

## 2 DESCRIPTION OF CONNECTION

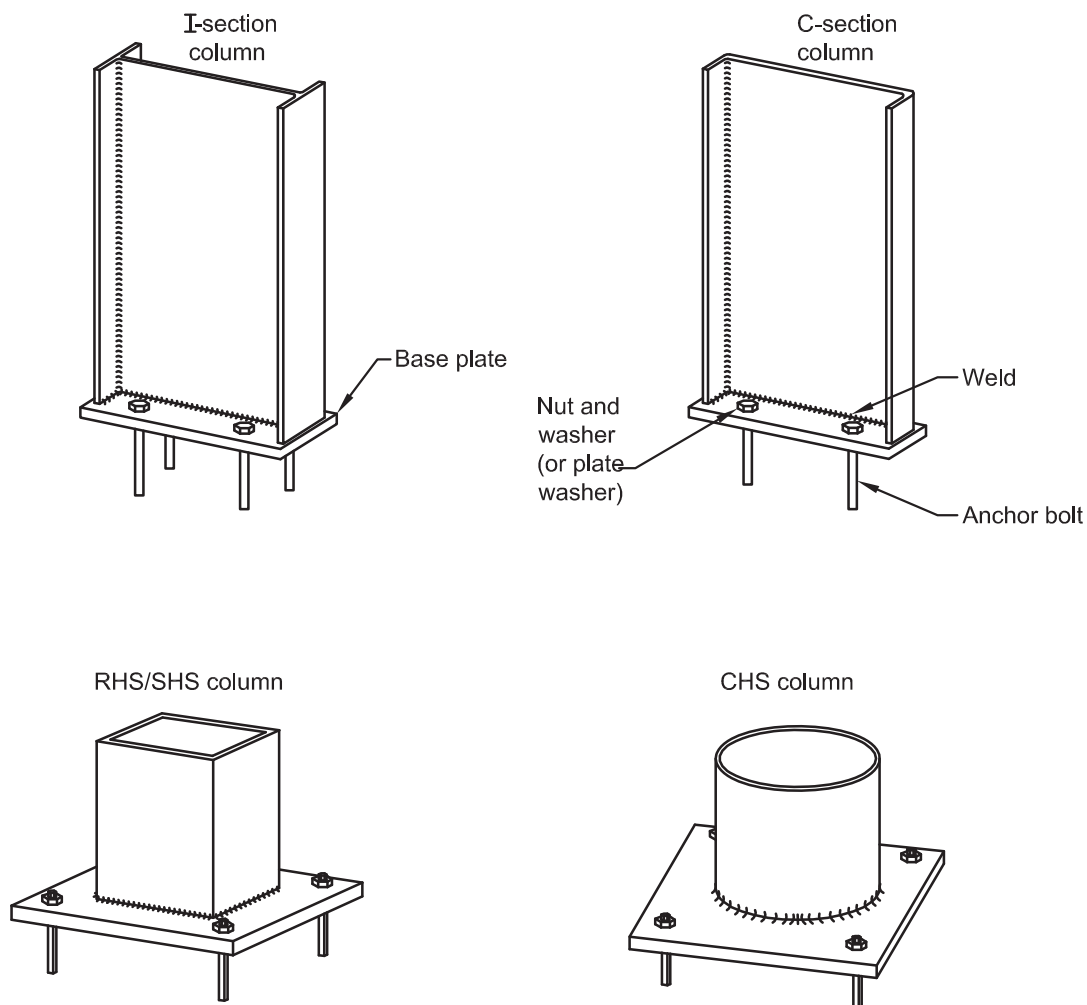


FIGURE 1 TYPICAL PINNED COLUMN BASE PLATES

The design assumption made in this Design Guide is that the base plate connection is a pinned connection (i.e. transmits no bending moment). Hence if the base plate uses the detailing given in this Design Guide, the base plate should be modelled as a pin in any computer analysis package, since the design actions obtained from the structural analysis are dependent upon the assumption made and AS 4100 Clause 4.2.5 requires consistency.

Typical pinned column bases shown at Figure 1 consist of:

- a rectangular base plate;
- a column welded to the base plate, usually with fillet welds;
- (usually) four anchor bolts which are either cast into the concrete support or are masonry anchors which may be drilled and fitted into the hardened concrete.

Pinned column base plate connections may be subject to combinations of the following design actions:

- axial compression and shear force;
- axial tension and shear force.



For the case of axial compression and shear force, the base plate should have sufficient strength and stiffness to transmit the design actions from the column into the foundation. The bolts are primarily locating devices although they may be designed to resist the shear force.

Columns subject to axial compression may be either:

- (a) prepared for full contact on the base plate, in which case, the axial compression force is transmitted by direct bearing from the column into the base plate. Cold saw cutting of the end of the column is sufficient to meet the requirements of Clause 14.4.4.2 of AS 4100 (Ref. 1) for full contact. For this arrangement, the weld connecting the column to the base plate is merely a locating device in terms of axial compression and will only be required to transmit horizontal shear force;

or

- (b) not prepared for full contact, in which case, both axial compression and shear force must be transmitted from the column into the base plate through the welds.

For the case of axial tension and shear force, the welds transmit both design actions from the column into the base plate. The base plate then must be designed for the bending that results from the transfer of the tension force from the base plate into the anchor bolts.

The anchor bolts must meet the following requirements:

- (i) They must transmit any tensile or shear design actions from the column into the foundation.
- (ii) During erection they must be capable of stabilising the column until other structural elements have been erected.

This type of base is simple to fabricate and relatively inexpensive. Rarely will it be more economical to use thinner base plates augmented by stiffeners, an arrangement that has been popular in the past, because of the cost of cutting out and welding the stiffeners. No guidance on stiffened base plates is provided herein for this reason.



**Design Guide 7**  
**Pinned base plate connections for columns**  
**by**

**T.J. Hogan**

**first edition—2011**



AUSTRALIAN STEEL INSTITUTE  
(ABN)/ACN (94) 000 973 839

**Design Guide 7**  
**Pinned base plate connections for columns**

Copyright © 2011 by AUSTRALIAN STEEL INSTITUTE

Published by: AUSTRALIAN STEEL INSTITUTE

All rights reserved. This book or any part thereof must not be reproduced in any form without the written permission of Australian Steel Institute.

*Note to commercial software developers: Copyright of the information contained within this publication is held by Australian Steel Institute (ASI). Written permission must be obtained from ASI for the use of any information contained herein which is subsequently used in any commercially available software package.*

FIRST EDITION 2011 (LIMIT STATES)

National Library of Australia Cataloguing-in-Publication entry:

Hogan, T.J.

Design Guide 7: Pinned base plate connections

1<sup>st</sup> ed.

Includes bibliographic references.

ISBN 978 1 9214762 4 2 (pbk.).

Steel, Structural—Standards – Australia.

Steel, Structural—Specifications – Australia.

Joints (Engineering)—Design and construction.

Australian Steel Institute.

(Series: Structural steel connections series).

This publication originated as part of

Design of structural connections

First edition 1978

Second edition 1981

Third edition 1988

Fourth edition 1994

Also in this series:

Design capacity tables for structural steel. Volume 3: Simple connections—Open sections

Handbook 1: Design of structural steel connections

Design Guide 1: Bolting in structural steel connections

Design Guide 2: Welding in structural steel connections

Design Guide 3: Web side plate connections

Design Guide 4: Flexible end plate connections

Design Guide 5: Angle cleat connections

Design Guide 6: Seated connections

Design Guide 10: Bolted moment end plate beam splice connections

Design Guide 11: Welded beam to column moment connections

Design Guide 12: Bolted end plate beam to column moment connections

Design Guide 13: Splice connections

Design capacity tables for structural steel. Volume 4: Rigid connections—Open sections

**Disclaimer:** The information presented by the Australian Steel Institute in this publication has been prepared for general information only and does not in any way constitute recommendations or professional advice. While every effort has been made and all reasonable care taken to ensure the accuracy of the information contained in this publication, this information should not be used or relied upon for any specific application without investigation and verification as to its accuracy, suitability and applicability by a competent professional person in this regard. The Australian Steel Institute, its officers and employees and the authors and editors of this publication do not give any warranties or make any representations in relation to the information provided herein and to the extent permitted by law (a) will not be held liable or responsible in any way; and (b) expressly disclaim any liability or responsibility for any loss or damage costs or expenses incurred in connection with this publication by any person, whether that person is the purchaser of this publication or not. Without limitation, this includes loss, damage, costs and expenses incurred as a result of the negligence of the authors, editors or publishers.

The information in this publication should not be relied upon as a substitute for independent due diligence, professional or legal advice and in this regard the services of a competent professional person or persons should be sought.



## CONTENTS

	<i>Page</i>		<i>Page</i>
List of figures	iv	9.4 DESIGN CHECK NO. 4—Design capacity for horizontal shear transfer by friction at base plate/concrete interface	35
List of tables	v	9.5 DESIGN CHECK NO. 5—Design capacity for horizontal shear transfer by bearing of embedded steel column	36
Preface	vi	9.6 DESIGN CHECK NO. 6—Design capacity for horizontal shear transfer through shear key	38
About the author	vii	9.7 DESIGN CHECK NO. 7—Design capacity for horizontal shear transfer through anchor bolts	40
Acknowledgements	viii		
<b>1 CONCEPT OF DESIGN GUIDES.....</b>	<b>1</b>	<b>10 RECOMMENDED DESIGN MODEL—</b>	
1.1 Background	1	<b>AXIAL TENSION AND SHEAR.....</b>	<b>43</b>
<b>2 DESCRIPTION OF CONNECTION .....</b>	<b>2</b>	10.1 DESIGN CHECK NO. 8—Design capacity of steel base plate	43
<b>3 TYPICAL DETAILING OF CONNECTION..</b>	<b>4</b>	10.2 DESIGN CHECK NO. 9—Design capacity of weld at column base	51
<b>4 DETAILING CONSIDERATIONS.....</b>	<b>6</b>	10.3 DESIGN CHECK NO. 10—Design capacity of anchor bolts in tension	52
4.1 Base plate dimensions for open sections	6	10.4 DESIGN CHECK NO. 5	56
4.2 Base plate detailing	8	10.5 DESIGN CHECK NO. 6	56
4.3 Anchor bolt detailing	11	10.6 DESIGN CHECK NO. 7	56
<b>5 CODE REQUIREMENTS .....</b>	<b>14</b>	10.7 DESIGN CHECK NO. 11—Design capacity for horizontal shear and tension applied to anchor bolts	57
<b>6 BASIS OF DESIGN MODEL.....</b>	<b>15</b>	<b>11 DESIGN EXAMPLES .....</b>	<b>58</b>
6.1 Axial compression	15	11.1 Axial compression and shear—Design Example No. 1	58
6.2 Horizontal shear	17	11.2 Axial compression or axial tension and shear—Design Example No. 2	62
6.3 Anchor bolts in shear	19	<b>12 REFERENCES.....</b>	<b>67</b>
6.4 Axial tension	21	<b>APPENDICES</b>	
6.5 Anchor bolts in tension	24	A Limcon software	69
6.6 Anchor bolts subject to tension and shear simultaneously	26	B ASI Design Guide 13 comment form	76
<b>7 CALCULATION OF DESIGN ACTIONS ...</b>	<b>27</b>		
<b>8 RECOMMENDED DESIGN MODEL—</b>			
<b>SUMMARY OF DESIGN CHECKS.....</b>	<b>28</b>		
<b>9 RECOMMENDED DESIGN MODEL—</b>			
<b>AXIAL COMPRESSON AND SHEAR .....</b>	<b>29</b>		
9.1 DESIGN CHECK NO. 1—Design capacity for bearing on concrete support	29		
9.2 DESIGN CHECK NO. 2—Design capacity of steel base plate	32		
9.3 DESIGN CHECK NO. 3—Design capacity of weld at column base	34		

