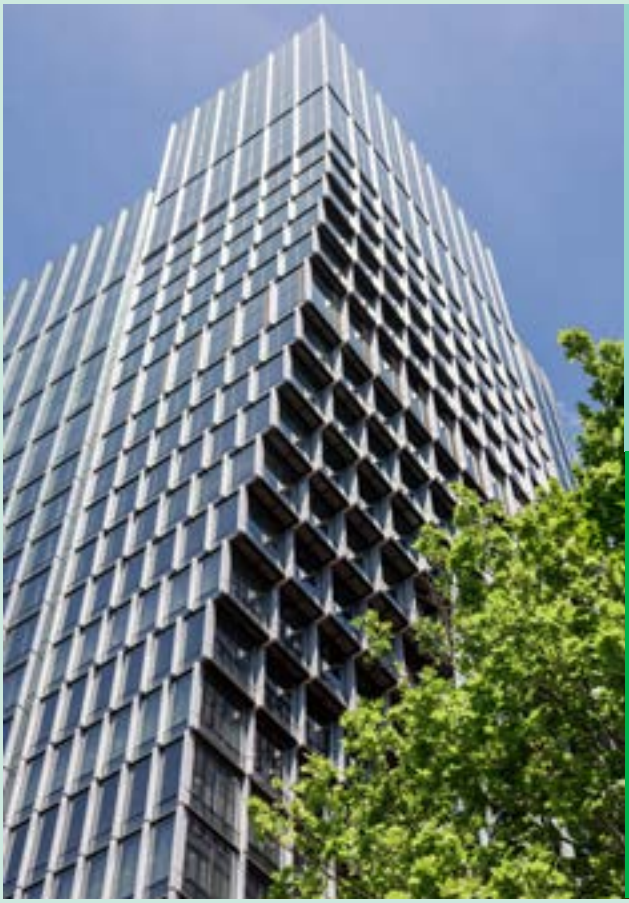
SENSE 600®

SENSE 600® CodeMark Certificate of Conformity Guide Columns



SENSE® SOLUTIONS | Delivered by InfraBuild
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How does CodeMark make it easy?

CodeMark makes it easy for Engineers to substitute SENSE 600® reinforcing bars for their equivalent load capacity 500 MPa reinforcing bar by knowing it is certified to comply with the National Construction Code (NCC) comprising the Building Code of Australia (BCA) Volumes 1 and 2.

The sometimes difficult process of producing a Performance Solution requiring either calculations, research or testing or a combination of these has already been completed and assessed. The resulting CodeMark Certificate of Conformity means that designs that follow the requirements for the SENSE 600® reinforcing bar applications detailed on the Certificate will be deemed-to satisfy the NCC.

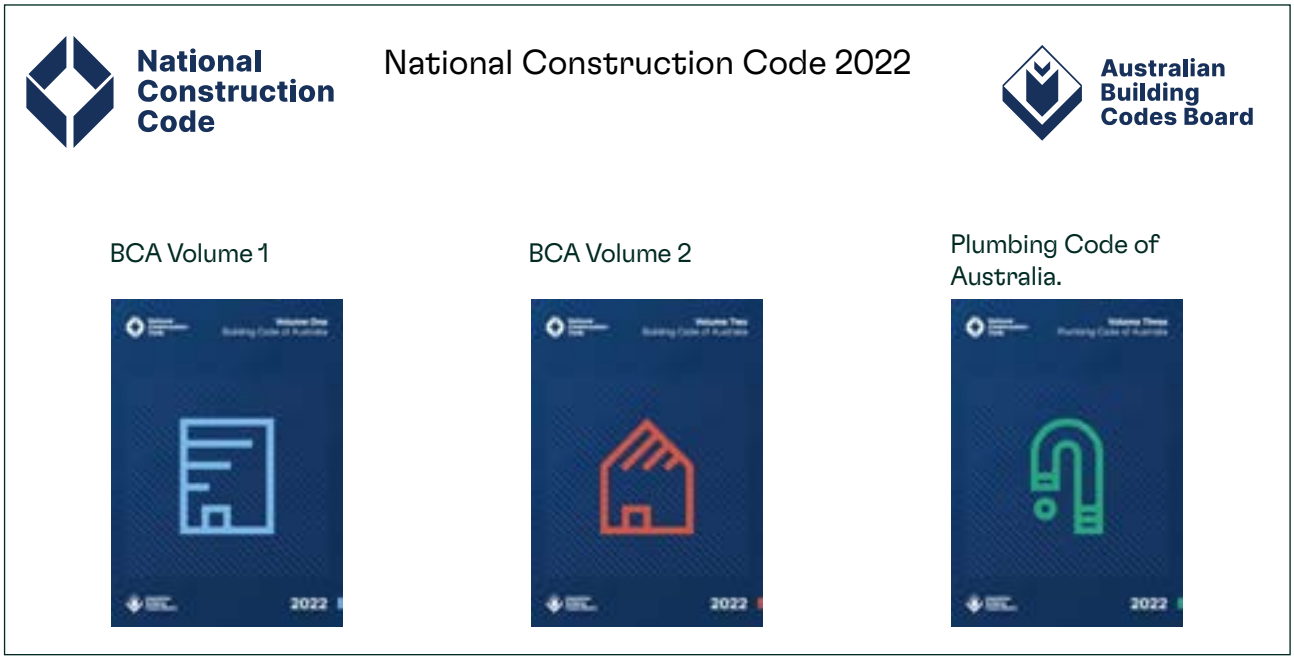


Figure 1 – National Construction Code (NCC)

Volumes 1 and 2 of the BCA 2022 Clause A5G3 states the following:

> **A5G3 Evidence of suitability – Volumes One and Two (BCA)**
>
> *(1) Subject to A5G5, A5G6, A5G7 and A5G9, evidence to support that the use of a material, product, form of construction or design meets a Performance Requirement or a Deemed-to-Satisfy Provision may be in the form of any one, or any combination of the following:*
>
> *(a) A current CodeMark Australia or CodeMark Certificate of Conformity.*
>
> *(b) A current Certificate of Accreditation.*
>
> *(c) A current Certificate of Accreditation.*

It is clear from this BCA extract that compliance with the SENSE 600® CodeMark Certificates of Conformity provides compliance to the BCA and hence the NCC.

What are the CodeMark Certifcates?

Two SENSE 600® Reinforcing Bar Performance Solutions relating to columns have been assessed and issued with a CodeMark Certificate of Conformity for use in all Classes of buildings covered by the NCC.

1) CodeMark Certificate for Longitudinal Column Bars

When SENSE 600® is used as longitudinal bars in a reinforced concrete column, designed to AS 3600: 2018

(i) The minimum cross-sectional area of SENSE 600® shall be $500/600$ x 1% (≈ 0.83%) of the gross cross-sectional area of the column.

(ii) the maximum fitment (and helices) spacing for SENSE 600® bars shall be

$15 \times \sqrt{\frac{600}{500}}$ db (≈ 16.4d_b)

2) CodeMark Certificate for Fitments

When SENSE 600® is used as column fitments they can be directly substituted for their equivalent load capacity 500 MPa fitment without redesign.

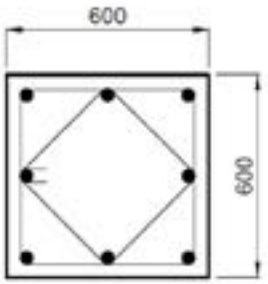
Example –Using CodeMark Certificates of Conformity

The following design example demonstrates how the CodeMark Certificates of Conformity can be used in the redesign of a column.

Consider the column shown in Figure 2 which has been designed by a Chartered Professional Engineer conforming to the requirements of AS 3600.

It is proposed that this column be redesigned with SENSE 600® bars substituted for the 500 MPa bars. That is 8S22 longitudinal bars and S11 fitments @ 300 centres.

B = 600 mm
D = 600 mm
Reinforcing steel
Longitudinal – 8N24 (500 MPa)
Fitments – N12@300 (500 MPa)
f'_c = 40 MPa
Cover = 40 mm



The design load cases are tabulated below

Load Case	N*	M*
1	7830	255
2	7680	365
3	6850	425
4	5530	470
5	6380	485

Figure 2 – Design Examaple

In this example, the SENSE SOLUTIONS® Column Software is used to check the column reinforced with SENSE 600® bars. The software is freely available on the SENSE SOLUTIONS® website or via direct link on: https://platform.skyciv.com/infrabuild

This software produces the column interaction diagram for both the 500 MPa bar design and the SENSE 600® design using equivalent load capacity diameter bars. Alternatively, Engineers could use commercial software packages such as RAPT® and Inducta®. Whichever software engineers choose they will get similar column interaction diagrams. The one shown in Figure 3 is produced from SENSE SOLUTIONS® – Column Software.

Figure 3 shows both the column interaction diagram for the column reinforced with 500 MPa 8N24 (black curve) and the SENSE 600® equivalent capacity bar option with SENSE 600® 8S22 (green curve). The 5 design load cases are shown plotted on the interaction diagram. All the plotted points lie below both curves which confirms the SENSE 600® option of 8S22 satisfies the strength requirements of the design.

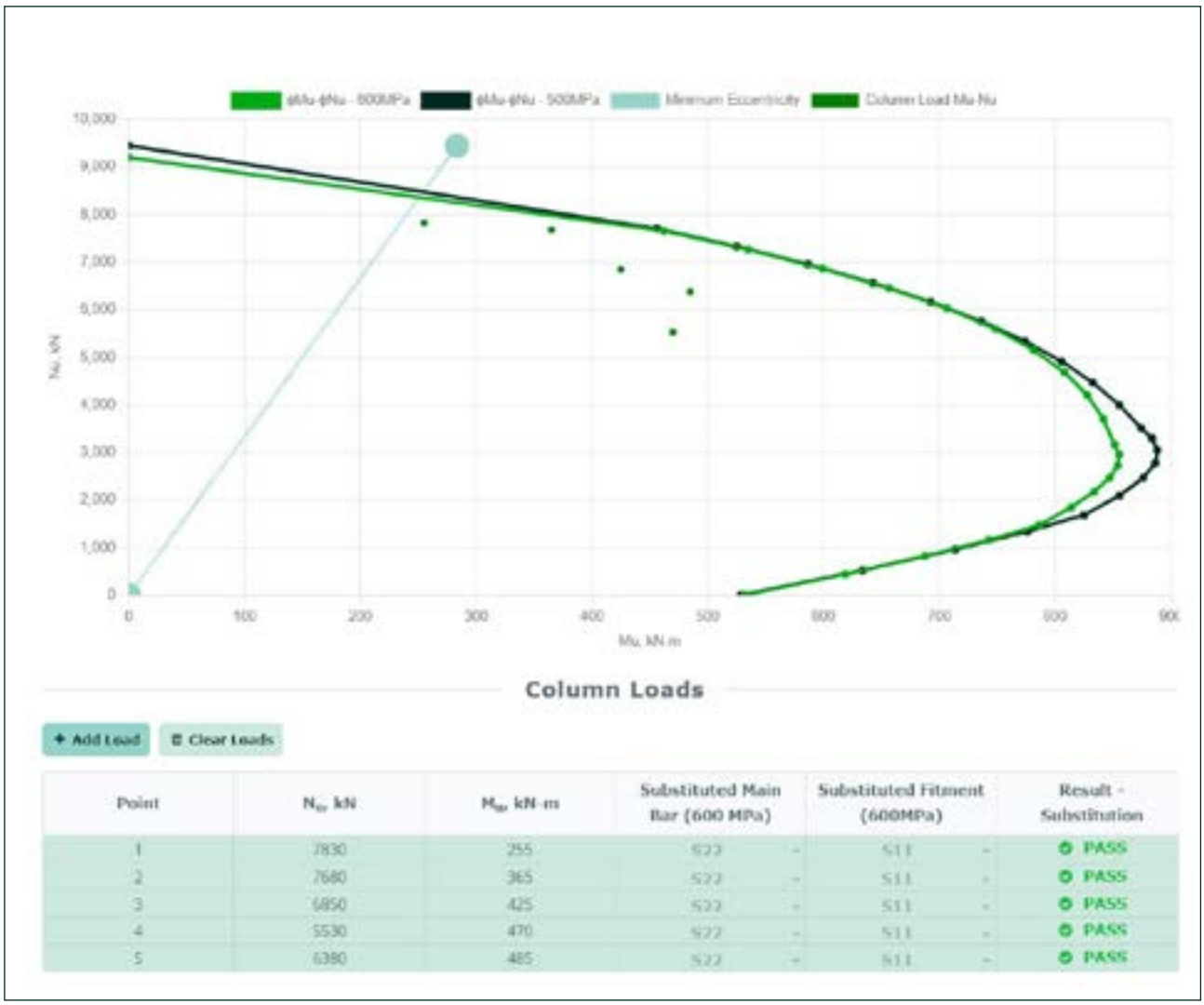


Figure 3 – SENSE SOLUTIONS column interaction curve

There are two further detailing checks that the designer would typically need to ensure conformance of the longitudinal bars to AS 3600 –

1) The minimum reinforcement required by AS 3600, Cl. 10.7.1 where the cross-sectional area of the longitudinal reinforcement in a column shall not be less than 0.01Ag (where A_g is the gross cross-sectional area of the column) and

2) The maximum spacing of fitments and helices required by AS 3600 Cl. 10.7.4.3(b) of $15d_b$ (where d_b is the longitudinal bar diameter).

The SENSE 600® Column Longitudinal Steel CodeMark Certificates of Conformity mean that these two checks are not required because –

1) The minimum reinforcement required for SENSE 600® bars, due to its higher yield strength, is 0.0083Ag compared with 0.001Ag for the 500 MPa bars. Noting that the area of a SENSE 600® bar is 0.83 times the area of its equivalent load capacity 500 MPa Bar.

2) The maximum fitment spacing for SENSE 600® bars is $15 \times \sqrt{\frac{600}{500}}$ db $(\approx 16.4d_b)$ compared to $15d_b$ for 500 MPa bars. Noting that the 16.4 times the diameter of a SENSE 600® bar is equal to 15 times the diameter of the equivalent load capacity 500 MPa Bar.

The fitment spacing is covered by the CodeMark Certificate of Conformity for the longitudinal bars and the fitment diameters (or sizes) are covered by a separate CodeMark Certificate of Conformity.

Designers could use AS 3600 Cl10.7.2 to Cl10.7.4.3 to demonstrate that SENSE 600® fitments can directly substitute for the 500 MPa fitments. However, this is not necessary given there is a CodeMark Certificate of Conformity covering this substitution. Engineers and Certifiers can use this CodeMark without the need to perform any calculations, they just need to follow the requirements of the Certificate which includes the substitution sizes shown in Table 1 below.

Table 1: Equivalent Capacity SENSE 600® Column Fitments

Designed 500 MPa fitment	**Alternative SENSE 600® fitment**		**Capacity (kN)**
Designation	Designation	Diameter (mm)	
N12	S11	11.0	56.5
N16	S15	14.6	101
N20	S18	18.3	157

While this example demonstrates how the CodeMark Certificates of Conformity can be used for a redesign, the same process can be used to simplify an initial design using SENSE 600® reinforcing bar.

Engineer's Structural Design Certificates

When an Engineer is required to provide a Structural Design Certificate for a Building Surveyor and/or a Regulatory Body the CodeMark Certificate of Conformity Nos which have been utilised should be stated. The statement should also identify the columns where these CodeMarks have been utilised to satisfy the BCA's Evidence of suitability requirements (Clause A5G3).

The CodeMark Certificates of Conformity No. to be used in column design are:

1. Certificate No. CM30136 SENSE 600® – Columns Fitments
2. Certificate No. CM301354 SENSE 600® – Longitudinal Column Reinforcement

The aforementioned Certificates of Conformity can be found on the SENSE Solutions website.

Other Design Guides

The following Design Guides may also be of interest:

- SENSE 600® Column Fitments
- SENSE 600® Reinforced Concrete Columns – Design Guide
- SENSE 600® CodeMark Certificates of Conformity – Residential Footings.

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It just makes SENSE

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