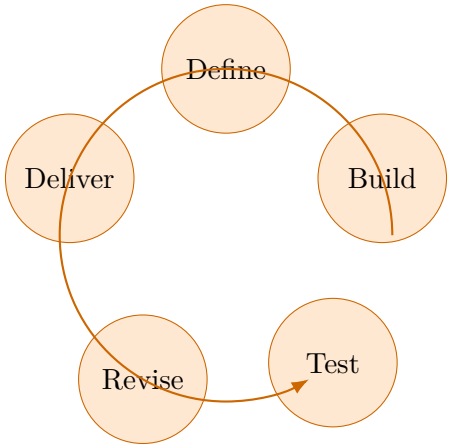
Summit CIVL 370: Structural Design I

Summit fully illustrated textbook edition



Original Summit-authored instructional text generated from the live course runtime, bibliography layer, and assessment structure.

March 22, 2026

@@TOKEN_0@@ Summit first edition draft @@TOKEN_1@@ college @@TOKEN_2@@ 3 @@TOKEN_3@@ 14 weeks @@TOKEN_4@@ 9.6 hours/week

Originality note

This textbook is a Summit-authored instructional text. It is informed by the course bibliography in @@TOKEN_0@@ and by open academic references used elsewhere in Summit, but it does not copy or restate any single commercial textbook.

How this textbook was built

This book was generated from the live Summit course runtime for Structural Design I: the syllabus, lesson sequence, reading chapters, guided practice, homework sets, quizzes, mastery exam, and workload standard. The design goal is to give a student a usable, course-complete book while preserving original Summit wording and sequencing.

A Summit-authored introductory design course on member sizing, load combinations, serviceability, and code-oriented structural decision making.

Design chapters should be read as iterative decision-making documents. Requirements, assumptions, tradeoffs, and communication are the core substance of the work.

This volume is structured as a teaching book rather than a bare note pack. Every chapter contains explanation, worked examples, guided practice, chapter homework, and a rear answer key so the student can study independently and still get disciplined feedback.

Course use guide

- Read one chapter at a time in sequence; each chapter is aligned to a live lesson block in the course workspace.
- Rebuild the worked examples before attempting the graded homework or quiz material.
- Keep a scratch notebook beside the text and write down assumptions, diagrams, and the points where you usually get stuck.
- Use the course tutor, guided practice, and homework only after you can explain the chapter in your own words.

Contents

Course map

- 4 live lesson chapters
- 4 graded homework checkpoints
- 4 timed quizzes
- 1 cumulative mastery exam
- 5 declared course outcomes

Prerequisite and readiness position

Course prerequisites: structural-analysis-i.

This course assumes the student can already use the prerequisite tools without re-learning them during the semester. Summit treats those prior requirements as active working knowledge, not as paperwork only.

Semester workload standard

Summit models this course as @@TOKEN_0@@ across a 14-week term plus final assessment window. The expected distribution is:

- Contact-equivalent instruction: 42 hours
- Reading: 16 hours
- Practice and problem solving: 24 hours
- Homework: 18 hours
- Lab, design, and reporting: 20 hours
- Exam preparation: 15 hours

Expected volume:

- 85-110 member-sizing, load-combination, and code-application exercises with design checks.
- 8-10 graded assignments mixing calculations, sketches, and short technical justifications.
- 6-8 design memos, calculation packages, or member-check submittals.

Reference basis

Primary synthesis anchors from the bibliography for this course (50 listed references total):

1. Engineering Mechanics: Statics
2. Engineering Mechanics: Dynamics
3. Mechanics of Materials
4. Engineering Mechanics
5. Structural Analysis
6. Engineering Mechanics
7. Engineering Mechanics
8. Engineering Mechanics

Chapter 1

Chapter 1 Loads, limit states, and member behavior

Chapter purpose

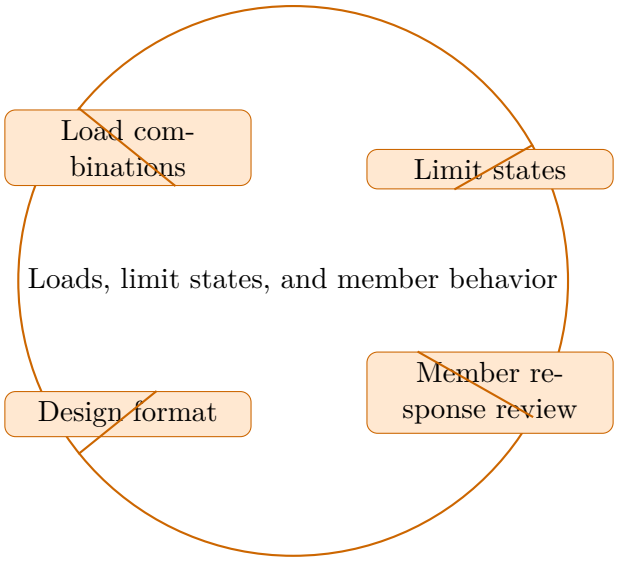
Students begin with load combinations, design checks, and how structural members carry demand.

This chapter sits at the opening of Structural Design I. It develops Load combinations, Limit states, Member response review, and Design format so that the student can move from explanation to execution without losing the thread of the course.

This chapter belongs to a family where the final artifact is rarely one equation or one answer. Instead, the student must combine analysis, judgment, iteration, and communication into a defensible design path. The text therefore treats process discipline as seriously as technical depth.

Core ideas

- Load combinations
- Limit states
- Member response review
- Design format



How to think through this chapter

A strong method in this family begins with requirements, constraints, and stakeholders, then moves through alternatives, screening criteria, and progressively more detailed justification. Every major decision should be traceable and reviewable by another engineer.

When working this chapter, keep the following question active: @@TOKEN_0@@ A good student answer should connect setup, assumptions, and conclusion instead of only chasing a final number or sentence.

CIVL 370 Structural Design I. Loads, limit states, and member behavior. This chapter explains why the topic matters, how strong students organize the work, and what separates a defensible submission from a shallow one in this unit.

Why Loads, limit states, and member behavior is a design decision, not a lookup exercise

Loads, limit states, and member behavior is really a decision-making chapter. The mathematics, code checks, and concept comparisons matter because they push the student toward one defensible recommendation and away from weaker ones.

In Structural Design I, this is where students learn not to confuse a formula with a decision. The formula only matters because it changes how load combinations should be judged.

How load combinations and limit states drive the option screen

A strong student starts by naming the constraints, criteria, and failure points. Only then does load combinations become useful, because now it sits inside a real decision frame rather than floating

as isolated content.

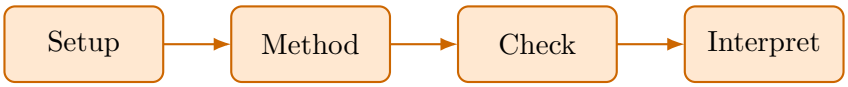
Limit states usually supplies the second check that keeps the recommendation honest. Good design work is rarely driven by one number alone.

How review-ready design work differs from draft thinking

Review-ready design work shows the option screen, the governing check, and the reason one direction survives while another does not. Weak work jumps too quickly from calculation to recommendation without showing the selection logic.

The easiest way to improve these chapters is to write the design rationale as if another engineer must sign it tomorrow.

Worked example



@@TOKEN_0@@ Walk through a structural design i design check built around load combinations and limit states.

1. Define the performance goal, constraints, and the standard the design must satisfy.
2. Compare the relevant options or checks with load combinations as the controlling criterion.
3. Record the governing assumptions, demand-capacity logic, or decision screen in a reviewable order.
4. State the selected direction and explain why it is the strongest engineering choice.

Read this example twice: once for the flow of ideas and once for the technical structure of the solution.

Worked-through guided example

@@TOKEN_0@@ Work a structural design i decision problem where load combinations changes the preferred option or the governing design check.

1. List the criteria, constraints, and what counts as an acceptable design path.
2. Use load combinations to compare the available options or checks in a reviewable order.
3. Close with the option you would defend and the reason it survives review.

A complete design response frames the criteria, shows how load combinations drives the decision, and documents the recommendation in a review-ready sequence.

Instructor commentary

Students should annotate this chapter for structure, not just facts. Mark where the argument changes direction, where the method requires a hidden assumption, and where the conclusion becomes more general than the worked example. If the chapter feels easy while you are reading it but difficult when you close the page, you have not yet converted recognition into mastery.

The right study pattern is define the problem, build options, evaluate tradeoffs, document the decision, and then revisit the work after critique.

Practice while you read

Practice Set 1: Loads, limit states, and member behavior

Students begin with load combinations, design checks, and how structural members carry demand.

@@TOKEN_0@@ Work a structural design i decision problem where load combinations changes the preferred option or the governing design check.

- Hint: List the constraints and criteria first. Then show how load combinations changes the option screen or final recommendation.
- Step 1: List the criteria, constraints, and what counts as an acceptable design path.
- Step 2: Use load combinations to compare the available options or checks in a reviewable order.
- Step 3: Close with the option you would defend and the reason it survives review.
- Checkpoint: A strong checkpoint answer shows the governing criteria, explains how load combinations changes the option screen, and lands on a defensible recommendation.

@@TOKEN_0@@ Work a structural design i decision problem where limit states changes the preferred option or the governing design check.

- Hint: List the constraints and criteria first. Then show how limit states changes the option screen or final recommendation.
- Step 1: List the criteria, constraints, and what counts as an acceptable design path.
- Step 2: Use limit states to compare the available options or checks in a reviewable order.
- Step 3: Close with the option you would defend and the reason it survives review.
- Checkpoint: A strong checkpoint answer shows the governing criteria, explains how limit states changes the option screen, and lands on a defensible recommendation.

Chapter homework

@@TOKEN_0@@ Students begin with load combinations, design checks, and how structural members carry demand.

1. Prepare a structural design i design check or option screen focused on load combinations. Show the governing criteria, tradeoffs, and the recommendation you would defend.
2. Prepare a structural design i design check or option screen focused on limit states. Show the governing criteria, tradeoffs, and the recommendation you would defend.
3. Prepare a structural design i design check or option screen focused on member response review. Show the governing criteria, tradeoffs, and the recommendation you would defend.
4. Prepare a structural design i design check or option screen focused on design format. Show the governing criteria, tradeoffs, and the recommendation you would defend.

Answers for these homework problems appear in the back-of-book answer key.

Chapter summary and study notes

- Define the governing criteria behind load combinations before comparing options.
- Show how limit states drives the recommendation.
- Document the decision path clearly enough for a review or design defense.

Study tips

- Write the criteria and constraints before comparing any option.
- Keep load combinations visible as a decision driver, not just a calculation step.
- Show why the recommended option survives review instead of only naming it.

Common traps

- Treating a design formula like the recommendation itself.
- Skipping the explicit criteria or constraints that govern the decision.
- Presenting the final choice without showing the option screen or review logic.

Family-level errors to watch for

- Jumping to a favored concept before writing requirements and criteria.
- Hiding assumptions or tradeoffs that control the decision.
- Producing calculations without a coherent design narrative or review trail.

Chapter 2

Chapter 2 Axial and flexural member design

Chapter purpose

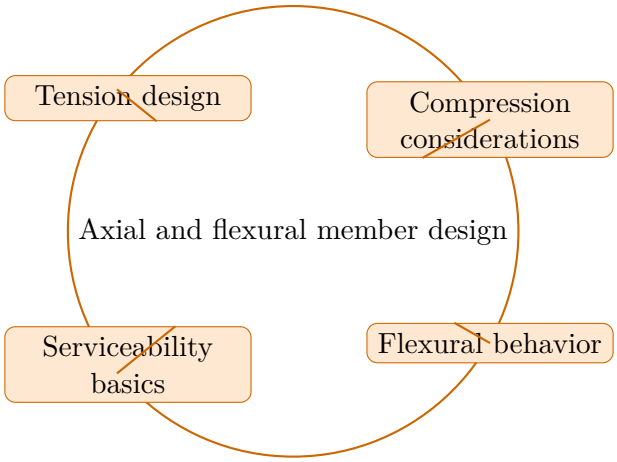
The course turns to preliminary design of members under axial and bending demand.

This chapter sits in the middle of Structural Design I. It develops Tension design, Compression considerations, Flexural behavior, and Serviceability basics so that the student can move from explanation to execution without losing the thread of the course.

This chapter belongs to a family where the final artifact is rarely one equation or one answer. Instead, the student must combine analysis, judgment, iteration, and communication into a defensible design path. The text therefore treats process discipline as seriously as technical depth.

Core ideas

- Tension design
- Compression considerations
- Flexural behavior
- Serviceability basics



How to think through this chapter

A strong method in this family begins with requirements, constraints, and stakeholders, then moves through alternatives, screening criteria, and progressively more detailed justification. Every major decision should be traceable and reviewable by another engineer.

When working this chapter, keep the following question active: @@TOKEN_0@@ A good student answer should connect setup, assumptions, and conclusion instead of only chasing a final number or sentence.

CIVL 370 Structural Design I. Axial and flexural member design. This chapter explains why the topic matters, how strong students organize the work, and what separates a defensible submission from a shallow one in this unit.

Why Axial and flexural member design is a design decision, not a lookup exercise

Axial and flexural member design is really a decision-making chapter. The mathematics, code checks, and concept comparisons matter because they push the student toward one defensible recommendation and away from weaker ones.

In Structural Design I, this is where students learn not to confuse a formula with a decision. The formula only matters because it changes how tension design should be judged.

How tension design and compression considerations drive the option screen

A strong student starts by naming the constraints, criteria, and failure points. Only then does tension design become useful, because now it sits inside a real decision frame rather than floating as isolated content.

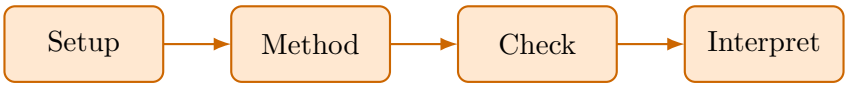
Compression considerations usually supplies the second check that keeps the recommendation honest. Good design work is rarely driven by one number alone.

How review-ready design work differs from draft thinking

Review-ready design work shows the option screen, the governing check, and the reason one direction survives while another does not. Weak work jumps too quickly from calculation to recommendation without showing the selection logic.

The easiest way to improve these chapters is to write the design rationale as if another engineer must sign it tomorrow.

Worked example



@@TOKEN_0@@ Walk through a structural design i design check built around tension design and compression considerations.

1. Define the performance goal, constraints, and the standard the design must satisfy.
2. Compare the relevant options or checks with tension design as the controlling criterion.
3. Record the governing assumptions, demand-capacity logic, or decision screen in a reviewable order.
4. State the selected direction and explain why it is the strongest engineering choice.

Read this example twice: once for the flow of ideas and once for the technical structure of the solution.

Worked-through guided example

@@TOKEN_0@@ Work a structural design i decision problem where tension design changes the preferred option or the governing design check.

1. List the criteria, constraints, and what counts as an acceptable design path.
2. Use tension design to compare the available options or checks in a reviewable order.
3. Close with the option you would defend and the reason it survives review.

A complete design response frames the criteria, shows how tension design drives the decision, and documents the recommendation in a review-ready sequence.

Instructor commentary

Students should annotate this chapter for structure, not just facts. Mark where the argument changes direction, where the method requires a hidden assumption, and where the conclusion becomes more general than the worked example. If the chapter feels easy while you are reading it but difficult when you close the page, you have not yet converted recognition into mastery.

The right study pattern is define the problem, build options, evaluate tradeoffs, document the decision, and then revisit the work after critique.

Practice while you read

Practice Set 2: Axial and flexural member design

The course turns to preliminary design of members under axial and bending demand.

@@TOKEN_0@@ Work a structural design i decision problem where tension design changes the preferred option or the governing design check.

- Hint: List the constraints and criteria first. Then show how tension design changes the option screen or final recommendation.
- Step 1: List the criteria, constraints, and what counts as an acceptable design path.
- Step 2: Use tension design to compare the available options or checks in a reviewable order.
- Step 3: Close with the option you would defend and the reason it survives review.
- Checkpoint: A strong checkpoint answer shows the governing criteria, explains how tension design changes the option screen, and lands on a defensible recommendation.

@@TOKEN_0@@ Work a structural design i decision problem where compression considerations changes the preferred option or the governing design check.

- Hint: List the constraints and criteria first. Then show how compression considerations changes the option screen or final recommendation.
- Step 1: List the criteria, constraints, and what counts as an acceptable design path.
- Step 2: Use compression considerations to compare the available options or checks in a reviewable order.
- Step 3: Close with the option you would defend and the reason it survives review.
- Checkpoint: A strong checkpoint answer shows the governing criteria, explains how compression considerations changes the option screen, and lands on a defensible recommendation.

Chapter homework

@@TOKEN_0@@ The course turns to preliminary design of members under axial and bending demand.

1. Prepare a structural design i design check or option screen focused on tension design. Show the governing criteria, tradeoffs, and the recommendation you would defend.
2. Prepare a structural design i design check or option screen focused on compression considerations. Show the governing criteria, tradeoffs, and the recommendation you would defend.
3. Prepare a structural design i design check or option screen focused on flexural behavior. Show the governing criteria, tradeoffs, and the recommendation you would defend.
4. Prepare a structural design i design check or option screen focused on serviceability basics. Show the governing criteria, tradeoffs, and the recommendation you would defend.

Answers for these homework problems appear in the back-of-book answer key.

Chapter summary and study notes

- Define the governing criteria behind tension design before comparing options.
- Show how compression considerations drives the recommendation.
- Document the decision path clearly enough for a review or design defense.

Study tips

- Write the criteria and constraints before comparing any option.
- Keep tension design visible as a decision driver, not just a calculation step.
- Show why the recommended option survives review instead of only naming it.

Common traps

- Treating a design formula like the recommendation itself.
- Skipping the explicit criteria or constraints that govern the decision.
- Presenting the final choice without showing the option screen or review logic.

Family-level errors to watch for

- Jumping to a favored concept before writing requirements and criteria.
- Hiding assumptions or tradeoffs that control the decision.
- Producing calculations without a coherent design narrative or review trail.

Chapter 3

Chapter 3 Shear, stability, and detailing logic

Chapter purpose

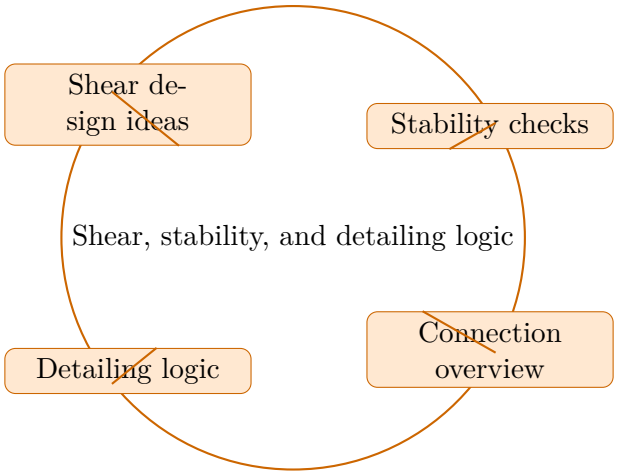
Students analyze secondary design checks and the detailing decisions that support real performance.

This chapter sits in the middle of Structural Design I. It develops Shear design ideas, Stability checks, Connection overview, and Detailing logic so that the student can move from explanation to execution without losing the thread of the course.

This chapter belongs to a family where the final artifact is rarely one equation or one answer. Instead, the student must combine analysis, judgment, iteration, and communication into a defensible design path. The text therefore treats process discipline as seriously as technical depth.

Core ideas

- Shear design ideas
- Stability checks
- Connection overview
- Detailing logic



How to think through this chapter

A strong method in this family begins with requirements, constraints, and stakeholders, then moves through alternatives, screening criteria, and progressively more detailed justification. Every major decision should be traceable and reviewable by another engineer.

When working this chapter, keep the following question active: @@TOKEN_0@@ A good student answer should connect setup, assumptions, and conclusion instead of only chasing a final number or sentence.

CIVL 370 Structural Design I. Shear, stability, and detailing logic. This chapter explains why the topic matters, how strong students organize the work, and what separates a defensible submission from a shallow one in this unit.

Why Shear, stability, and detailing logic is a design decision, not a lookup exercise

Shear, stability, and detailing logic is really a decision-making chapter. The mathematics, code checks, and concept comparisons matter because they push the student toward one defensible recommendation and away from weaker ones.

In Structural Design I, this is where students learn not to confuse a formula with a decision. The formula only matters because it changes how shear design ideas should be judged.

How shear design ideas and stability checks drive the option screen

A strong student starts by naming the constraints, criteria, and failure points. Only then does shear design ideas become useful, because now it sits inside a real decision frame rather than floating as isolated content.

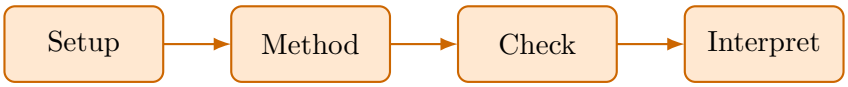
Stability checks usually supplies the second check that keeps the recommendation honest. Good design work is rarely driven by one number alone.

How review-ready design work differs from draft thinking

Review-ready design work shows the option screen, the governing check, and the reason one direction survives while another does not. Weak work jumps too quickly from calculation to recommendation without showing the selection logic.

The easiest way to improve these chapters is to write the design rationale as if another engineer must sign it tomorrow.

Worked example



@@TOKEN_0@@ Walk through a structural design i design check built around shear design ideas and stability checks.

1. Define the performance goal, constraints, and the standard the design must satisfy.
2. Compare the relevant options or checks with shear design ideas as the controlling criterion.
3. Record the governing assumptions, demand-capacity logic, or decision screen in a reviewable order.
4. State the selected direction and explain why it is the strongest engineering choice.

Read this example twice: once for the flow of ideas and once for the technical structure of the solution.

Worked-through guided example

@@TOKEN_0@@ Work a structural design i decision problem where shear design ideas changes the preferred option or the governing design check.

1. List the criteria, constraints, and what counts as an acceptable design path.
2. Use shear design ideas to compare the available options or checks in a reviewable order.
3. Close with the option you would defend and the reason it survives review.

A complete design response frames the criteria, shows how shear design ideas drives the decision, and documents the recommendation in a review-ready sequence.

Instructor commentary

Students should annotate this chapter for structure, not just facts. Mark where the argument changes direction, where the method requires a hidden assumption, and where the conclusion becomes more general than the worked example. If the chapter feels easy while you are reading it but difficult when you close the page, you have not yet converted recognition into mastery.

The right study pattern is define the problem, build options, evaluate tradeoffs, document the decision, and then revisit the work after critique.

Practice while you read

Practice Set 3: Shear, stability, and detailing logic

Students analyze secondary design checks and the detailing decisions that support real performance.

@@TOKEN_0@@ Work a structural design i decision problem where shear design ideas changes the preferred option or the governing design check.

- Hint: List the constraints and criteria first. Then show how shear design ideas changes the option screen or final recommendation.
- Step 1: List the criteria, constraints, and what counts as an acceptable design path.
- Step 2: Use shear design ideas to compare the available options or checks in a reviewable order.
- Step 3: Close with the option you would defend and the reason it survives review.
- Checkpoint: A strong checkpoint answer shows the governing criteria, explains how shear design ideas changes the option screen, and lands on a defensible recommendation.

@@TOKEN_0@@ Work a structural design i decision problem where stability checks changes the preferred option or the governing design check.

- Hint: List the constraints and criteria first. Then show how stability checks changes the option screen or final recommendation.
- Step 1: List the criteria, constraints, and what counts as an acceptable design path.
- Step 2: Use stability checks to compare the available options or checks in a reviewable order.
- Step 3: Close with the option you would defend and the reason it survives review.
- Checkpoint: A strong checkpoint answer shows the governing criteria, explains how stability checks changes the option screen, and lands on a defensible recommendation.

Chapter homework

@@TOKEN_0@@ Students analyze secondary design checks and the detailing decisions that support real performance.

1. Prepare a structural design i design check or option screen focused on shear design ideas. Show the governing criteria, tradeoffs, and the recommendation you would defend.
2. Prepare a structural design i design check or option screen focused on stability checks. Show the governing criteria, tradeoffs, and the recommendation you would defend.
3. Prepare a structural design i design check or option screen focused on connection overview. Show the governing criteria, tradeoffs, and the recommendation you would defend.
4. Prepare a structural design i design check or option screen focused on detailing logic. Show the governing criteria, tradeoffs, and the recommendation you would defend.

Answers for these homework problems appear in the back-of-book answer key.

Chapter summary and study notes

- Define the governing criteria behind shear design ideas before comparing options.
- Show how stability checks drives the recommendation.
- Document the decision path clearly enough for a review or design defense.

Study tips

- Write the criteria and constraints before comparing any option.
- Keep shear design ideas visible as a decision driver, not just a calculation step.
- Show why the recommended option survives review instead of only naming it.

Common traps

- Treating a design formula like the recommendation itself.
- Skipping the explicit criteria or constraints that govern the decision.
- Presenting the final choice without showing the option screen or review logic.

Family-level errors to watch for

- Jumping to a favored concept before writing requirements and criteria.
- Hiding assumptions or tradeoffs that control the decision.
- Producing calculations without a coherent design narrative or review trail.

Chapter 4

Chapter 4 Integrated member design project

Chapter purpose

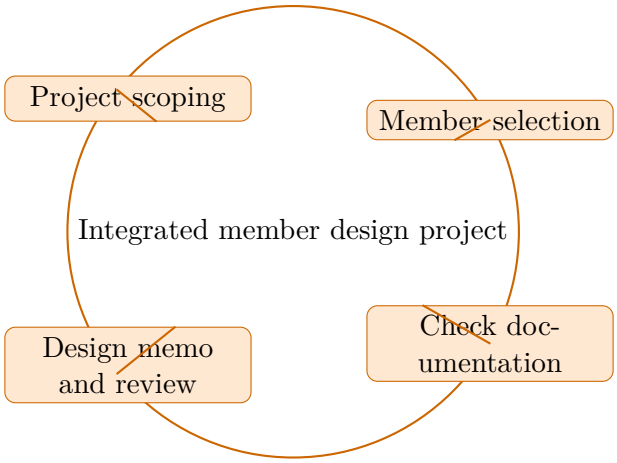
The semester closes with a guided design package tying loads, behavior, checks, and communication together.

This chapter sits at the end of Structural Design I. It develops Project scoping, Member selection, Check documentation, and Design memo and review so that the student can move from explanation to execution without losing the thread of the course.

This chapter belongs to a family where the final artifact is rarely one equation or one answer. Instead, the student must combine analysis, judgment, iteration, and communication into a defensible design path. The text therefore treats process discipline as seriously as technical depth.

Core ideas

- Project scoping
- Member selection
- Check documentation
- Design memo and review



How to think through this chapter

A strong method in this family begins with requirements, constraints, and stakeholders, then moves through alternatives, screening criteria, and progressively more detailed justification. Every major decision should be traceable and reviewable by another engineer.

When working this chapter, keep the following question active: @@TOKEN_0@@ A good student answer should connect setup, assumptions, and conclusion instead of only chasing a final number or sentence.

CIVL 370 Structural Design I. Integrated member design project. This chapter explains why the topic matters, how strong students organize the work, and what separates a defensible submission from a shallow one in this unit.

Why Integrated member design project is a design decision, not a lookup exercise

Integrated member design project is really a decision-making chapter. The mathematics, code checks, and concept comparisons matter because they push the student toward one defensible recommendation and away from weaker ones.

In Structural Design I, this is where students learn not to confuse a formula with a decision. The formula only matters because it changes how project scoping should be judged.

How project scoping and member selection drive the option screen

A strong student starts by naming the constraints, criteria, and failure points. Only then does project scoping become useful, because now it sits inside a real decision frame rather than floating as isolated content.

Member selection usually supplies the second check that keeps the recommendation honest. Good

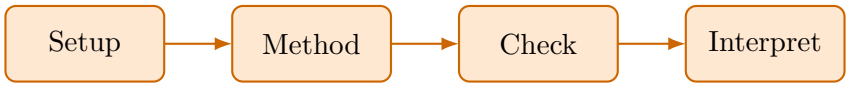
design work is rarely driven by one number alone.

How review-ready design work differs from draft thinking

Review-ready design work shows the option screen, the governing check, and the reason one direction survives while another does not. Weak work jumps too quickly from calculation to recommendation without showing the selection logic.

The easiest way to improve these chapters is to write the design rationale as if another engineer must sign it tomorrow.

Worked example



@@TOKEN_0@@ Walk through a structural design i design check built around project scoping and member selection.

1. Define the performance goal, constraints, and the standard the design must satisfy.
2. Compare the relevant options or checks with project scoping as the controlling criterion.
3. Record the governing assumptions, demand-capacity logic, or decision screen in a reviewable order.
4. State the selected direction and explain why it is the strongest engineering choice.

Read this example twice: once for the flow of ideas and once for the technical structure of the solution.

Worked-through guided example

@@TOKEN_0@@ Work a structural design i decision problem where project scoping changes the preferred option or the governing design check.

1. List the criteria, constraints, and what counts as an acceptable design path.
2. Use project scoping to compare the available options or checks in a reviewable order.
3. Close with the option you would defend and the reason it survives review.

A complete design response frames the criteria, shows how project scoping drives the decision, and documents the recommendation in a review-ready sequence.

Instructor commentary

Students should annotate this chapter for structure, not just facts. Mark where the argument changes direction, where the method requires a hidden assumption, and where the conclusion becomes more general than the worked example. If the chapter feels easy while you are reading it but difficult when you close the page, you have not yet converted recognition into mastery.

The right study pattern is define the problem, build options, evaluate tradeoffs, document the decision, and then revisit the work after critique.

Practice while you read

Practice Set 4: Integrated member design project

The semester closes with a guided design package tying loads, behavior, checks, and communication together.

@@TOKEN_0@@ Work a structural design i decision problem where project scoping changes the preferred option or the governing design check.

- Hint: List the constraints and criteria first. Then show how project scoping changes the option screen or final recommendation.
- Step 1: List the criteria, constraints, and what counts as an acceptable design path.
- Step 2: Use project scoping to compare the available options or checks in a reviewable order.
- Step 3: Close with the option you would defend and the reason it survives review.
- Checkpoint: A strong checkpoint answer shows the governing criteria, explains how project scoping changes the option screen, and lands on a defensible recommendation.

@@TOKEN_0@@ Work a structural design i decision problem where member selection changes the preferred option or the governing design check.

- Hint: List the constraints and criteria first. Then show how member selection changes the option screen or final recommendation.
- Step 1: List the criteria, constraints, and what counts as an acceptable design path.
- Step 2: Use member selection to compare the available options or checks in a reviewable order.
- Step 3: Close with the option you would defend and the reason it survives review.
- Checkpoint: A strong checkpoint answer shows the governing criteria, explains how member selection changes the option screen, and lands on a defensible recommendation.

Chapter homework

@@TOKEN_0@@ The semester closes with a guided design package tying loads, behavior, checks, and communication together.

1. Prepare a structural design i design check or option screen focused on project scoping. Show the governing criteria, tradeoffs, and the recommendation you would defend.
2. Prepare a structural design i design check or option screen focused on member selection. Show the governing criteria, tradeoffs, and the recommendation you would defend.
3. Prepare a structural design i design check or option screen focused on check documentation. Show the governing criteria, tradeoffs, and the recommendation you would defend.
4. Prepare a structural design i design check or option screen focused on design memo and review. Show the governing criteria, tradeoffs, and the recommendation you would defend.

Answers for these homework problems appear in the back-of-book answer key.

Chapter summary and study notes

- Define the governing criteria behind project scoping before comparing options.
- Show how member selection drives the recommendation.
- Document the decision path clearly enough for a review or design defense.

Study tips

- Write the criteria and constraints before comparing any option.
- Keep project scoping visible as a decision driver, not just a calculation step.
- Show why the recommended option survives review instead of only naming it.

Common traps

- Treating a design formula like the recommendation itself.
- Skipping the explicit criteria or constraints that govern the decision.
- Presenting the final choice without showing the option screen or review logic.

Family-level errors to watch for

- Jumping to a favored concept before writing requirements and criteria.
- Hiding assumptions or tradeoffs that control the decision.
- Producing calculations without a coherent design narrative or review trail.

Chapter 5

Quiz review and official exam preparation

Homework structure

- Homework Set 1: Loads, limit states, and member behavior: 4 graded problems attached to chapter 1.
- Homework Set 2: Axial and flexural member design: 4 graded problems attached to chapter 2.
- Homework Set 3: Shear, stability, and detailing logic: 4 graded problems attached to chapter 3.
- Homework Set 4: Integrated member design project: 4 graded problems attached to chapter 4.

Quiz structure

- Quiz 1: Loads, limit states, and member behavior: 4 questions, timed, and single-attempt in the live course. Quiz 1 should be taken only after you can solve the chapter homework without outside prompts.
- Quiz 2: Axial and flexural member design: 4 questions, timed, and single-attempt in the live course. Quiz 2 should be taken only after you can solve the chapter homework without outside prompts.
- Quiz 3: Shear, stability, and detailing logic: 4 questions, timed, and single-attempt in the live course. Quiz 3 should be taken only after you can solve the chapter homework without outside prompts.
- Quiz 4: Integrated member design project: 4 questions, timed, and single-attempt in the live course. Quiz 4 should be taken only after you can solve the chapter homework without outside prompts.

Official mastery exam

- Structural Design I cumulative mastery exam: 5 major questions, High rigor, first official attempt locks the course grade.

Structural Design I cumulative mastery exam preparation checklist

- Review every unit in Structural Design I until you can explain the governing method or decision logic without notes.
- Redo the homework checkpoints and one full practice round before the official attempt.
- Expect Summit to grade setup quality, assumptions, interpretation, and conclusion, not only raw answers.
- Use the AI tutor and guided practice only until you can defend the work independently.

How to use this book before assessment

- Read the relevant chapter and rebuild both worked examples without looking.
- Solve the guided practice in the chapter before attempting the graded homework.
- Check your chapter-homework answers only after you complete a full written attempt.
- Review the quiz answer key after each chapter block and classify your errors by concept, setup, algebra, or interpretation.
- Before the official exam, revisit the chapter purposes, homework corrections, and answer-key notes rather than rereading formulas only.

Chapter 6

Course vocabulary index

- @@TOKEN_0@@: treat this as a working term in the course. You should be able to define it, recognize where it appears, and use it correctly in a solution or explanation.
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Chapter 7

Back-of-book answers and solution outlines

Guided practice answer key

Chapter 1: Loads, limit states, and member behavior

@@TOKEN_0@@

1. Work a structural design i decision problem where load combinations changes the preferred option or the governing design check.

- Checkpoint answer: A strong checkpoint answer shows the governing criteria, explains how load combinations changes the option screen, and lands on a defensible recommendation. - Solution note: A complete design response frames the criteria, shows how load combinations drives the decision, and documents the recommendation in a review-ready sequence.

1. Work a structural design i decision problem where limit states changes the preferred option or the governing design check.

- Checkpoint answer: A strong checkpoint answer shows the governing criteria, explains how limit states changes the option screen, and lands on a defensible recommendation. - Solution note: A complete design response frames the criteria, shows how limit states drives the decision, and documents the recommendation in a review-ready sequence.

1. Work a structural design i decision problem where member response review changes the preferred option or the governing design check.

- Checkpoint answer: A strong checkpoint answer shows the governing criteria, explains how member response review changes the option screen, and lands on a defensible recommendation. - Solution note: A complete design response frames the criteria, shows how member response review drives the decision, and documents the recommendation in a review-ready sequence.

Chapter 2: Axial and flexural member design

@@TOKEN_0@@

1. Work a structural design i decision problem where tension design changes the preferred option or the governing design check.

- Checkpoint answer: A strong checkpoint answer shows the governing criteria, explains how tension design changes the option screen, and lands on a defensible recommendation. - Solution note: A complete design response frames the criteria, shows how tension design drives the decision, and documents the recommendation in a review-ready sequence.

1. Work a structural design i decision problem where compression considerations changes the preferred option or the governing design check.

- Checkpoint answer: A strong checkpoint answer shows the governing criteria, explains how compression considerations changes the option screen, and lands on a defensible recommendation. - Solution note: A complete design response frames the criteria, shows how compression considerations drives the decision, and documents the recommendation in a review-ready sequence.

1. Work a structural design i decision problem where flexural behavior changes the preferred option or the governing design check.

- Checkpoint answer: A strong checkpoint answer shows the governing criteria, explains how flexural behavior changes the option screen, and lands on a defensible recommendation. - Solution note: A complete design response frames the criteria, shows how flexural behavior drives the decision, and documents the recommendation in a review-ready sequence.

Chapter 3: Shear, stability, and detailing logic

@@TOKEN_0@@

1. Work a structural design i decision problem where shear design ideas changes the preferred option or the governing design check.

- Checkpoint answer: A strong checkpoint answer shows the governing criteria, explains how shear design ideas changes the option screen, and lands on a defensible recommendation. - Solution note: A complete design response frames the criteria, shows how shear design ideas drives the decision, and documents the recommendation in a review-ready sequence.

1. Work a structural design i decision problem where stability checks changes the preferred option or the governing design check.

- Checkpoint answer: A strong checkpoint answer shows the governing criteria, explains how stability checks changes the option screen, and lands on a defensible recommendation. - Solution note: A complete design response frames the criteria, shows how stability checks drives the decision, and documents the recommendation in a review-ready sequence.

1. Work a structural design i decision problem where connection overview changes the preferred option or the governing design check.

- Checkpoint answer: A strong checkpoint answer shows the governing criteria, explains how connection overview changes the option screen, and lands on a defensible recommendation. - Solution note: A complete design response frames the criteria, shows how connection overview drives the decision, and documents the recommendation in a review-ready sequence.

Chapter 4: Integrated member design project

@@TOKEN_0@@

1. Work a structural design i decision problem where project scoping changes the preferred option or the governing design check.

- Checkpoint answer: A strong checkpoint answer shows the governing criteria, explains how project scoping changes the option screen, and lands on a defensible recommendation. - Solution note: A complete design response frames the criteria, shows how project scoping drives the decision, and documents the recommendation in a review-ready sequence.

1. Work a structural design i decision problem where member selection changes the preferred option or the governing design check.

- Checkpoint answer: A strong checkpoint answer shows the governing criteria, explains how member selection changes the option screen, and lands on a defensible recommendation. - Solution note: A complete design response frames the criteria, shows how member selection drives the decision, and documents the recommendation in a review-ready sequence.

1. Work a structural design i decision problem where check documentation changes the preferred option or the governing design check.

- Checkpoint answer: A strong checkpoint answer shows the governing criteria, explains how check documentation changes the option screen, and lands on a defensible recommendation. - Solution note: A complete design response frames the criteria, shows how check documentation drives the decision, and documents the recommendation in a review-ready sequence.

Homework answer key

Homework Set 1: Loads, limit states, and member behavior

1. Prepare a structural design i design check or option screen focused on load combinations. Show the governing criteria, tradeoffs, and the recommendation you would defend.

- Answer / solution summary: A strong submission frames the criteria, compares the relevant options through load combinations, documents the governing check, and ends with a review-ready recommendation.

1. Prepare a structural design i design check or option screen focused on limit states. Show the governing criteria, tradeoffs, and the recommendation you would defend.

- Answer / solution summary: A strong submission frames the criteria, compares the relevant options through limit states, documents the governing check, and ends with a review-ready recommendation.

1. Prepare a structural design i design check or option screen focused on member response review. Show the governing criteria, tradeoffs, and the recommendation you would defend.

- Answer / solution summary: A strong submission frames the criteria, compares the relevant options through member response review, documents the governing check, and ends with a review-ready recommendation.

1. Prepare a structural design i design check or option screen focused on design format. Show the governing criteria, tradeoffs, and the recommendation you would defend.

- Answer / solution summary: A strong submission frames the criteria, compares the relevant options through design format, documents the governing check, and ends with a review-ready recommendation.

Homework Set 2: Axial and flexural member design

1. Prepare a structural design i design check or option screen focused on tension design. Show the governing criteria, tradeoffs, and the recommendation you would defend.

- Answer / solution summary: A strong submission frames the criteria, compares the relevant options through tension design, documents the governing check, and ends with a review-ready recommendation.

1. Prepare a structural design i design check or option screen focused on compression considerations. Show the governing criteria, tradeoffs, and the recommendation you would defend.

- Answer / solution summary: A strong submission frames the criteria, compares the relevant options through compression considerations, documents the governing check, and ends with a review-ready recommendation.

1. Prepare a structural design i design check or option screen focused on flexural behavior. Show the governing criteria, tradeoffs, and the recommendation you would defend.

- Answer / solution summary: A strong submission frames the criteria, compares the relevant options through flexural behavior, documents the governing check, and ends with a review-ready recommendation.

1. Prepare a structural design i design check or option screen focused on serviceability basics. Show the governing criteria, tradeoffs, and the recommendation you would defend.

- Answer / solution summary: A strong submission frames the criteria, compares the relevant options through serviceability basics, documents the governing check, and ends with a review-ready recommendation.

Homework Set 3: Shear, stability, and detailing logic

1. Prepare a structural design i design check or option screen focused on shear design ideas. Show the governing criteria, tradeoffs, and the recommendation you would defend.

- Answer / solution summary: A strong submission frames the criteria, compares the relevant options through shear design ideas, documents the governing check, and ends with a review-ready recommendation.

1. Prepare a structural design i design check or option screen focused on stability checks. Show the governing criteria, tradeoffs, and the recommendation you would defend.

- Answer / solution summary: A strong submission frames the criteria, compares the relevant options through stability checks, documents the governing check, and ends with a review-ready recommendation.

1. Prepare a structural design i design check or option screen focused on connection overview. Show the governing criteria, tradeoffs, and the recommendation you would defend.

- Answer / solution summary: A strong submission frames the criteria, compares the relevant options through connection overview, documents the governing check, and ends with a review-ready recommendation.

1. Prepare a structural design i design check or option screen focused on detailing logic. Show the governing criteria, tradeoffs, and the recommendation you would defend.

- Answer / solution summary: A strong submission frames the criteria, compares the relevant options through detailing logic, documents the governing check, and ends with a review-ready recommendation.

Homework Set 4: Integrated member design project

1. Prepare a structural design i design check or option screen focused on project scoping. Show the governing criteria, tradeoffs, and the recommendation you would defend.

- Answer / solution summary: A strong submission frames the criteria, compares the relevant options through project scoping, documents the governing check, and ends with a review-ready recommendation.

1. Prepare a structural design i design check or option screen focused on member selection. Show the governing criteria, tradeoffs, and the recommendation you would defend.

- Answer / solution summary: A strong submission frames the criteria, compares the relevant options through member selection, documents the governing check, and ends with a review-ready recommendation.

1. Prepare a structural design i design check or option screen focused on check documentation. Show the governing criteria, tradeoffs, and the recommendation you would defend.

- Answer / solution summary: A strong submission frames the criteria, compares the relevant options through check documentation, documents the governing check, and ends with a review-ready recommendation.

1. Prepare a structural design i design check or option screen focused on design memo and review. Show the governing criteria, tradeoffs, and the recommendation you would defend.

- Answer / solution summary: A strong submission frames the criteria, compares the relevant options through design memo and review, documents the governing check, and ends with a review-ready recommendation.

Quiz answer key

Quiz 1: Loads, limit states, and member behavior

1. Which topic is explicitly central to Loads, limit states, and member behavior?

- Answer key: Load combinations. Load combinations is one of the direct topics named in Loads, limit states, and member behavior.

1. Before working forward in Loads, limit states, and member behavior, what should you identify first?

- Answer key: Accepted answer(s): criteria, constraints, tradeoffs, recommendation. High-quality work in Loads, limit states, and member behavior starts by identifying criteria, constraints, tradeoffs, recommendation, not by jumping directly into the middle of the method.

1. Which deliverable belongs to Loads, limit states, and member behavior?

- Answer key: Load homework. Load homework is a direct deliverable from Loads, limit states, and member behavior, so students are expected to complete it before moving on.

1. Name one direct topic from Loads, limit states, and member behavior.

- Answer key: Accepted answer(s): Load combinations, Limit states, Member response review, Design format. Load combinations, Limit states, Member response review, Design format are direct topics in Loads, limit states, and member behavior. A strong student should be able to name them without opening the notes.

Quiz 2: Axial and flexural member design

1. Which topic is explicitly central to Axial and flexural member design?

- Answer key: Tension design. Tension design is one of the direct topics named in Axial and flexural member design.

1. Before working forward in Axial and flexural member design, what should you identify first?

- Answer key: Accepted answer(s): criteria, constraints, tradeoffs, recommendation. High-quality work in Axial and flexural member design starts by identifying criteria, constraints, tradeoffs, recommendation, not by jumping directly into the middle of the method.

1. Which deliverable belongs to Axial and flexural member design?

- Answer key: Member-design homework. Member-design homework is a direct deliverable from Axial and flexural member design, so students are expected to complete it before moving on.

1. Name one direct topic from Axial and flexural member design.

- Answer key: Accepted answer(s): Tension design, Compression considerations, Flexural behavior, Serviceability basics. Tension design, Compression considerations, Flexural behavior, Serviceability basics are direct topics in Axial and flexural member design. A strong student should be able to name them without opening the notes.

Quiz 3: Shear, stability, and detailing logic

1. Which topic is explicitly central to Shear, stability, and detailing logic?

- Answer key: Shear design ideas. Shear design ideas is one of the direct topics named in Shear, stability, and detailing logic.

1. Before working forward in Shear, stability, and detailing logic, what should you identify first?

- Answer key: Accepted answer(s): criteria, constraints, tradeoffs, recommendation. High-quality work in Shear, stability, and detailing logic starts by identifying criteria, constraints, tradeoffs, recommendation, not by jumping directly into the middle of the method.

1. Which deliverable belongs to Shear, stability, and detailing logic?

- Answer key: Design worksheet. Design worksheet is a direct deliverable from Shear, stability, and detailing logic, so students are expected to complete it before moving on.

1. Name one direct topic from Shear, stability, and detailing logic.

- Answer key: Accepted answer(s): Shear design ideas, Stability checks, Connection overview, Detailing logic. Shear design ideas, Stability checks, Connection overview, Detailing logic are direct topics in Shear, stability, and detailing logic. A strong student should be able to name them without opening the notes.

Quiz 4: Integrated member design project

1. Which topic is explicitly central to Integrated member design project?

- Answer key: Project scoping. Project scoping is one of the direct topics named in Integrated member design project.

1. Before working forward in Integrated member design project, what should you identify first?

- Answer key: Accepted answer(s): criteria, constraints, tradeoffs, recommendation. High-quality work in Integrated member design project starts by identifying criteria, constraints, tradeoffs, recommendation, not by jumping directly into the middle of the method.

1. Which deliverable belongs to Integrated member design project?

- Answer key: Design package. Design package is a direct deliverable from Integrated member design project, so students are expected to complete it before moving on.

1. Name one direct topic from Integrated member design project.

- Answer key: Accepted answer(s): Project scoping, Member selection, Check documentation, Design memo and review. Project scoping, Member selection, Check documentation, Design memo and review are direct topics in Integrated member design project. A strong student should be able to name them without opening the notes.

Mastery exam solution outlines

Structural Design I cumulative mastery exam

1. Prepare a structural design i design response that uses load combinations to compare alternatives and defend a recommendation.

- What to show: Criteria and constraints; The governing design check or comparison; A recommendation that could survive review - Solution outline: State the criteria, limits, and design assumptions before comparing any options. Use load combinations and limit states to show what drives the recommendation. End with the selected direction and a short defense of why it is the strongest option.

1. Prepare a structural design i design response that uses tension design to compare alternatives and defend a recommendation.

- What to show: Criteria and constraints; The governing design check or comparison; A recommendation that could survive review - Solution outline: State the criteria, limits, and design assumptions before comparing any options. Use tension design and compression considerations to show what drives the recommendation. End with the selected direction and a short defense of why it is the strongest option.

1. Prepare a structural design i design response that uses shear design ideas to compare alternatives and defend a recommendation.

- What to show: Criteria and constraints; The governing design check or comparison; A recommendation that could survive review - Solution outline: State the criteria, limits, and design assumptions before comparing any options. Use shear design ideas and stability checks to show what drives the recommendation. End with the selected direction and a short defense of why it is the strongest option.

1. Prepare a structural design i design response that uses project scoping to compare alternatives and defend a recommendation.

- What to show: Criteria and constraints; The governing design check or comparison; A recommendation that could survive review - Solution outline: State the criteria, limits, and design assumptions before comparing any options. Use project scoping and member selection to show what drives the recommendation. End with the selected direction and a short defense of why it is the strongest option.

1. Write a cumulative structural design i response that explains what high-quality work looks like from setup to final defense in this course.

- What to show: A staged workflow from the opening setup to the final conclusion; The assumptions or judgment points that control course-level work; A clear statement of what mastery looks like in practice - Solution outline: Use the course outcome "Interpret load combinations and limit states in a design workflow." as the anchor for the response. Show how criteria, constraints, tradeoffs, recommendation appear in a disciplined course-level workflow. End by explaining what would make a submission reviewable, defensible, and ready to earn full credit.

Reference note

For the full bibliography behind this textbook, use @@TOKEN_0@@. The answer key in this book is Summit-authored and aligned to the live course runtime.