

## Dowco Learning Network – Connection Design for Structural Steel

---

### Overview

The Dowco Learning Network's, Connection Design for Structural Steel is a 120-hour web-based course. It allows you to learn at your own pace, over the internet. Based on CISC (Canadian Institute of Steel Construction) standards, this advanced course for senior Steel Detailers and Structural Engineers provides an excellent training and resource tool for connections design considerations in structural steel members.

This course will provide you with the fundamental understanding to calculate resultant forces, tension and load capacity in bolted and welded connections; shear and eccentric connections; in beams, HSS and trusses.

### Requirements

You need only a computer with a high speed internet connection and a web browser to take the course.

### Prerequisites

Prior experience in the steel industry is required. You should not consider taking this course without either extensive knowledge as a Steel Detailer or training as a Structural Engineer combined with experience in the design of steel structures. A thorough understanding of mathematics and steel structures is essential.

### Goals and Outcomes

At the end of this course you will:

- ✓ Understand the principle of Limit States Design, know how and why you access Beam Load Tables
- ✓ Comprehend the use of bolts in connections and how they are stressed in concentric, eccentric, tension and shear
- ✓ Recognize the use of welds in connection design in using fillet, CPJG (Complete Joint Penetration Groove) and PJPG (Partial Joint Penetration Groove) welds
- ✓ Understand tension members, beam shear, eccentric, moment, HSS (Hollow Structural Section) and truss connections
- ✓ Become familiar with the prying action of joints
- ✓ Know the formulas required in calculations and the tables to reference in the CISC Handbook.

### Certificates

Certificates of merit are awarded to deserving students based on overall grade:

- |                          |             |
|--------------------------|-------------|
| ○ Gold Certificate       | 86% or more |
| ○ Silver Certificate     | 78% to 85%  |
| ○ Bronze Certificate     | 70% to 77%  |
| ○ Completion Certificate | 60% to 70%  |

### Texts and fees

CISC, Handbook of Steel Construction, Ninth Edition, © 2006

All information is presented over the internet. The texts are reference material only, though it is highly recommended that this handbook is acquired.

**Course Components**

The course is broken down into 10 different modules. The students will progress through the modules one at a time and in sequence. There are lots of examples (many are interactive) and quizzes to ensure mastery is achieved, all of which may be repeated as many times as the student wishes. At the end of each module there is a test that may only be taken once.

Each module is password protected and the passwords for the subsequent modules are presented as “Feedback” when you complete the test at the end of each module.

**Testing**

Review Worksheets and Tests cover all the material and include multiple-choice, true/false, fill-in the blank and matching type questions. Test results are given immediately. You can review the tests, contact the instructor via email, or chat online to other students.

Review Worksheets can be taken as many times as you wish. Tests can be taken only once.

**Marking Scheme**

<b>Section</b>	<b>Weighting</b>
Worksheets	20%
Tests	80%
<b>Total</b>	<b>100%</b>

**Course Outline**

The course is broken down into 10 different modules. Modules are covered in sequence.

**Module 1: General Overview**

An overview is provided of S.I. Units as they pertain to mass, force and pressure. Conversion factors are also provided. The concept of strength and ductility is reviewed and the principle of Limit States Design is covered. The factored resistance of beams is covered and an introduction to the beam selection and beam load tables take place. Beam and bearing stiffeners and examples of their applications is demonstrated.

**Module 2: Bolted Connections**

This module deals with the capacities of bolts in shear and tension. Bolts in concentric, eccentric, tension, and combined tension and shear are examined. You will be shown how to calculate bolt, hole size and the number of bolts required in a connection. The shear capacity of bolts and tension capacity of plates are also discussed.

**Module 3: Welded Connections**

Fillet CJPG (Complete Joint Penetration Groove) and PJPG (Partial Joint Penetration Groove) weld design, geometry, effective lengths and resistance to shear, tension, compression and directional loads and forces are covered. The resistance, tension, preparation and detailing will of these welds are reviewed. Other general information will be provided about welds that should be understood as it relates to material, symbols and terminology.

**Module 4: Tension Member Connections Shear Lag**

This module covers tension member connections for both bolted and welded joints. Factored tensile resistance is explained with references to the S16-01 standard. The effective net area of connections is explained as used in many calculations for tension

fracture (shear yielding and shear fracture). Transmission of forces through bolts and welds is also reviewed.

### **Module 5: Beam Shear Connections**

This module covers the characteristics of simple beam shear Connections. Double angles, end plate, tee, single angle and shear tabs are examples of connections that exist in shear. The limit state of each of these will be reviewed. The use and importance of Tables 3-37 to 3-42 in the CISC Handbook are to determine the factored resistance of beam shear connections demonstrated. The influence of copes on beams and their impact on these types of connections are also reviewed.

### **Module 6: Eccentric Connections**

This module will review both bolted and welded eccentric connections. Bolted eccentric connections reference Tables 3-14 to 3-20 and welded eccentric connections reference Tables 3-26 to 3-33. Bolted eccentric connections with diagonal bracing are designed and beam-to-column bracing is examined. Welded eccentric connections are looked at to determine both weld and plate size.

### **Module 7: Prying Action**

This module will look at prying action in joints. When bolts are loaded in tension the prying action of the plates may impact joint strength. The tension on bolts put pressure on the plates which have their own prying forces which are dependent upon the thickness of the plate. Understand why the prying forces of the connection may fatigue in time.

7 equations in prying action design procedure are examined. Graphs on amplified bolt force are reviewed and used to evaluate flange thickness, gauge distance and bolt size. The design procedure and design check for connections with prying action is looked at. Bolts in combined shear and tension such as bearing-type and slip critical connections are also covered.

### **Module 8: Moment Connections**

Module 8 explores the characteristics of moment connections and factors influencing these connections. The different types of moment connections are analyzed and the use of stiffeners in these connections for uniform stress distribution and to prevent buckling are considered. The process for designing the connections with and without stiffeners is worked.

### **Module 9: HSS Connections**

This module is based on the text “Hollow Structural Section: Connections and Trusses - A Design Guide” written by JA Packer and J.E. Henderson. While it only touches the surface you be introduced to connections into HSS members such as rectangular and circular columns. Effective connections via bolts, fillet, PJP, and CJP welds will be examined in different types of connections.

### **Module 10: Truss Connections**

Steel trusses occur in all types of building structures and are generally used when longer spans are required. They also function to support large concentrated loads such as those which can occur when building columns are interrupted for architectural reasons.