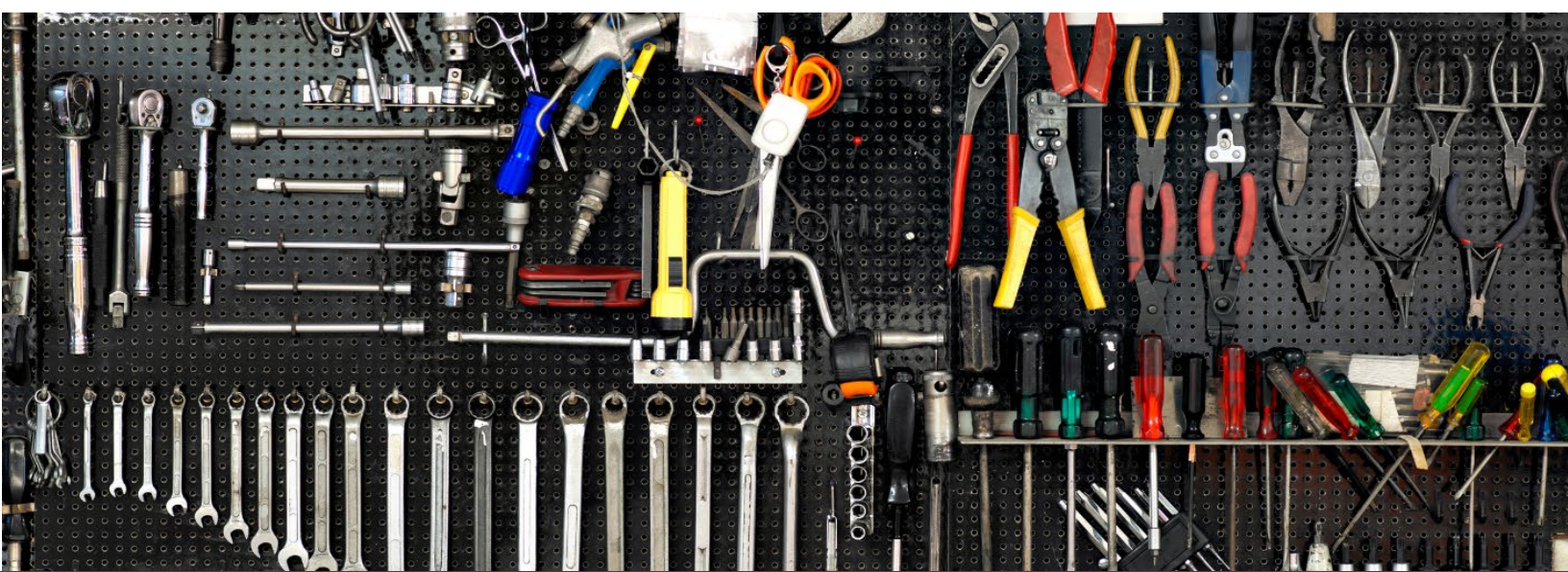


INSTRUCTOR GUIDE

Mechanical Foundations

September 2026



Course Outline

- Module: Fasteners
- Module: Hydraulics and Pneumatics
- Module: Leverage
- Module: Physics
- Module: Tools Reference Guide



U.S. Department of Transportation
Federal Transit Administration

A program of the Federal Transit Administration administered by the International Transportation Learning Center

Course: Mechanical Foundations

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Course Description

This section outlines the course duration, provides an overview of the classroom instruction format, and details the module structure to ensure a clear understanding of the training layout.

Foundational Skills Course: Mechanical Foundations

Mechanical Foundations is a series of modular courses designed to provide participants with a basic overview and practical experience with the fundamentals of mechanical principles. The overall course is approximately **12 hours** in length and includes hands-on, participant-led activities to support engagement with the material.

The Mechanical Foundations modules cover topics such as fasteners, hydraulics and pneumatics, leverage, and physics principles.

In addition, learners will also gain knowledge of mechanical tools and their uses with the tools reference guide, featuring components of common mechanical tools, applications and standard operating procedures, safety practices and guidelines, and suggested preventive maintenance protocols. Some tool sections also feature suggested hands-on learning applications and brief instructional videos.

Module – Fasteners

This module provides an overview of common fastener and hardware types, their purposes, and common applications for them in the transit industry. Learners will practice measuring and matching different fastener and hardware components and identifying the advantages and disadvantages of selecting the appropriate fastener or hardware component.

Objectives:

- Identify the various types of fasteners and explain their purpose, including screws, nuts, bolts, washers, staples, retaining hardware, and miscellaneous hardware.
- Explain the advantages and disadvantages of fastener materials.
- Recognize common applications for fasteners.

Module – Hydraulics and Pneumatics

This module introduces fluid dynamics and its relationship to hydraulic and pneumatic systems. Learners will examine the differences between systems, walk through the process of each system's operation, identify the advantages and disadvantages of each system, and review the importance of each system in transit applications.

Objectives:

- Define fluid dynamics and explain how it relates to hydraulic and pneumatic systems.
 - Define and differentiate hydraulics and pneumatics.
 - Identify mechanisms that use hydraulic and pneumatic systems.
 - Explain the importance of hydraulics and pneumatics in transit maintenance.
 - Compare the advantages and disadvantages of hydraulic and pneumatic systems.
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Module – Leverage

This module provides an overview of leverage and its role in moving or lifting loads to reduce effort. Learners will identify common tools and tasks for leverage and examine applications of leverage within the transit industry.

Objectives:

- Explain how leverage helps move or lift a load with less effort.
 - Recognize tools and maintenance tasks that use leverage.
 - Describe why leverage is important for safe and efficient transit maintenance.
-

Module – Physics

This module provides an overview of fundamental physics concepts including Newton's Three Laws of Motion. Learners will examine how these physics concepts and Newton's Three Laws of Motion apply to real-world mechanical systems within transit.

Objectives:

- Define physics and explain concepts such as force, motion, work, energy, power, resistance and friction.
 - Describe Newton's Three Laws of Motion.
 - Apply basic principles to real world mechanical systems in transit maintenance.
-

Module – Tools Reference Guide

This reference guide offers a comprehensive guide to the basic tools used for transit maintenance. Each section features a description of the tool, a review of common types and key components, safety practices, standard operating procedures (SOPs), and preventive

maintenance practices. Some tool sections feature suggested hands-on learning activities and instructional videos.

Assessments

This course provides a **Pre-Assessment** to be given *before* instruction and a **Post-Assessment** to be given *after* instruction. These assessments align with the learning objectives and can be used to measure learning gains and instructional effectiveness.

Course Preparation

This section outlines the steps instructors should take to prepare for the course, such as gathering required materials and checking that all audio-visual equipment is set up and functioning.

Checklist of Instruction

✓	Confirm the training dates, location, and number of participants.
	Gain access to the courseware through the Transit Workforce Center website. Make sure you can access and download the materials in advance.
	Follow your agency's requirements for class sign-in. If required, print sign-in sheet for each day of class.
	For each module, read and study the Instructor Facilitation Toolkit, PowerPoint presentations, Participant Resource Guide, and any state or local documentation pertaining to your agency's location.
	Test all equipment placed in the training room prior to the start time on the first day of the course.

Supplies, Audio-Visual Equipment, Internet Access

The following is important for the adequate delivery of this course:

✓	LCD projector compatible with a notebook computer and cables for proper connection.
	Computer with software to run Microsoft PowerPoint.
	Projection screen (at least 6' x 6').
	Internet access

	Room audio
	<i>Optional</i> – Wireless remote to advance PowerPoint
	Office supplies such as pencils, note pads, markers, highlighters, flip chart with markers, dry-erase board, etc.

Course Materials (Instructor and Participant)

All materials are available on the Transit Workforce Center website. Check back regularly for updated materials and additional resources.

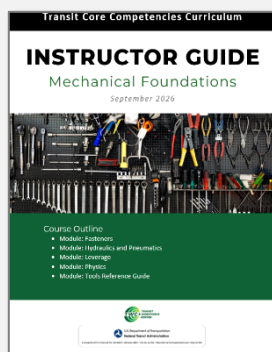
Best Practices for Delivering Training

This section provides strategies for effective training delivery to maintain a clear and organized flow of instruction while fostering an inclusive and supportive learning environment.

Before Instruction

1. Review the **Instructor Guide** (this document) and the **Instructor Facilitation Tool Kit** for each module.

The **Instructor Guide** provides an overview of the full course along with course preparation and best practices for facilitation.

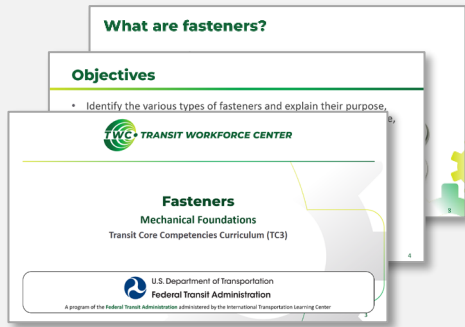
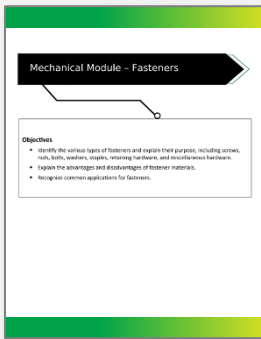


An **Instructor Facilitation Tool Kit** is included with each module and provides module specific information such as materials, lesson progression, and answer keys.



2. Review the **PowerPoint** and tailor the content to your specific agency and training needs.

3. Make sure you have a printed copy of the **Participant Guide Resource** for each learner. *All activity handouts are embedded in the Participant Resource Guide.*

The PowerPoint provides content and visuals along with instructor notes to guide facilitation. Familiarize yourself with the animations and transitions within the PowerPoint. 	The Participant Guide Resource provides copies of the PPT slides, handouts, and space for learners to take notes. Each learner should have their own copy of the Participant Guide Resource. 
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During Instruction

1. Arrive at least an hour early on class day. Give yourself plenty of time to organize the training *before* the participants arrive.
2. Circulate an attendance sign-in sheet each day and make sure that all participants sign into the class to record their attendance.
3. Review the **learning objectives** at the beginning and end of each module to help learners understand what they are expected to learn and why it matters. It also sets clear expectations and helps learners focus their attention on the most important skills or knowledge in the lesson. The learning objectives are embedded in the PowerPoints.
4. Be available for questions during breaks, lab or hands-on learning activities, and after class.
5. Be mindful of time as you facilitate instruction. Use the “Pacing Guide” slide at the beginning of each PowerPoint to understand overall time requirements. Instructor notes included under each slide also suggest teaching times to help you stay on track. Remember that these are suggested times. It’s important to be responsive to your learners and gauge when they are ready to move on or if they need more time.

6. Circulate among groups during class and lab activities to answer questions, offer guidance, and ensure participants stay on track. Provide constructive feedback during activities and participant presentations.
7. Check for understanding throughout the lesson by asking targeted recall and clarification questions aligned with the learning objectives. Use participant responses to gauge comprehension and adjust instruction or pacing as needed.

After Instruction

8. Reflect after each lesson and take a few moments to note what went well and what could be improved for next time. Use these reflections to refine your facilitation approach and make adjustments for future sessions.

Teaching Methods

A variety of teaching methods will be used throughout this course to support different learning styles and instructional needs. Each method is intentionally selected to help learners understand key concepts, practice skills, and stay engaged. Instructors are encouraged to use these methods flexibly and adjust their approach based on learner needs and course pacing.

Teaching Method	Definition	Best Practices
Lecture	A trainer-led method used to present information, concepts, or procedures efficiently to a group of learners.	Keep lectures short and focused to maintain attention. Use visuals like those provided in the PPT or examples to reinforce key points. Pause periodically to check understanding or invite questions.
Hands-On Learning	An active learning method where learners practice skills or tasks through real-world or simulated activities.	Clearly explain the task before learners begin. Provide demonstrations or models when possible. Allow time for practice and feedback.
Discussion-Based Learning	A learner-centered approach that encourages participants to share ideas, ask questions, and think critically through group dialogue.	Ask open-ended questions which cannot be answered with a simple yes or no to encourage learners to explain their thinking. Encourage participation from all group members. Guide the discussion to stay on topics and aligned with learning objectives.
One-on-One Instruction	An individualized teaching approach that provides personalized guidance and support based on a learner's specific needs.	Identify the learner's goals or challenges early. Adjust pacing and instruction based on learner feedback. Use this time to reinforce confidence and clarify misunderstandings.
Self-Paced Learning <i>*May include eLearning</i>	A method that allows learners to progress through content independently at their own speed, often using written or digital materials.	Provide clear instructions and expectations. Break content into manageable sections. Include opportunities for self-checks or reflection to reinforce learning.