



MODEL HANDBOOK

**The Use of Structural Software
for Building Design Approval**

2007

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In particular, and to avoid doubt, the use of this Handbook does not –

- guarantee acceptance or accreditation of a design, material or building solution by any entity authorised to do so under any law;
- mean that a design, material or building solution complies with the Building Code of Australia (BCA);
- guarantee that the software used, or designs produced using the software, are appropriate to demonstrate compliance with the BCA; or
- absolve the user from complying with any Local, State, and Territory or Australian Government legal requirements.



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Preface

The Inter-Government Agreement (IGA) that governs the ABCB places a strong emphasis on reducing reliance on regulation, including consideration of non-regulatory alternatives such as non-mandatory documents.

This Handbook is one of a series produced by the ABCB. This series of Handbooks is being developed in response to comments and concerns expressed by government, industry and the community that relate to the built environment. ABCB Handbooks are informative non-mandatory documents containing generic advice on factors that may be considered or approaches that may be taken in dealing with specific building issues. Any numerical values or specific instructions contained in this Handbook should be considered as examples of outcomes from the proposed process rather than specific guidance on the issues. It should be noted that the Handbook represents the views of the ABCB and the authors and there may be other equally valid points of view on these topics.

The assessment and approval of proprietary prefabricated structural systems has been a matter of considerable discussion. These systems essentially use a software package to produce a design solution for a specific proposal. There is a high degree of reliance on the software to produce a product that is in compliance with the Building Code of Australia (BCA).

This Handbook is intended to provide general information to assist both software providers and users understand attributes that a software package should have to be suitable for use to derive BCA complying design solutions. The Handbook may also ease the burden of the building approval authorities who are faced with computer-based submissions. However, users should note the general disclaimer in relation to use of this Handbook on page i. This Handbook is not intended to be applied to engineering design software that a professional structural engineer uses as part of the design process. It specifically targets computer-based submissions that do not have a certificate of compliance issued by a professional engineer (as defined in the BCA). The responsibility for these latter cases rests with the software providers in relation to the content of the software and the users for their correct usage.

It is ordinarily recognized that the software itself is usually not the problem. Incorrect or inappropriate uses of the software, including inadequate communication to the users and the other trades on what needs to be done, have been found to be the source of most problems encountered in practice.





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Definition of Terms

Unless the contrary intention appears, the following definitions are provided for the purposes of this Handbook:

Compliance Document	means documentary evidence that a software package meets all the BCA requirements and any referenced documents.
Professional Engineer	means a person who is- if legislation is applicable – a registered professional engineer in the relevant discipline who has appropriate experience and competence in the relevant field; or if legislation is not applicable – a Corporate Member of the Institution of Engineers, Australia; or eligible to become a Corporate Member of the Institution of Engineers, Australia, and has appropriate experience and competence in the relevant field.
software	means building structural software that uses design criteria based on the Deemed-to-Satisfy Provisions of the BCA or its referenced documents. In particular, it refers to software that can be used to generate computer-based submissions without compliance certificates from professional engineers.

1 Introduction

Reminder

This Handbook is not mandatory or regulatory in nature and compliance with it will not necessarily discharge a user's legal obligations. This Handbook should only be read and used subject to, and in conjunction with, the general disclaimer at page i.

1.1 General

Need for a Handbook

This Handbook has been prepared to assist in:

- a) describing the attributes a software package should have to make it acceptable for use in demonstrating compliance of a design solution with the BCA; and
- b) providing a process that may demonstrate the acceptability of new software and revisions to existing software.

Aim of this Handbook

The aim of this Handbook is to assist in providing a basis for accepting the use of suitable software to demonstrate compliance with the BCA.

Regulatory matters

Approval authorities may have specific requirements for software to assure and demonstrate the reliability of the outcomes which are different or additional to the general guidance provided in this Handbook. Refer also to A2.2 of the Volume One and 1.2.2 of the Volume Two of the BCA, Evidence of suitability.

Use of Appendices

Appendix A of this Handbook contains an information sheet that may be supplied to the approval authority.

Appendix B of this document outlines the content of the Compliance Document. The document contains a list of information that may be used to demonstrate that the building design based on the software complies with the relevant provisions of the BCA and its referenced documents.

Appendix C of this document contains two suggested checklists, one for the software users and the other for the construction supervisor. These are designed to facilitate the work by identifying items that may need to be checked by each relevant party.

1.2 Scope

This Handbook describes the essential elements of software that should ordinarily demonstrate compliance with the BCA as well as general requirements for software documentation, testing, quality assurance and user training.

The scope of this Handbook is limited to software that uses criteria derived from the BCA Deemed-to-Satisfy Provisions or its referenced documents.

1.3 Limitations

This Handbook has been developed to assist in the use of building structural software to demonstrate compliance with the BCA. The Handbook is only applicable to software that uses design criteria based on the Deemed-to-Satisfy Provisions of the BCA or its referenced documents.

The Handbook specifically targets software that can be used to generate computer-based submissions without compliance certificates from professional engineers.

2 Software Features

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2.1 General

All software used to demonstrate compliance with BCA provisions should ordinarily have the ability to produce evidence that the software meets all the necessary BCA provisions and their referenced documents. The evidence should ideally be included in a Compliance Document to be kept by the software provider and made available for examination by building approval authorities and other relevant building practitioners if required. The Compliance Document should ordinarily address issues such as:

- What software testing has been done to substantiate the veracity of the outputs?
- What versions of the BCA and its referenced documents have been incorporated into the software?

Although most of the year to year changes to the BCA and its referenced documents may not materially affect the software, the Compliance Document should ordinarily be reconfirmed at least once a year to ensure that the latest relevant changes are taken into account.

The essential features of the Compliance Document should ordinarily be summarized and incorporated into the software output (see Section 2.4 Software Outputs).

2.2 Compliance Documentation

Documentation of software used to demonstrate compliance with BCA provisions should ordinarily address the following issues:

- Scope and limitation of application of software;
- User characteristics - degree of training/competence required;
- BCA Provisions and their referenced documents that have been incorporated into the software; and
- Evidence of quality assurance.

Appendix B provides a more comprehensive list of suggested information for inclusion in the Compliance Document.

2.3 Software Characteristics

Software providers should clearly indicate the degree of competence and training necessary for users of the software.

Software, which is used to generate computer-based submissions without compliance certificates from professional engineers, should ordinarily have the following characteristics:

- a) Inputs to software should be limited to items that can be readily identified in the documentation to be submitted for approval;
- b) There should be no manual over-ride on what can be considered as 'engineering criteria' and any over-ride should be clearly stated in the output;
- c) No outputs should be made available if the inputs exceed the declared limitations of the software; and
- d) Self checking input error warnings.

If specific information must be provided by a structural engineer then this should be apparent to the user. The engineer that provided the information should be clearly stated in the outputs.

2.4 Software Outputs

Outputs, relevant to the assessment of structural safety, of all software used to demonstrate compliance with BCA provisions, should ordinarily include the following information:

- a) Name and version number of the software;
- b) Declaration of compliance with BCA Deemed-to-Satisfy Provisions and location of the Compliance Document;
- c) Name and edition of BCA and the relevant referenced documents that have been incorporated into the software;
- d) Specific recommended installation/transport procedures if these procedures are essential parts of the design assumptions (For example, if a roof truss relies on roofing battens to provide lateral restraints and this requires two nails per batten-to-truss connection; then this should be stated as part of the outputs);

- e) Input parameter settings (including those that are locked in the software) when these are allowed in the BCA or referenced documents. These include any discretionary factors referred to in the appropriate Australian Standards or other relevant documents; and
- f) Name of the person who has used the program to produce the design so that their suitability/competence to use the program can be checked by the building certifier. Where appropriate their training or approval number for the use of the software should also be included, along with the period of validity.



3 Software Application

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In order to ensure that the software has been used appropriately, it is good practice for software users to check the following:

- Is the usage within the limitations of the software?
- Have the applied loads been correctly determined?
- Are the spans and layouts consistent with the drawings?
- Have all parameter settings been appropriately determined and selected?

In addition, it is suggested that the software user supervisor and construction supervisor check the following:

- Have all member sizes been specified and do they look reasonable?
- Have all the connections been specified and do they look reasonable?
- Are there any special members that need individual attention?
- Are there any special precautions to be taken during erection?

In general, the report produced by the software user for the building approval authority should contain enough information to enable an informed judgment to be made on the adequacy of the design, including installation procedures. Appendix A outlines a common format for reporting to achieve this purpose.



4 Other Factors to be Considered

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Correct application of the software is necessary but not the only condition for a satisfactory outcome. Other factors that will ordinarily need to be considered include:

- Ensuring that the basic assumptions made in the software (such as adequate lateral restraints) are actually fulfilled in reality,
- Adequate detailing of 'non-structural' elements,
- Adequate supervision of installation,
- Ensuring that components are not damaged in storage and installation,
- Ensuring adequate temporary and permanent bracing, and
- Critical members such as girder trusses need careful checking ordinarily by a structural engineer.

Appendix C provides two check lists, one for the software users and the other for the construction supervisor. Their aims are to facilitate the work for each concerned party.



5 Testing and Quality Assurance

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The software supplier should ordinarily have in place a quality assurance program which is independently verified by an appropriate organization.

The QA program should ordinarily validate that the software will perform the following functions as appropriate:

- Execute sound structural analysis,
- Apply relevant provisions, including any discretionary factors, in the appropriate Australian Standards or other relevant documents, and
- Properly select from the appropriate proprietary components for use in a particular situation.

The validation can be carried out using a number of methods such as, alternative methods of structural analysis, selecting a variety of typical building applications and selecting a variety of structural configurations.

The method(s) of validating the software should normally be identified in the Compliance Document, in particular how the performance of the three functions above were ascertained and the name of the person who has carried out the validation.



6 Training of Users

Reminder

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A guide/user manual and, if required, a training program for users should be available depending on the software and the types of users. This material should ordinarily cover the current version and updates for any proposed new version of the software.

Suitable means of identifying trained personnel should ordinarily be made available to certifiers. For example, anyone who has received training on a software application could be given: (a) a letter or certificate (which could be presented to certifiers when requested), or (b) a unique training number (which can be quoted in the design documentation submitted for approval). Alternatively, a list of trained persons could be made available in print or on web sites.



7 Evidence of Suitability of Software

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Evidence should be produced to demonstrate that the software is suitable for demonstrating compliance with the BCA. This could include evidence that:

- The software has the features outlined in Clause 3 and the application falls within the limits outlined in Clause 4;
- The software has undergone appropriate testing and quality assurance as outlined in Clause 6; and
- User Manuals, Guides and Training programs are available for users (if required).

The status of the software, such as whether it has been accepted by an approval authority, should also be clearly indicated.

The evidence should be included in the Compliance Document (see Appendix B).



8 Process for Validating and Upgrading Software

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This Handbook is not mandatory or regulatory in nature and compliance with it will not necessarily discharge a user's legal obligations. This Handbook should only be read and used subject to, and in conjunction with, the general disclaimer at page i .

Any revisions, updates or new versions should ideally be identified by a unique number or other form of designation. The status of any revisions, updates or new versions, such as whether it has been accepted by an approval authority, should also be clearly indicated. The Compliance Document should be updated to reflect the changes.





Appendix A - INFORMATION FOR APPROVAL AUTHORITY

GENERAL

Date:

Reference No:

Property Title:

Building Classification and use:

Scope of Software:

Address:

Name of Software used in analysis (including version number):

Name and contact details of the organization responsible for the software:

Name of the person approving the design output:



Appendix B - COMPLIANCE DOCUMENT

GENERAL

Documentation of the evidence that a software package meets all the BCA requirements and its referenced documents is called a Compliance Document. It should ordinarily be kept by the software provider and made available for examination if required. This Compliance Document should be assessed by an independent third party to confirm that (a) the design process used in the software is in compliance with the BCA and its referenced documents and (b) the management and use of the software are in accordance with this Handbook. The assessor is entitled to request further clarifications to be included in the Compliance Document and is required to confirm in writing that the Compliance Document has been prepared in accordance with this Handbook.

This Appendix outlines what information should usually be included in the Compliance Document.

CONTENT OF COMPLIANCE DOCUMENT

The content of the Compliance Document should ordinarily include the following information (not necessarily in the order indicated):

- Name of Software (including version number);
- Scope and limitation of application of software (particularly applications that are NOT appropriate for use);
- User Qualifications - degree of training/competence required (if any), availability of list of qualified operators;
- Name and contact details of the organization responsible for the software;
- Declaration of compliance and location of the Compliance Document;
- Name and edition of the BCA and its referenced documents that have been incorporated into the software;
- References for general installation instructions and specific recommended installation/transport procedures which are not part of the 'general requirements' or 'standard industry practice';
- Evidence of software validation that has been done to substantiate the veracity of the outputs;
- Evidence of software quality assurance measures;
- Availability of guide or training for users;
- History of revision/upgrading; and

- Software Features: This section should be designed to allow the approval authorities to determine whether the design process used in the software complies with the technical requirements of the BCA and its referenced documents. Typically, it should contain the following information:
 - Input features:
 - Relevant referenced documents
 - Loads and load combinations used in design
 - Options for loading inputs
 - Structural details: geometry, member properties
 - Options for structural detail inputs
 - Analysis and Design features:
 - Relevant referenced documents
 - Type of analysis used in software
 - Assumptions made in analysis
 - Options available for analysis
 - Member design procedures (strength & serviceability)
 - Connection design procedures
 - Other design features (bracing, lateral restraints etc.)
 - Output features:
 - Software capability to provide analysis outputs (e.g. action effects on members etc.)
 - Software capability to provide design outputs (e.g. design calculation, details for members and connections etc.)

Typical examples of input /output screens and outputs used in submission to approval authority should also be included in the Compliance Document.

Appendix C - SUGGESTED CHECKLISTS

CHECKLIST FOR SOFTWARE USER

ITEM	YES	NO
1. Is the software appropriate for the application and has it been used within the documented limits of the software?		
2. Have input sources been checked?		
3. Do the inputs to the software match the design documentation?		
4. Are the assumptions made in the software reasonable and match the design documentation?		
5. Have critical components been checked?		
6. Has documentation of any additional checks deemed to be warranted been included?		
7. List any major assumptions and provide comments on them (e.g. internal walls as supports, special hold-down requirements, top chord restraints, overhang support, special loads etc.)		

SITE CHECK LIST FOR THE CONSTRUCTION SUPERVISOR

ITEM	YES	NO
1. Have site storage and lifting caused any damage to the components?		
2. Have approved plans and layouts been followed?		
3. Have lateral and diagonal bracing specifications (temporary and permanent) been followed?		
4. Have instructions from the manufacturers been supplied and followed?		