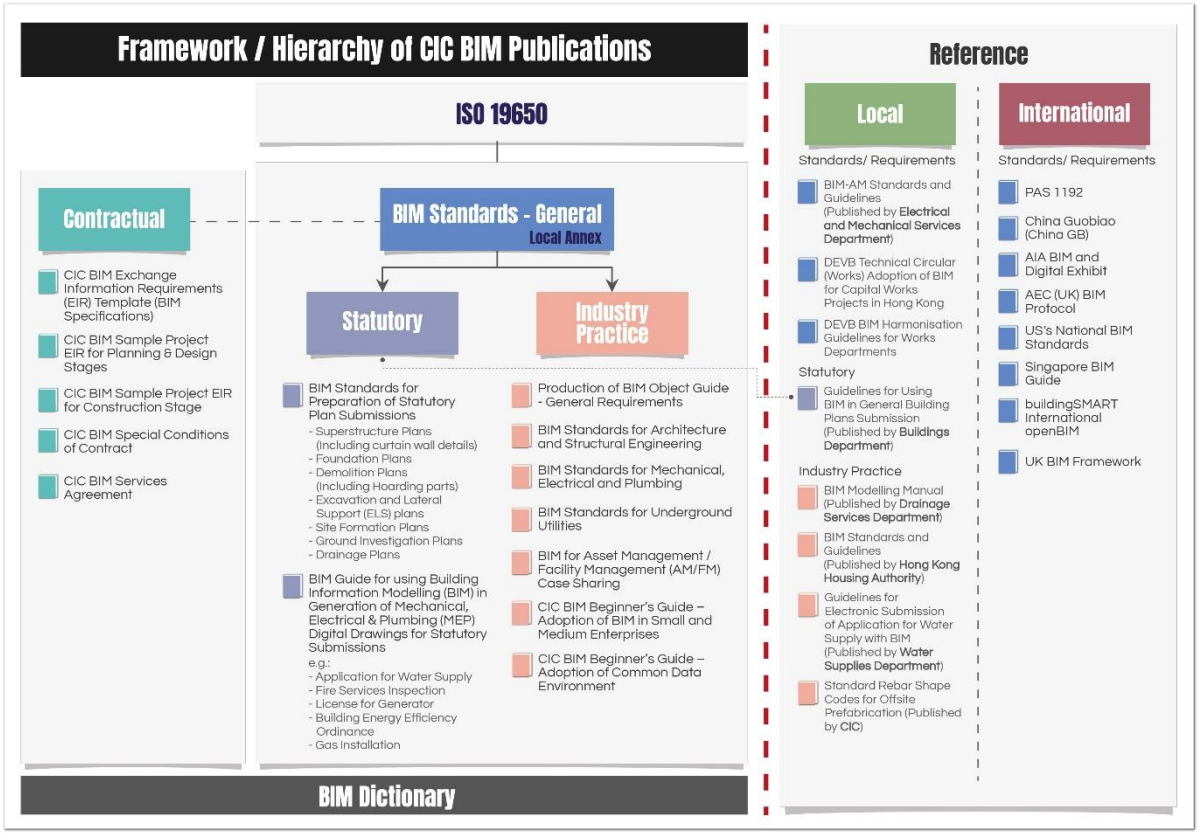


Figure 1 Framework / Hierarchy of CIC BIM Publications

1.2 Objectives

The objectives of publishing this document are:

1.2.1. To provide a list of standard rebar shape codes for offsite prefabrication (the “List”) to facilitate structural design/detailing and/or offsite prefabrication of rebar.

1.2.2. To establish a mechanism in developing and maintaining the List.

1.2.3. To encourage practitioners to use the List by giving recommendations.

2 Standardisation of Rebar Shape Codes for Offsite Prefabrication

This section describes the methodology used in deriving the list of standard rebar shape codes for offsite prefabrication.

2.1 Methodology

2.1.1 To find out rebar shapes not covered by BS 8666:2005

In April 2021, a study was conducted by the CIC to understand all rebar shape codes actually being used for offsite prefabricated rebar. The aim is to find out the percentage of non-standard shapes code in rebar usage in construction work in comparison to standard shape (BS 8666:2005) in Hong Kong.

2.1.2 Data Collection

As of April 2022, there are four Approved Steel Reinforcing Bar Prefabrication Yards in the List of Approved Steel Reinforcing Bar Prefabrication Yards administered by the Civil Engineering and Development Department (CEDD). Their names and addresses are shown below.

Name of Yard	Address of Yard
VSC Construction Steel Solutions Limited	17 Tsing Keung Street, Tsing Yi, New Territories, Hong Kong
SW Construction Limited	No. 5 Lung Yiu Street, Tuen Mun Area 38, New Territories, Hong Kong
Golik Steel (HK) Limited (Tai Po Plant)	Tai Po Industrial Estate, 3 Dai Shing Street, Tai Po, New Territories
Golik Steel (HK) Limited (Tsing Yi Plant)	Sai Tso Wan Road, Tsing Yi Island, New Territories

The CIC successfully reached all 4 approved yards and collected their responses. The rebar shape usage data received cover a 39-month period from 1 January 2018 to 31 March 2021.

2.1.2 Data Grouping and Comparison

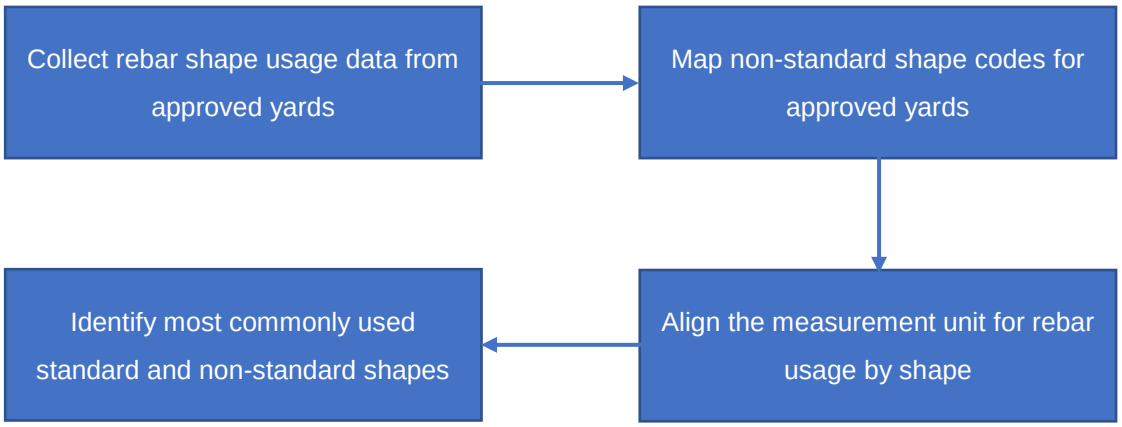
Since each prefabrication yard has created its own shape codes to facilitate production of

rebar of shapes not covered in BS8666, the study found that each Yard uses different numbering systems for same non-standard rebar shape codes. For ease of comparison, the non-standard shape codes of one yard is chosen as the basis and other yards' data are grouped against it to find out the percentage of use of each type of non-standard shape as a whole.

2.1.3 Slight Inconsistence

Due to use of different Enterprise Resource Planning (ERP) systems by each company, the percentage of use of non-standard shape data collected from VSC Construction Steel Solutions Limited and SW Construction Limited are based on ***"number of units prefabricated"***; while percentage of use of non-standard shape data collected from Golik Steel (HK) Limited (Tai Po Plant) and Golik Steel (HK) Limited (Tsing Yi Plant) are based on ***"steel usage (tonnes)"***. To align the measurement unit between the approved yards, the number of non-standard shape units prefabricated from the two Golik yards is estimated based on the percentage steel usage (tonnes) of each shape code.[2]

The review methodology can be summarised in the flow chart below.



2.2 Result

2.2.1 Preliminary Result

[2] For each rebar shape code: $Number\ of\ units\ prefabricated =$

$Total\ number\ of\ all\ units\ prefabricated \times Percentage\ of\ steel\ usage\ (tonnes)$

From 1 January 2018 to 31 March 2021, over 50,000,000 units of prefabricated rebar had been supplied to Hong Kong construction industry, in which 87.4% of all prefabricated rebar could be grouped under the 34 standard shapes of the BS8666:2005, approximate 10% could be grouped under 55 non-standard shape codes, and the rest were rebar shapes related to the use of couplers. Furthermore, it was found that 7.9% of the non-standard shapes[3] could be grouped under ten [10] non-standard shapes.

2.2.2 Feedback from Stakeholders

Professional advice was also sought from Members of the Task Force on BIM Standards. In particular, representatives from the Buildings Department (BD) suggested to include rebar shape commonly used for reinforced concrete curb into the list of standard rebar shape codes for offsite prefabrication. The shape constitutes an additional 0.08% of all prefabricated rebar in that period.

2.3 Conclusion

Since eleven [11] additional non-standard shapes together with the 34 standard shapes in BS8666:2005 could cover 95.4% of all prefabricated rebar in that period, and further inclusion of other non-standard shape is not significant (for example, inclusion of another ten shapes will increase less than 0.5%[3] of the total utilisation rate), it is decided that the first list of standard rebar shape codes for offsite prefabrication could be formed using all the standard shapes of the BS8666:2005 and eleven [11] other non-standard shapes commonly used by the approved yards in Hong Kong. Detail of the list is shown in the Appendix.

2.4 Maintenance of the List of Standard Rebar Shape Codes for Offsite Prefabrication

The list of standard rebar shape codes for offsite prefabrication derived using the methodology described in Section 2.1 is not expected to change much in the future. However, as the list is based on the actual usage of some commonly used (non-BS8666 standard) rebar shapes, the CIC would review from time to time and update the list to ensure it covers at least 95% of the rebar shapes prefabricated offsite.

[3] Rebar shapes related to the use of couplers not included.

3 Recommendations

In order to achieve maximum benefit of using the List shown in the Appendix, it is recommended to use the List as far as practicable in (but not limited to) the following situations.

3.1 Structural Design/Detailing of Reinforced Concrete Structures

Currently, most if not all structural designers/engineers are not required to consider standard rebar shapes nor need to specify the shape codes of the rebar in their reinforced concrete (RC) details drawings. However, it would be beneficial to the entire design and construction process if such consideration and specification have been made in their structural design/detailing stage. Designers should use, as far as practical, the standard rebar shapes listed in this reference material for structural design/detailing.

The structural designer/engineer could also use the standard shapes included in BIM authoring software to develop a BIM model with rebar modelled. Such model could facilitate checking of constructability as well as digital fabrication whereby information of the rebar could directly be transferred to machine for fabrication.

3.2 Procuring Rebar from Offsite Prefabrication Yards

Before procuring rebar from offsite prefabrication yards, the bar fixer of contractors or subcontractors will determine the number of different shapes of rebar to be procured from the construction drawings. During this process, the bar fixer may produce alternative rebar detailing to suit actual site condition or to enhance constructability.

It is recommended that the bar fixer could use the List and provide rebar detailing using the standard shapes and their codes to avoid generating non-standard rebar shapes. The example in Section 3.1 is a good practice to consider when breaking down the RC details for procurement.

3.3 Teaching Structural Design/Detailing in Higher Education

When teaching structural design/detailing in higher education, it is recommended to educate the students to use, as far as practicable, only standard rebar shapes for their design/detailing. Therefore, unless it is practically impossible the students should arrange their structural elements as regularly as possible and provide the corresponding reinforcing bars using the standard shapes and hence standard shape codes only.

3.4 Upgrading/Developing BIM Authoring Software

In upgrading/developing their BIM authoring software, software vendors are recommended to incorporate the list of standard rebar shape codes shown in the Appendix into their software. This would enhance usability of the software and facilitate users in using the standard rebar shape codes when developing their BIM models for design and construction stages.

4 References

1) British Standards Institution. (2005). BS8666:2005.
2) Civil Engineering and Development Department. (2020). List of Approved Steel Reinforcing Bar Prefabrication Yards.
   (URL: https://www.cedd.gov.hk/filemanager/eng/content_724/List of Approved Rebar Yards_2020.06.18.pdf)
3) Construction Industry Council. (2021). CIC BIM Standards - General (Version 2.1 - 2021), with new templates in Appendix D.
4) Construction Industry Council. (2020). CIC BIM Standards for Preparation of Statutory Plan Submissions (December 2020).

5 Acknowledgement

The CIC would like to acknowledge the contribution of the following experts/organisations in the production of the List:

Name	Representative of:
Alex Ho	Construction Industry Council
Sandy Fong	Development Bureau
Lam Tin-kar	Golik Steel (HK) Limited
Lau Ping-kong	Golik Steel (HK) Limited
Patrick Lau	VSC Construction Steel Solutions Limited
Jason Lim	VSC Construction Steel Solutions Limited
Chan Lok-chai	Hong Kong Bar-Bending Contractors Association
Ricky Chui	Hong Kong Construction Materials Association
Kelvin Lau	Hong Kong Construction Materials Association
Adam Choy	The Association of Consulting Engineers of Hong Kong
David Hung	The Association of Consulting Engineers of Hong Kong
Wilson Sung	The Association of Consulting Engineers of Hong Kong

Task Force on BIM Standards

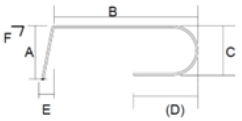
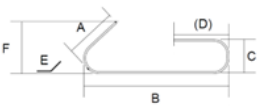
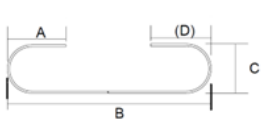
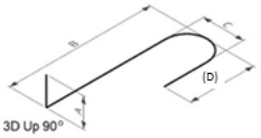
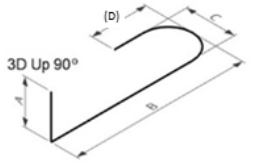
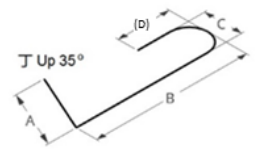
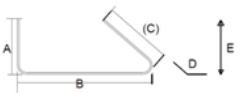
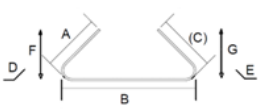
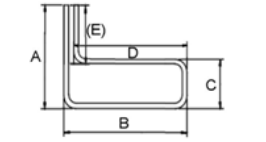
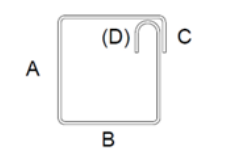
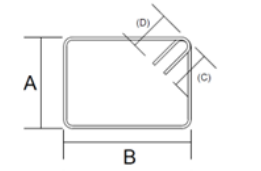
Name	Representative of:
Jack Cheng (Chairperson)	The Hong Kong University of Science and Technology
Ada Fung	Committee on BIM, Construction Industry Council
Clement Chung	The Association of Consulting Engineers of Hong Kong
Boris Yiu	Development Bureau
Mark Lai	Buildings Department
Alex Chu	Lands Department
Froky Wong	Hong Kong Institute of Building Information Modelling
Kelvin Wong	Airport Authority Hong Kong
Aaron Chan	The Hong Kong Institute of Architects
Wong Chi Pan	Hong Kong Construction Association
Kwok Tak Wai	The Hong Kong Federation of Electrical and Mechanical Contractors Limited

Convenor and Secretary

George Wong	Construction Industry Council
Ron Ng	
Lok Fung	
Ella Poon	
Michael Leung	
Kelvin Ngan	

Appendix: List of Standard Rebar Shape Codes for Offsite Prefabrication

This list includes all the standard shape codes of BS8666 (see note) and the following shape codes commonly used in Hong Kong prefabrication yards.

Shape Code 22a 	Shape Code 22b 	Shape Code 22c 
Length= A + B + 0.57C + (D) – 0.5r – 2.6d	Length= A + B + 0.57C + (D) – 0.5r – 2.6d	Length= A + B + 1.14C + (D) – 3.2d
Shape Code 22d 	Shape Code 22e 	Shape Code 22f 
Length= A + B + 0.57C + (D) – 0.5r – 2.6d	Length= A + B + 0.57C + (D) – 0.5r – 2.6d	Length= A + B + 0.57C + (D) – 0.5r – 2.6d
Shape Code 25a 	Shape Code 25b 	Shape Code 41b 
Length= A + B + (C) – 0.5r – d	Length= A + B + (C)	Length=A+B+C+D+(E) - 2r - 4d
Shape Code 51a 	Shape Code 52 	
Length= 2(A + B) + C + (D) – 1.5r – 4d	Length= 2(A + B) + 2(C) – 1.5r – 3d	

Note: For details of BS8666 rebar shape codes (Shape Code 00, 01, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 26, 27, 28, 29, 31, 32, 33, 34, 35 ,36, 41, 44, 46, 47 ,51, 56, 63, 64, 67, 75, 77, 98), please refer to BS8666:2005.

CONSTRUCTION INDUSTRY COUNCIL
建造業議會

Feedback Form

Standard Rebar Shape Codes for Offsite Prefabrication

To improve future editions of this publication, we would be grateful to have your comments.

(Please put a "✓" in the appropriate box.)

1. As a whole, I feel that the publication is:	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Informative	❑	❑	❑	❑	❑
Comprehensive	❑	❑	❑	❑	❑
Useful	❑	❑	❑	❑	❑
Practical	❑	❑	❑	❑	❑

2. Does the publication enable you to understand more about the subject?	Yes	No	No Comment
	❑	❑	❑

3. Have you made reference to the publication in your work?	Quite Often	Sometimes	Never
	❑	❑	❑

4. To what extent have you incorporated the recommendations of the publication in your work?	Most	Some	None
	❑	❑	❑

5. Overall, how would you rate our publication?	Excellent	Very Good	Satisfactory	Fair	Poor
	❑	❑	❑	❑	❑

6. Other comments and suggestions, please specify (use separate sheets if necessary).

Personal Particulars (optional):*

Name: Mr. / Mrs./ Ms./ Dr./ Prof./ Ar. / Ir / Sr ^

Company:

Tel:

Address:

E-mail:

* The personal data in this form will be used only for this survey. Your data will be kept confidential and dealt with only by the Construction Industry Council.

^ Circle as appropriate.

Please return the feedback form to:

CIC Secretariat – BIM
E-mail: bim@cic.hk
Address: 38/F, COS Centre, 56 Tsun Yip Street, Kwun Tong, Kowloon, Hong Kong
Fax No.: (852) 2100 9090