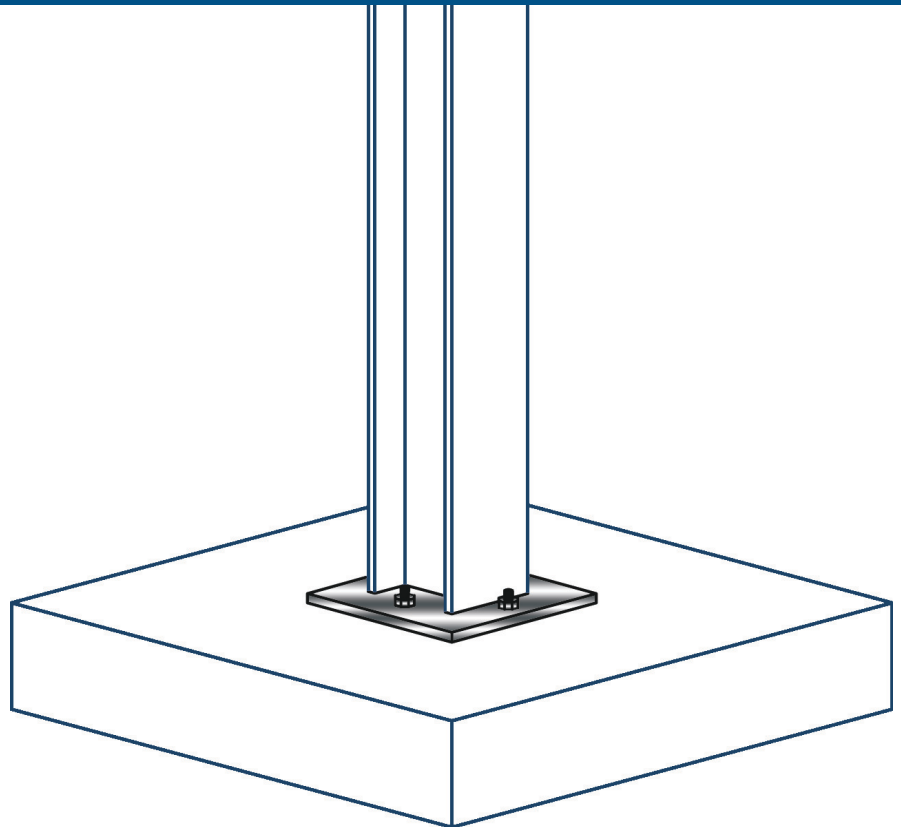




Steel Design Guide

Base Plate and Anchor Rod Design

Second Edition



This is a preview. [Click here to purchase the full publication.](#)



Steel Design Guide

Base Plate and Anchor Rod Design

Second Edition

JAMES M. FISHER, Ph.D., P.E.
Computerized Structural Design, S.C.
Milwaukee, Wisconsin

and

LAWRENCE A. KLOIBER, P.E.
LeJuene Steel Company
Minneapolis, Minnesota

AMERICAN INSTITUTE OF STEEL CONSTRUCTION, INC.

This is a preview. [Click here to purchase the full publication.](#)

Copyright © 2006

by

American Institute of Steel Construction, Inc.

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

The information presented in this publication has been prepared in accordance with recognized engineering principles and is for general information only. While it is believed to be accurate, this information should not be used or relied upon for any specific application without competent professional examination and verification of its accuracy, suitability, and applicability by a licensed professional engineer, designer, or architect. The publication of the material contained herein is not intended as a representation or warranty on the part of the American Institute of Steel Construction or of any other person named herein, that this information is suitable for any general or particular use or of freedom from infringement of any patent or patents. Anyone making use of this information assumes all liability arising from such use.

Caution must be exercised when relying upon other specifications and codes developed by other bodies and incorporated by reference herein since such material may be modified or amended from time to time subsequent to the printing of this edition. The Institute bears no responsibility for such material other than to refer to it and incorporate it by reference at the time of the initial publication of this edition.

Printed in the United States of America

First Printing: May 2006

Acknowledgements

The authors would like to thank Robert J. Dexter from the University of Minnesota, and Daeyong Lee from the Steel Structure Research Laboratory, Research Institute of Industrial Science & Technology (RIST), Kyeonggi-Do, South Korea, for their writing of Appendix A and the first draft of this Guide. The authors also recognize the contributions of the authors of the first edition of this guide, John DeWolf from the University of Connecticut and David Ricker (retired) from Berlin Steel Construction Company, and thank Christopher Hewitt and Kurt Gustafson of AISC for their careful reading, suggestions, and their writing of Appendix B. Special appreciation is also extended to Carol T. Williams of Computerized Structural Design for typing the manuscript.

AISC would also like to thank the following individuals who assisted in reviewing the drafts of this Design Guide for their insightful comments and suggestions.

Victoria Arbitrio	Donald Johnson
Reidar Bjorhovde	Geoffrey L. Kulak
Crystal Blanton	Bill R. Lindley II
Charles J. Carter	David McKenzie
Brad Davis	Richard Orr
Robert O. Disque	Davis G. Parsons II
James Doyle	William T. Segui
Richard M. Drake	David F. Sharp
Samuel S. Eskildsen	Victor Shneur
Daniel M. Falconer	Bozidar Stojadinovic
Marshall T. Ferrell	Raymond Tide
Roger D. Hamilton	Gary C. Violette
John Harris	Floyd J. Vissat
Allen J. Harrold	

Table of Contents

1.0 INTRODUCTION.....	1		
2.0 MATERIAL, FABRICATION, INSTALLATION, AND REPAIRS.....	2		
2.1 Material Specifications.....	2		
2.2 Base Plate Material Selection.....	2		
2.3 Base Plate Fabrication and Finishing.....	3		
2.4 Base Plate Welding.....	4		
2.5 Anchor Rod Material.....	5		
2.6 Anchor Rod Holes and Washers.....	6		
2.7 Anchor Rod Sizing and Layout.....	7		
2.8 Anchor Rod Placement and Tolerances	7		
2.9 Column Erection Procedures.....	8		
2.9.1 Setting Nut and Washer Method.....	8		
2.9.2 Setting Plate Method	9		
2.9.3 Shim Stack Method	9		
2.9.4 Setting Large Base Plates	9		
2.10 Grouting Requirements	9		
2.11 Anchor Rod Repairs.....	10		
2.11.1 Anchor Rods in the Wrong Position	10		
2.11.2 Anchor Rods Bent or Not Vertical	10		
2.11.3 Anchor Rod Projection Too Long or Too Short.....	10		
2.11.4 Anchor Rod Pattern Rotated 90°	12		
2.12 Details for Seismic Design D.....	12		
3.0 DESIGN OF COLUMN BASE PLATE CONNECTIONS.....	13		
3.1 Concentric Compressive Axial Loads	14		
3.1.1 Concrete Bearing Limit	14		
3.1.2 Base Plate Yielding Limit (W-Shapes)	15		
3.1.3 Base Plate Yielding Limit (HSS and Pipe)	16		
3.1.4 General Design Procedure.....	16		
3.2 Tensile Axial Loads	18		
3.2.1 Anchor Rod Tension	19		
3.2.2 Concrete Anchorage for Tensile Forces	19		
3.3 Design of Column Base Plates with Small Moments.....	23		
3.3.1 Concrete Bearing Stress	24		
3.3.2 Base Plate Flexural Yielding Limit at Bearing Interface	24		
3.3.3 Base Plate Flexural Yielding at Tension Interface.....	25		
3.3.4 General Design Procedure	25		
3.4 Design of Column Base Plates with Large Moments.....	25		
3.4.1 Concrete Bearing and Anchor Rod Forces	25		
3.4.2 Base Plate Yielding Limit at Bearing Interface	26		
3.4.3 Base Plate Yielding Limit at Tension Interface.....	27		
3.4.4 General Design Procedure	27		
3.5 Design for Shear.....	27		
3.5.1 Friction.....	27		
3.5.2 Bearing.....	27		
3.5.3 Shear in Anchor Rods.....	29		
3.5.4 Interaction of Tension and Shear in the Concrete	30		
3.5.5 Hairpins and Tie Rods	30		
4.0 DESIGN EXAMPLES.....	31		
4.1 Example: Base Plate for Concentric Axial Compressive Load (No concrete confinement).....	31		
4.2 Example: Base Plate for Concentric Axial Compressive Load (Using concrete confinement)	32		
4.3 Example: Available Tensile Strength of a ¾-in. Anchor Rod	34		
4.4 Example: Concrete Embedment Strength	34		
4.5 Example: Column Anchorage for Tensile Loads.....	34		
4.6 Example: Small Moment Base Plate Design ..	37		
4.7 Example: Large Moment Base Plate Design ..	38		
4.8 Example: Shear Transfer Using Bearing.....	40		
4.9 Example: Shear Lug Design.....	40		
4.10 Example: Edge Distance for Shear	42		
4.11 Example: Anchor Rod Resisting Combined Tension and Shear	42		
REFERENCES.....	45		
APPENDIX A	47		
APPENDIX B	55		

