



**UNIVERSITY
PROGRAMS**

Steel Connections: A Teaching Aid for Design Considerations Qnect Videos

Student Activities

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Introduction

This teaching aid includes six videos that walk through using Qnect, including discussions about design decisions and different types of connections. The videos are intended to be completed independently by each student, either as an in-class recitation where each student has a computer or as a homework assignment.

Most of the videos are short (less than 15 minutes). Videos 5 and 6 are longer and require students to follow along in Qnect.

- [Video 1: How to Set Up and Use Qnect](#) (13 minutes)
- [Video 2: Introduction to the Integrated Design Project Building](#) (12 minutes)
- [Video 3: Overview of Connection Design Decisions](#) (8 minutes)
- [Video 4: Constructability Considerations](#) (9 minutes)
- [Video 5: Beam-to-Girder Shear Connection Types](#) (34 minutes)
- [Video 6: Beam-to-Column Shear Connection Types](#) (16 minutes)

This document contains activities and questions that can be assigned to the students as supplements to the videos. Note that the focus is primarily on shear connections because Qnect does not yet offer full functionality of bracing or moment connections. This may be available with future versions of Qnect.

Learning Objectives

Through use of this teaching aid, students will:

1. Learn to use Qnect in order to perform connection designs
2. Distinguish between different connection types and implications of design decisions
3. Learn to select design parameters, and compare and contrast parameters to understand its implications on connection capacity.

Notes for Instructors

Once students have watched each video, they are encouraged to answer comprehension questions for videos 1 – 4 and try out some activities along with working through the videos 5 and 6. Sample activity questions are provided on the following pages, and they are also included as an editable Word document with the files for this teaching aid.

These activities can be used as a homework assignment or a recitation class. It is expected that it may take students a few hours to perform all of this work, so you should adjust the assignment accordingly to fit your time availability. You are welcome to expand upon or condense any of these activities to capture what you are trying to achieve for your class. i.e. – if connection design is very important, more comparison of the Qnect calculations to design tables in the AISC Steel Construction Manual would be beneficial. If you are focused more on cost and constructability, perhaps just a comparison of members and their relative will be sufficient.

Since beam-to-girder connections are covered first in this video series, most of the work focuses on this connection type. If you prefer to focus on beam-to-column connections, you could apply the same activity ideas to that type of joint.

Qnect Connection Activity

Video 1 Comprehension Questions

- 1) Briefly explain the capabilities of Qnect as outlined in the video you just watched.

- 2) What parties within a building design team (i.e. structural designer, architect, owner, fabricator, contractor, etc.) would most likely use Qnect?

- 3) What type of structural information is provided in the Downers Grove Tekla Structures model? List at least 3 pieces of information that can be obtained from the Tekla model to be used with Qnect.

Qnect Connection Activity

Video 2 Comprehension Questions

- 1) How is a bay defined? What is the bay size for this building in the East-West direction?
- 2) Why is it desirable to have uniform and orthogonal bay sizes?
- 3) What is the purpose of the embed plate at the end of the floors at the 1st floor level?
- 4) Explain the difference between a gravity and lateral system.
- 5) Members in this Tekla model are color coded as grey, light purple, dark purple, green, and yellow. Name the member or system that the following colors represent, and describe their role in the load path of this building.
- 6) Why is it that you typically see steel truss joists to support a roof, but less commonly to support a floor level?
- 7) What observations are made about the location of the Lateral Force Resisting Frames (LFRS) in this building?
- 8) What role does the composite floor (concrete slab on metal deck) have when we consider the load path of wind load making its way down to the foundation of the building?

Qnect Connection Activity

Video 3 Comprehension Questions

- 1) Briefly summarize the typical three scenarios regarding which responsible parties would perform the connection design.

What is the Engineer of Record's (EOR) responsibility for each of these cases?

- 2) If the connection design is delegated to a third party, give four examples of the information that must be provided by the EOR in order for the work to be performed.
- 3) What type of information is included in typical connection details? Provide at least two examples.
- 4) How are connection demands typically indicated in the construction drawings?

Qnect Connection Activity

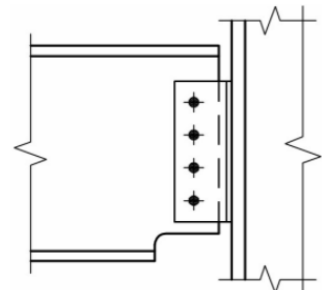
Video 4 Comprehension Questions

- 1) Describe why it is desirable to install two erection bolts as a preliminary step during the construction of a steel building.
- 2) What is “plumbing” of the structure?
- 3) Explain the difference between a field-welded and shop-welded connection. Which is generally preferred?
- 4) Describe the constructability challenges if specifying a shop-welded/field bolted beam-to-girder double angle connection.
- 5) From the list of connections provided, indicate whether the connection would typically be considered a connection within the gravity frame (GF) or lateral frame (LF). Indicate GF or LF below.

Shear tab connection _____
Double angle connection _____
Moment connection _____
Unstiffened seated connection _____

Beam to brace connection _____
Single angle connection _____
Brace to column connection _____

- 6) For the connection shown, circle the cope. Briefly explain the purpose of coping



Qnect Connection Activity

Beam-to-Girder Connections (to be completed after Video 5)

Refer to the Downers Grove Qnect model and find the beam to spandrel connection at level 2 that is closest to Column A-1 for this study.

- 1) Start with a shear tab connection with a 3/8" plate and 3/4" diameter A325N bolts, with 3" spacing, eccentricity of 3", and 1.5" edge distances. Obtain the following information from Qnect and also complete the shaded region of the table.

Beam Size: _____

Girder Size: _____

Factored Connection Demand: _____

Values obtained from Qnect

Connection Type:	Shear Tab	Single Angle - bolted/welded	Double Angle - bolted/bolted	Double Angle - welded/bolted
# of bolts req'd				
Weld size, as applicable				
Plate or angle thickness				
Capacity of the connection				
Controlling limit state				
Connection cost				

- 2) Using Qnect, re-design the connection for the other three connection types in the table and input that information.
- 3) For the bolted-bolted double angle connection, review the Qnect connection calculations and validate the capacity determined from Qnect by using AISC design tables and limit state calculations. If the connection design table is not a match with the Qnect results, explain why. Remember that the design table also does not consider member limit states (i.e. coped beam checks, bearing on the beam web, etc.) so you may need to calculate these member limit states independently of simply using the design aid.

- 4) Select the connection type with the lowest capacity. Modify one of the pertinent preference settings in Qnect in order to increase that connection capacity by 20%. i.e. – if bolt shear is the controlling limit state, modify the connection to use a higher grade bolt or larger diameter bolt (see General Bolt Preferences in your job on the Qnect Dashboard). Explain what modifications you made and how this influenced the overall connection capacity.

Qnect Connection Activity

Beam-to-Column Connections (to be completed after Video 6)

- 1) Explain three of the issues that may pertain to beam-to-column *web* connections that are not prevalent to beam-to-column *flange* connections.
- 2) Show screenshots of two different connection types designed using Qnect that achieve adequate capacity for the beam-to-column web connection at level 2, column C-2. Compare the connection capacities determined from Qnect. Then discuss at least one pro and con of each configuration.