Introduction to BIM for Structural Design and Engineering

# Instructor guide

Course duration: ~ 5 hours, depending on lecture time and slides used

Recommended student level: Students in intro-level BIM courses in architecture, engineering, and construction programs.

Products: Autodesk Revit, Cloud Worksharing

This instructor guide is a comprehensive tool for facilitating this course in the classroom. Prepare to teach the course by thoroughly reviewing this document, as well as all related course materials and resources. You may also share this document with your students to guide them in their assignments. It’s always recommended that you work through the course yourself in preparation for each module.

**Learning objectives:**

* Describe Building Information Modeling (BIM) and its role in structural engineering.
* Create a new project using an architectural model.
* Create structural foundations.
* Model structural steel systems.
* Place structural floors and slabs.
* Add structural reinforcing.
* Create and manage views, sections and callouts.
* Query the model to create documentation and schedules.
* Use Civil 3D to place a project using shared coordinates.
* Workshare Revit models to the cloud.

The overall course contains the following resources:

* 10 video modules covering all the topics in the course.
* Dataset files for use when following the video modules.
* Quiz questions with timecodes for remedial knowledge check.
* Exam-style final test questions at the conclusion of the course.
* 8 practice exercises with exercise files and solutions.
* 3 challenge assignments with recommended assessment criteria.
* Lecture slides that introduce topics and themes covered in the course.

**Pre-requisites:**

In this course, learners will discover how to use Autodesk Revit for the tasks they’ll encounter during their BIM project development The course offers students some of the core concepts to start using Revit for structural design and could be assigned in the first week or two of class. It is expected that the student has basic computer knowledge.

This course is designed to provide students with a foundational understanding of structural modeling using Revit and realizing its transformative impact on architecture, engineering, construction and operation of built assets. By exploring BIM principles and workflows, students will gain insights into how BIM drives efficiency, collaboration, and innovation across all project stages.

To that end, students should be given access to the various products within the course. Instructions for granting students product licenses and setting up ACC in the classroom are included with the Teaching Supplements downloads so they can try out Revit Cloud Worksharing. .

**Structure of the course:**

The course is split into 10 modules and is designed to cover core Autodesk skills required for Revit structural modeling and BIM fundamenatal workflows.

**Videos:**

Each video begins with a list of learning objectives covered in the video. The dataset mentioned throughout all the videos are available if students wish to follow along or practice after the video.

**Dataset:**

The example used in the videos is of a simple building project with a Revit model for the architecture and structural discliplines, and the dataset is available to follow along with the instruction in both metric and imperial formats.

**Practice exercises:**

There are eight practice exercises included, each exploring a different set of topics. The practice exercises are designed to give students an opportunity to test their knowledge and apply what they have learned in they are using the course on their own. Each practice exercise is accompanied by a dataset and video solution.

**Challenge exercise:**

Two challenge assignments and one end-of-course challenge are included, focusing on a set of topics covered in the course. Students are presented with a challenge in an applicable real-world situation, and they apply their skills and the techniques learned to solve the challenge. A grading rubric is provided for the instructor, giving guidelines on assessment criteria. You can also encourage students to work in small groups, first discussing the desired outputs and working collectively to derive the best process and execution in the software.

**Video quiz questions:**

Quiz questions are included with each video of the course and the timecodes are included so that students can review the related sections in the video for questions they have answered incorrectly.

**Final test questions:**

A cumulative set of exam-style questions are included at the conclusion of the course for students to measure what they have learned against realistic multiple-choice questions.

**Lecture slides:**

Lecture slides are offered to help facilitate in-class discussion.

**Using the course in the classroom or self-paced**

The Introduction to BIM for Structural Design and Engineering course can be implemented as an independent, self-paced project, or can be completed in the classroom in a team setting. A couple of options are outline below:

Option 1: Self-paced

Each student will log into Autodesk.com/learn using their Autodesk Account credentials and follow along with the project instruction. (Alternatively, you may choose to assign the material through your LMS.) Students can work through the projects on their own by following the project steps and challenge instructions, and by exploring any supporting assets. This is a great way to allow students to move through the learning materials at their own pace and explore additional learning opportunities or increase shop time. The self-paced option can also be used for out of classroom or remote assignments. A certificate of completion is awarded once the course is completed.

Option 2: Instructor-led

In this option, instructors will log into Autodesk.com/learn using their Autodesk Account credentials and download the learning materials. Instructors can then guide the students through each project, using the accompanying lecture slides for instruction and practice exercises as handouts. This option allows for guided, step-by-step classroom engagement. This approach works well in a more traditional classroom setting and will allow instructors to easily keep students on the same pace. The challenge exercise can be used as a learning opportunity for students who complete their work early or are looking for additional hands-on opportunities.

Each section is listed below along with suggested time allocations for instruction. The referenced demonstrations are based on the step-by-step instruction included in the videos.

Course contents

Each module is listed below along with suggested time allocations for instruction. Review the video tutorials for the detailed instruction in each module.

**Module 1-01 Use BIM for Structural Design**

**Total time required for module:** 15 minutes

**Discuss course objectives:** 2 minutes

**Demonstrate:** 8 minutes

* Open and explore a 3D model with other trades linked to it.
* Recognize the importance of 2D sheets and views for documentation and construction execution.
* Describe the analytical model and its importance.
* Use the Project Browser.
* Select elements and recognize the different types of properties.

**Datasets:** *No datasets for this video*

**Assignments (additional):**

* **Quiz:** 5 minutes

**Module 2-01 Create a new model**

**Total time required for module:** 15 minutes

**Discuss course objectives:** 2 minutes

**Demonstrate:** 8 minutes

* Start a new project using a template.
* Link an architectural model in the correct location.
* Pin a linked model.

**Datasets:** *M2\_01 Exercise Flies*

**Assignments (additional):**

* **Quiz:** 5 minutes

**Module 2-02 Configure view settings**

**Total time required for module:** 10 minutes

**Discuss course objectives:** 2 minutes

**Demonstrate:** 3 minutes

* Change the view’s discipline parameter.
* Alter visibility graphics.
* Update the Halftone/Underlay settings.

**Datasets:** *M2\_02\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**Module 2-03 Add a starting view and transfer project standards**

**Total time required for module:** 15 minutes

**Discuss objectives:** 2 minutes

**Demonstrate:** 8 minutes

* Create a sheet.
* Add a starting view border.
* Transfer project standards.

**Datasets:** *M2\_03 Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**Module 2-04 Add levels**

**Total time required for module:** 25 minutes

**Discuss objectives:** 2 minutes

**Demonstrate:** 11 minutes

* Add top of steel levels.
* Copy/monitor levels.
* Change a level datum bubble.

**Hands-on time:** 10 minutes

**Review objectives:** 2 minutes

**Datasets:** *M2\_04 Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**Module 2-05 Add a structural grid**

**Total time required for module:** 25 minutes

**Discuss objectives:** 2 minutes

**Demonstrate:** 11 minutes

* Add grids.
* Edit grids.
* Adjust grid type properties.

**Hands-on time:** 10 minutes

**Review objectives:** 2 minute

**Datasets:** *M2\_05\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**Module 3-01 Add foundation wall systems and footings**

**Total time required for module:** 20 minutes

**Discuss objectives:** 1 minute

**Demonstrate:** 8 minutes

* Create a new foundation wall.
* Place walls using a linked model as the guide.
* Create a new wall footing and place it under a wall.

**Hands-on time:** 10 minutes

**Review objectives:** 1 minute

**Datasets:** *M3\_01\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**Module 3-02 Add piers and pilasters**

**Total time required for module:** 20 minutes

**Discuss objectives:** 1 minute

**Demonstrate:** 8 minutes

* Create a new concrete column.
* Set bottom and top constraints for structural elements.
* Add multiple structural elements by picking a window around the grids.

**Hands-on time:**10 minutes

**Review objectives:** 1 minute

**Datasets:** *M3\_02\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**M3-03 Add isolated footings**

**Total time required for module:** 15 minutes

**Discuss objectives:** 1 minute

**Demonstrate:** 3 minutes

* Create a new isolated footing.
* Place footings automatically.
* Place footings manually.

**Hands-on time:** 10 minutes

**Review objectives:** 1 minute

**Datasets:** *M3\_03\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**M3-04 Add stepped footings**

**Total time required for module:** 20 minutes

**Discuss objectives:** 2 minute

**Demonstrate:** 6 minutes

* Edit a wall profile.
* Add an in-place family.
* Join materials.

**Hands-on time:** 10 minutes

**Review objectives:** 2 minute

**Datasets:** *M3\_04 Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**M****4-01 Place columns**

**Total time required for module:** 15 minutes

**Discuss objectives:** 2 minute

**Demonstrate:** 6 minutes

* Place steel wide flange columns by grid intersection.
* Set the top and bottom constraints.
* Load columns and change the shape.

**Hands-on time:** 10 minutes

**Review objectives:** 2 minute

**Datasets:** *M4\_01\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**M4-02 Add steel framing**

**Total time required for module:** 20 minutes

**Discuss objectives:** 2 minute

**Demonstrate:** 6 minutes

* Model steel beams from column to column.
* Model Hollow Structural Section (HSS) tube beams.
* Adjust beam elevations.

**Hands-on time:** 10 minutes

**Review objectives:** 2 minute

**Datasets:** *M4\_02\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**M4-03 Adjust beam systems**

**Total time required for module:** 15 minutes

**Discuss objectives:** 1 minute

**Demonstrate:** 5 minutes

* Specify beam types.
* Select on center dimensioning.
* Use Copy/Paste in the workflow.

**Hands-on time:** 7 minutes

**Review objectives:** 1 minute

**Datasets:** *M4\_03\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**M4-04 Add bar joists**

**Total time required for module:** 20 minutes

**Discuss objectives:** 2 minute

**Demonstrate:** 7 minutes

* Load specific bar joists.
* Set 3D snapping.
* Add new beam systems.

**Hands-on time:** 10 minutes

**Review objectives:** 1 minute

**Datasets:** *M4\_04\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**M4-05 Add lateral brace frames**

**Total time required for module:** 25 minutes

**Discuss objectives:** 2 minute

**Demonstrate:** 12 minutes

* Add a framing elevation.
* Add a brace.
* Add in-place gussets.

**Hands-on time:** 10 minutes

**Review objectives:** 1 minute

**Datasets:** *M4\_05\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**M4-06 Place structural steel connections**

**Total time required for module:** 20 minutes

**Discuss objectives:** 2 minute

**Demonstrate:** 6 minutes

* Load connections.
* Place connections.
* Propagate connections.

**Hands-on time:** 10 minutes

**Review objectives:** 2 minute

**Datasets:** *M4\_06\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**M5-01 Create a structural floor**

**Total time required for module:** 20 minutes

**Discuss objectives:** 1 minute

**Demonstrate:** 8 minutes

* Create a structural slab on grade.
* Model a floor with steel decking.
* Cantilever floor edges.

**Hands-on time:** 10 minutes

**Review objectives:** 1 minute

**Datasets:** *M5\_01\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**M5-02 Pitch floors**

**Total time required for module:** 15 minutes

**Discuss objectives:** 2 minute

**Demonstrate:** 4 minutes

* Add split lines.
* Add a variable layer.
* Add points.

**Hands-on time:** 7 minutes

**Review objectives:** 2 minute

**Datasets:** *M5\_02\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**M5-03 Add floor recesses**

**Total time required for module:** 20 minutes

**Discuss objectives:** 1 minute

**Demonstrate:** 8 minutes

* Edit a floor.
* Offset a floor.
* Add a thickened edge.

**Hands-on time:** 10 minutes

**Review objectives:** 1 minute

**Datasets:** *M5\_03\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**M5-04 Add circulation with shaft openings**

**Total time required for module:** 20 minutes

**Discuss objectives:** 1 minute

**Demonstrate:** 8 minutes

* Create a shaft opening.
* Create shaft opening framing.
* Add symbolic lines to openings.

**Hands-on time:** 10 minutes

**Review objectives:** 1 minute

**Datasets:** *M5\_04\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**M6-01 Specify cover settings and add bars**

**Total time required for module:** 20 minutes

**Discuss objectives:** 1 minute

**Demonstrate:** 8 minutes

* Configure cover settings.
* Add perpendicular bars.
* Add parallel bars.

**Hands-on time:** 10 minutes

**Review objectives:** 1 minute

**Datasets:** *M6\_01\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**M6-02 Add dowels**

**Total time required for module:** 15 minutes

**Discuss objectives:** 1 minute

**Demonstrate:** 5 minutes

* Sketch rebar.
* Configure layout settings.
* Add a keyway to a foundation wall

**Hands-on time:** 7 minutes

**Review objectives:** 1 minute

**Datasets:**

*M6\_02\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**M6-03 Add pier reinforcing**

**Total time required for module:** 20 minutes

**Discuss objectives:** 2 minute

**Demonstrate:** 6 minutes

* Use the Rebar Shape browser.
* Add rebar shapes to a pier.
* Configure view settings.

**Hands-on time:** 10 minutes

**Review objectives:** 2 minute

**Datasets:**

*M6\_03\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**M6-04 Add area reinforcing**

**Total time required for module:** 20 minutes

**Discuss objectives:** 2 minute

**Demonstrate:** 6 minutes

* Add area reinforcing to a wall.
* Add area reinforcing to a slab.
* Tag and annotate reinforcing.

**Hands-on time:** 10 minutes

**Review objectives:** 2 minute

**Datasets:**

*M6\_04\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**M7-01 Duplicate views**

**Total time required for module:** 20 minutes

**Discuss objectives:** 2 minute

**Demonstrate:** 6 minutes

* Duplicate a view.
* Create a dependent view.
* Create scope boxes.

**Hands-on time:** 10 minutes

**Review objectives:** 2 minute

**Datasets:**

*M7\_01\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**M7-02 Create sections and callouts**

**Total time required for module:** 22 minutes

**Discuss objectives:** 1 minute

**Demonstrate:** 10 minutes

* Create a section.
* Add a callout to a section.
* Add a breakline.

**Hands-on time:** 10 minutes

**Review objectives:** 1 minute

**Datasets:**

*M7\_02\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**M7-03 Create 3D and perspective views**

**Total time required for module:** 20 minutes

**Discuss objectives:** 1 minute

**Demonstrate:** 8 minutes

* Add a perspective view.
* Create a selection box.
* Lock and dimension a 3D view.

**Hands-on time:** 10 minutes

**Review objectives:** 1 minute

**Datasets:**

*M7\_03\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**M7-04 Configure visibility graphics**

**Total time required for module:** 20 minutes

**Discuss objectives:** 1 minute

**Demonstrate:** 8 minutes

* Modify view specific visibility graphics.
* Edit global object styles.
* Create and apply view templates.

**Hands-on time:** 10 minutes

**Review objectives:** 1 minute

**Datasets:**

*M7\_04\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**M8-01 Create sheets**

**Total time required for module:** 25 minutes

**Discuss objectives:** 1 minute

**Demonstrate:** 13 minutes

* Create a new sheet
* Place views onto sheets
* Print and export sheets

**Hands-on time:** 10 minutes

**Review objectives:** 1 minute

**Datasets:**

*M8\_01\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**M8-02 Create schedules**

**Total time required for module:** 20 minutes

**Discuss objectives:** 1 minute

**Demonstrate:** 8 minutes

* Create a footing schedule.
* Create a pier schedule.
* Create a column schedule.

**Hands-on time:** 10 minutes

**Review objectives:** 1 minute

**Datasets:**

*M8\_02\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**M8-03 Add dimensions, text, and tags**

**Total time required for module:** 20 minutes

**Discuss objectives:** 1 minute

**Demonstrate:** 8 minutes

* Create and use a dimension style.
* Create and use a text style.
* Use tags to display data.

**Hands-on time:** 10 minutes

**Review objectives:** 1 minute

**Datasets:**

*M8\_03\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**M9-01** **Perform analytical automation**

**Total time required for module:** 20 minutes

**Discuss objectives:** 1 minute

**Demonstrate:** 8 minutes

* Define the analytical model and what it is used for.
* Runa an analytical automation.
* Describe analytic members.

**Hands-on time:** 10 minutes

**Review objectives:** 1 minute

**Datasets:**

*M9\_01\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**M7-03 Add load cases**

**Total time required for module:** 17 minutes

**Discuss objectives:** 1 minute

**Demonstrate:** 5 minutes

* Add a load case.
* Add load combinations.
* Modify boundary condition settings.

**Hands-on time:** 10 minutes

**Review objectives:** 1 minute

**Datasets:**

*M9\_02\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**M10-01 Set shared coordinates and create a site model**

**Total time required for module:** 25 minutes

**Discuss objectives:** 1 minute

**Demonstrate:** 13 minutes

* Verify state plane coordinates.
* Create a site model.
* Link Civil 3D and Revit.
* Acquire and publish coordinates.
* Collaborate in the cloud with Autodesk Construction Cloud.
* Use worksets.

**Hands-on time:** 10 minutes

**Review objectives:** 1 minute

**Datasets:**

*M10\_01\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**M10-02 Workshare Revit models**

**Total time required for module:** 20 minutes

**Discuss objectives:** 1 minute

**Demonstrate:** 8 minutes

* Collaborate in the cloud with Autodesk Construction Cloud.
* Use worksets.
* Reload a link.

**Hands-on time:** 10 minutes

**Review objectives:** 1 minute

**Datasets:**

*M10\_02\_Exercise Files*

**Assignments (additional):**

* **Quiz:** 5 minutes

**Next steps (additional):**

**End-of-course exam questions:** 20 minutes

**Challenge assignment 1: Create a roof framing plan with bar joists:** 30 minutes

*Could be assigned after Module 4.*

**Datasets:**

*M4 Challenge*

**Challenge assignment 2: Add circulation and create a detail sheet:** 30 minutes

*Could be assigned after Module 7.*

**Datasets:**

*M7 Challenge*

**End-of-course challenge exercise – Create foundation walls, footings, and rebar:** 90 minutes

**Datasets:**

*Course challenge*