# 11. Recommended Practice for Rail Transit Vehicle Inspection and Maintenance Training and Qualifications

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**Abstract:** This recommended practice provides guidance for training and qualifications of rail transit system employees or contractors that perform inspection and maintenance of rail transit vehicles.

**Key Words:** rail transit system, training, qualifications, vehicle inspection and maintenance,

# Introduction

(This introduction is not a part of APTA RT-VIM-RP-011-03, *Recommended Practice for Rail Transit Vehicle Inspection and Maintenance Training and Qualifications.*)

This Recommended Practice for Rail Transit Vehicle Inspection and Maintenance Training and Qualification represents a common viewpoint of those parties concerned with its provisions, namely, transit operating/planning agencies, manufacturers, consultants, engineers and general interest groups. The application of any standards, practices or guidelines contained herein is purely voluntary. In some cases, federal and/or state regulations govern portions of a rail transit system's operations. In those cases, the government regulations take precedence over these recommended practices. APTA recognizes that for certain applications, the standards or practices, as implemented by individual rail transit agencies, may be either more or less restrictive than those given in this document.

This recommended practice describes the basic qualification and training requirements that rail transit systems should use for employees or contractors responsible for the inspection, testing and maintenance of rail transit vehicles. APTA recommends the use of this recommended practice by:

- Individuals or organizations that inspect and maintain rail transit vehicles;

- Individuals or organizations that contract with others for the inspection and maintenance of rail transit vehicles; and

- Individuals or organizations that influence how rail transit vehicles are inspected and maintained.

## Participants

The American Public Transportation Association greatly appreciates the contributions of the following individual(s), who provided the primary effort in the drafting of the *Recommended Practice for Rail Transit Vehicle Inspection and Maintenance Training and Qualifications*:

| | |
|---|---|
| Dave Barber | Tom Peacock |
| David Blizzard | John D. Sadora |
| Phil Eberl | Jayendra N. Shah |
| Brian Ley | Clive Thornes |
| Joe Marie | Brian Whately |
| Jim O' Kelly | Hannie L. Woodson, Jr. |

At the time that this standard was completed, the VIM Committee included the following members:

**Jayendra Shah**, *Chair*
**Ben Antonio**, *Vice Chair*

| | | |
|---|---|---|
| Dave Barber | John Condrasky | David Phelps |
| Richard Berk | Chris Eichin | James Plomin |
| David Blizzard | Kevin Johnson | John Sadorra |
| Stephen Bonina | Paul Kovacs | Robert Spadafora |
| Joseph Brattelli | Dave Kubicek | Clive Thornes |
| Gordon Campbell | Brian Ley | Brian Whately |
| David Case | Joseph Marie | Hannie Woodson |
| Dhiren Chakraborty | Bill McCoy | |
| Lisa Cobb | Thomas Peacock | |

APTA Rail Transit Standards Vehicle Inspection and Maintenance Committee project consultant:

Gordon S. Campbell, *LDK Engineering*

APTA Rail Transit Standards project team:

Gabrielle Bayme, *Standards Development Program Specialist and Project Editor*
Saahir Brewington, *Administrative Assistant and Project Editor*
Antoinette Hankins, *Program Assistant*
Thomas Peacock, *Director-Operations & Technical Services*
David Phelps, *Senior Project Manager - Rail Programs*

# Contents

# Recommended Practice for Rail Transit Vehicle Inspection and Maintenance Training and Qualifications

## 1. Overview

### 1.1 Scope

This recommended practice provides guidance for training and qualifications of rail transit system employees or contractors that perform inspection and maintenance of rail transit vehicles. The recommended practice can be applied to develop training materials for employees or contractors that perform inspection and maintenance of rail transit vehicles including daily vehicle inspections and periodic inspection and maintenance programs.

### 1.2 Purpose

The purpose of this recommended practice is to ensure that rail transit system employees or contractors that perform vehicle inspection and maintenance tasks are trained to perform those tasks correctly. An effective inspection and maintenance program for rail transit vehicles resulting in safe and reliable operation requires:

- Comprehensive inspection and maintenance procedures and instructions;

- Fully trained and qualified supervisors, inspectors and maintainers; and

- Supervisors that understand and enforce the maintenance procedures and instructions.

This recommended practice provides guidance on the content of rail transit system training and qualification programs for vehicle inspection and maintenance. Section 5 of this recommended practice suggests requirements for such a program. Section 6 gives suggestions for the material that should be developed as part of an inspection and maintenance training course such as lesson plans, instructors notes, student handouts, etc. The instructional methods and level of detail are necessarily generic. Rail transit systems should determine the training methods and level of instruction detail appropriate for use with their equipment and the existing skill level of their employees.

## 2. References

No references were used to develop this recommended practice.

# 3. Definitions, abbreviations, and acronyms

## 3.1 Definitions

For the purposes of this recommended practice, the following terms and definitions apply:

**3.1.1 contractor:** A person under contract with the rail transit system or an employee of an organization under contract with the rail transit system to perform inspection and/or maintenance of rail transit vehicles.

## 3.2 Abbreviations and acronyms

**OEM**  original equipment manufacturer

# 4. Frequency of performance

Rail transit systems should establish frequency of performance requirements for training and qualifications of rail transit system employees or contractors that perform inspection and maintenance of safety critical systems on rail transit vehicles based upon operating experience and attrition rates. However, rail transit systems should not assign vehicle inspection or maintenance tasks – without guidance from or the presence of a qualified employee – to an employee or contractor until that person has successfully completed the training recommended for that system or procedure by this recommended practice.

Rail transit systems should determine appropriate intervals for refresher training based upon the complexity of their equipment and the observations of vehicle inspection and maintenance supervisors. However, APTA recommends that this interval not exceed three years.

Rail transit systems should develop and conduct training for inspection and maintenance of new equipment prior to that equipment being placed in revenue service.

# 5. Requirements and specific tasks

Each rail transit system should establish a training and qualification program for employees and/or contractors that perform inspection and maintenance of rail transit vehicles.

As part of this program, each rail transit system should, at a minimum:

a) Identify the tasks related to the inspection, testing, and maintenance that will be performed on each type of equipment that the rail transit system operates.

b) Develop written procedures for the performance of the tasks identified in paragraph a).

c) Identify the skills and knowledge necessary to perform each task identified in paragraph a).

d) Create a training curriculum that includes classroom and "hands-on" lessons designed to impart the skills and knowledge identified as necessary to perform each task identified in paragraph a). Rail transit systems should use the guidance given in section 6 of this recommended practice to develop the training curriculum.

e) Require all employees and contractors to successfully complete the training course that covers the tasks for which they are responsible. This may include written and "hands-on" testing.

f) Require direct supervisors of employees or contractors to complete a program that fully imparts the knowledge and skills necessary to ensure that the employees whom they supervise successfully perform the tasks that they are assigned. This should include all refresher training.

g) When an employee who performs inspection and maintenance tasks as part of his normal duties does not perform his normal duties for an extended period of time (to be determined by individual rail transit agencies), require refresher training that includes classroom and "hands-on" training, and may include written and "hands-on" testing.

h) Require refresher training for maintaining qualifications at periodic intervals. The extent of the refresher training and the time interval at which it is required is determined by the rail transit system. New equipment training can be substituted for refresher training.

i) Add new tasks and equipment to the training program as soon as the information on inspection and maintenance is available.

j) Maintain records adequate to demonstrate that each employee and contractor performing inspection and maintenance tasks on rail transit vehicles is currently qualified to do so.

## 6. Course development requirements

Rail transit systems should use these course development requirements to ensure that their vehicle inspection and maintenance courses:

- are high quality;

- have a consistent look and feel;

- are easy to adapt to new equipment or changes in operating environment;

- lead to safe and reliable vehicle operation; and

- support effective delivery of the course material.

## 6.1 General course requirements

The content of courses should focus on the specific rail transit inspection and maintenance tasks required by state oversight agencies and/or contained in OEM's inspection and maintenance recommendations as implemented by rail transit system procedures and policies.

Courses in the rail transit system vehicle inspection and maintenance curriculum should be designed for a target audience of varying experience levels.

Rail transit systems should develop a course instructor's guide for each course and use a common course style guide and formats for all the courses in the curriculum.

## 6.2 Course instructor's guide

The instructor's guide should provide all of the information, instructions, documentation and materials necessary for an experienced instructor to deliver the course. The instructor's guide should consist of the following components:

- Cover page

- Table of Contents

- Course Objectives that briefly state which skills or tasks students will be expected to perform after successful completion of the course.

- Course Master Sheet that briefly summarizes all the information about the course.

- Lesson Plans

- Methods of Evaluation and required passing score

- Instructional Materials and Master Copies

Annex A contains specific recommendations for the development of each of these components of the course instructor's guide.

## 6.3 Course style guide

The course style guide describes instructional methods to be used to present the course and describes the content and format for the course materials. The course style guide should cover:

- Instructional methods

- Testing and evaluation

- Test Item Bank

- Sample Tests

- Answer Key/Correction Guide

- Test Validation

- Test Item Criteria

- Performance Tests

- Performance Check Lists

- Course Material Assembly and Appearance

- Audio-Visual Material Specifications

- Writing Style

- Word Processing and Presentation Software Requirements

Annex B contains detailed recommendations for each of these course style guide topic.

## Annex A (informative) Instructor's Guide For Vehicle Inspection and Maintenance Training

~ Note ~
The instructional methods and level of detail included in this example are necessarily generic. Rail transit systems should determine the training methods and level of instruction detail appropriate for use with their equipment and the existing skill level of their employees.

## Purpose of the Course Development Requirements

The purpose of these Course Development Requirements is to ensure that the courses comprising the curriculum:

- are high quality

- have a consistent look and feel

- are easily adaptable to local needs

- support effective delivery of the course material

There are two parts to the Course Development Requirements:

1. Instructor Guide Requirements specify the elements that must be included in Instructor Guides. Each course will be documented in an Instructor Guide.

2. The Course Style Guide provides guidance on issues of style and the assembly of materials.

## General Principles

- Course content should focus on specific job tasks that are directly related to state oversight agency requirements and/or Original Equipment Manufacturer's recommendations as implemented by rail transit system procedures and policies.

- Courses in the rail transit standards vehicle inspection and maintenance curriculum should be designed for a target audience of experienced mechanical personnel.

## The Instructor Guide

The rail transit standards vehicle inspection and maintenance curriculum will consist of a series of Instructor Guides. An Instructor Guide includes the following elements:

**Cover Page**

The Cover Page displays the course.

**Table of Contents**

The Table of Contents displays the page locations of the elements and sub-elements of the Instructor Guide

**Course Master Sheet**

The Course Master Sheet summarizes information about the course on one or two pages. It contains the following elements:

Course title

Provide a short descriptive title for the program.

Course identifier

Leave a space to be filled in by the local agency with the local course identifier (e.g. course number) for local course administration.

Course objective(s)

State the course objectives. This should be one or two sentences describing in broad terms what the participants will know or be able to do upon completing the course. *(For example, Upon completion of this course participants will be able to perform a single car brake test.)*

Instructional level code

Level code establishes required prerequisites for participants.

Course duration (hours)

State the nominal duration of the instruction in hours. If there is significant practice or OJT time indicate it separately. Time for performance tests should be expressed per person or per group depending on the planned method of conducting them. *(i.e. 15 minutes per person or one hour for every four participants)*

Instruction Overview

Provide a brief narrative of one or two paragraphs describing the flow of the major instructional activities.

| Target audience description | Describe the employees for whom the course is designed. State any necessary background or prerequisite skills. *(Assume that participants are experienced maintenance personnel in the general course subject area.)* |
|---|---|
| Facilities, equipment, tools and materials | List the facilities, equipment, tools or material required to present the course. (i.e. cars, hand tools, test equipment, etc.) |
| Instructional equipment and supplies | List the instructional equipment and supplies required to present the course (overhead projectors, flip charts, markers, etc.). |
| Instructor qualifications | Describe the qualifications of the course instructor. Include any specialized knowledge or skills. *(Assume that instructors are experts in the course subject area.)* |
| Course content references | Provide bibliographic references for major source materials (manuals, documents, texts, etc.). |
| Course developer/subject expert contact information | Provide the names, surface and e-mail addresses, phone and fax numbers of the course developer(s) and significant subject matter experts. |

**Lesson Plan**

The lesson plan is a reference tool for the instructor during the delivery of the course. A lesson covers one or more terminal objectives and is the smallest assignable unit of instruction. A lesson plan must contain:

Lesson Heading

The lesson heading provides the following information:

- the course title and the lesson title or number

- the terminal objective(s)

- the running time of the lesson (classroom and lab times are listed separately)

- specific notes on how to prepare for and conduct the training including the required material, equipment, facility, tools, etc.

Terminal objectives

Terminal objectives should be in behavioral terms ("given a defective widget, the trainee will be able to describe the proper action to take to correct…") and must include conditions and standards.

Lesson Plan Format

Lesson plans should be in a two-column format. The right column is for instructional text and the left for topic headings, time frames, instructional strategy and media use notes. Follow the Lesson Plan Format in Annex C.
The hierarchical structure of the lesson will be indicated through the use of headings and subheadings.
Instructional activities are clearly identified in the lesson so the instructor can utilize the proper materials in the correct sequence.

| Level Of Detail | The lesson plan should be written in a "thick outline" format with key phrases and individual points fully detailed. The lesson plan should contain sufficient detail so that a trainer with subject matter expertise who is unfamiliar with the course should be able to present it in a credible fashion with minimal preparation. |
|---|---|
| **Test Administration** | A separate tabbed section should contain the test item bank for the course (or for each lesson, if there are multiple lessons in the course), any written or performance tests, answer keys or scoring guides, and performance evaluation checklists. |
| **Instructional Materials and Masters** | Masters of all handouts and job aids should be placed in the back of the course binder. Electronic media (diskettes, CD-ROMs, etc.) with the original document(s) can also be stored in the back of the binder. Extra copies of handouts/job aids may be stored separately from the masters in the same binder (marked accordingly). |

## Annex B (informative) Course Style Guide For Vehicle Inspection and Maintenance Training

~ Note ~

The instructional methods and level of detail included in this example are necessarily generic. Rail transit systems should determine the training methods and level of instruction detail appropriate for use with their equipment and the existing skill level of their employees.

## Recommended Instructional Methods

Select the instructional methods that best support the type of content and the expected student outcomes. Varying the instructional methods within the course promotes attentiveness and enhances learning.

Many of the course objectives will require mastery of practical skills and procedures. Demonstration and practice are recommended as effective teaching strategies for these kinds of objectives. A good three-step model for demonstration and practice is:

Step 1  Demonstrate the skill at normal pace.

Step 2  Break the skill into small, logical steps. Demonstrate each step slowly and explain as you go.

Step 3  Guide participants as they practice the skill.

## Testing/Evaluation

End users of the rail transit system vehicle inspection and maintenance curriculum are responsible for the final construction of written and performance tests and for local test administration and grading policies.

Course Developers will provide sufficient test items to make up a test item bank that end users can use to create tests that are comprehensive enough to document trainees' mastery of the course content.

Course Developers will construct sample written tests and hands-on performance tests for evaluation of "practical" skills.

**Test Item Bank**

Provide sufficient test items to enable local instructors to construct lesson and/or course mastery tests. Drawing from the test item bank, the local instructor should be able to create a test that covers the content domain of the course and will discriminate between participants who have mastered the course material and those who have not. The test item bank should thoroughly sample the course content. A minimum of two or three questions per terminal objective is recommended.

To facilitate the creation of multiple equivalent tests it is permissible to write multiple items for each objective.

**Sample Tests**

Provide at least one sample test for each course or lesson. Sample tests must be formatted for pencil and paper administration. They should be designed as lesson or course mastery tests.

Provide clear instructions for testers and test takers to follow. Include the conditions under which the test is to be administered, exact testing procedures, any equipment or materials required, permissible aids or references and the time allowed.

**Answer Key/Correction Guide**

For each test provide a correction guide/answer key for use by the instructor when correcting the test.

**Test Validation**

Validation of any tests or evaluations will be the sole responsibility of the end users of the Curriculum. Course Developers are not required to conduct validation studies. However, to support local validation efforts, Course Developers should observe the following guidelines when developing test items and tests:

- all test items must relate directly to job tasks and to content covered in the lesson

- the total number and distribution of test items in the Test Item Bank must adequately sample the content of the course

- the selection of test items in sample tests should adequately sample the content of the course or lesson

- individual test items should be well-constructed (see the section on Test Items)

**Test Items**

When creating test questions use only multiple choice or matching items. Use the following guidelines when developing these items.

- **Multiple Choice·**

  - avoid use of negative constructions in the stem and in alternatives·

  - make alternative choices roughly the same length·

  - provide at least four preferably five choices

  - provide only one correct or best response·

  - ensure correct answers are randomly distributed among alternative positions when incorporating items in a sample test

  - use all of the above/none of the above sparingly as the correct response·

  - avoid grammatical clues

- **Matching Items**

  - include a stimulus column and a response column·

  - include more responses than stimulus items·

  - list responses in systematic order

  - use a stimulus and a response that are similar in nature

  - use less than 10 stimulus items

  - use only short phrases or single words in the response list

  - avoid grammatical clues

**Performance Tests**

When performance tests are appropriate to assess how well participants are able to perform tasks, provide recommended performance test procedures.

Instructions for performance items must be clear and concise. They should state exactly what task must be performed, under what conditions and the minimum level of acceptable performance. Each performance item should cover a single well-defined task. Ensure that the performance criteria for tasks are not more difficult than those required on the job.

Use the Sample Test format for performance test headers and footers. Vary the body text to suit the performance test content.

**Performance Checklist**

For each performance test a performance checklist must be pro-vided to guide evaluation of the task. Use the Answer Key format for performance checklist headers and footers. Vary the body text as required.

**Quizzes**

Written or oral quizzes may be included for use throughout the course to determine students' grasp of particular lessons and/or objectives.

## Course material appearance and assembly

Instructor Guides should conform to the following:

**Instructor Guide**

The instructor guide should provide all of the information, documentation and materials necessary to deliver the course. The instructor guide is to be stored in a D ring, three ring binder with full face and spine sleeve designed for cover and spine inserts. Binders are not to exceed 3 inches and are to have page lifters. If a course requires two or more binders, they should be labeled volumes 1, 2, 3 etc. on the cover and spine sleeve inserts.

Masters of all materials intended for reproduction should be placed in a folder in the rear of the binder. Videotapes, photographs, slides and other bulky media may be placed in a separate binder or folder.

**Instructor Guide Format**

The instructor guide is to be printed on one side in a portrait orientation on standard 8 ½" by 11" paper. Use the formats in Annex C.

**Student Materials**

Instructional materials can vary greatly due to their various pur-poses and types. They may include, workbooks, reference/user guides, self-study guides, job aids and handouts. However, all quality training materials should be:

- accurate
- easy to use and understand
- appropriate to the instructional objectives
- relevant to the purpose (quick reference, study guide, etc.)
- easy to read (written at a sixth to eighth grade level)
- gender neutral and bias free

To the extent that the type of material permits, student materials should be placed in the Instructor Guide binder in a separate tabbed section.

**Audio-visual material specification**

The basic course design should assume that only minimal audio-visual support (overhead projector) will be available to instructors.

Course developers may also elect to prepare instructional materials in other formats (e.g. Power Point presentations, slides or videotape). However, any material developed in these formats must also be provided in a basic format (hard copy or overhead transparencies).

Content produced in multimedia, slide or videotape formats should be documented in hard copy through screen prints or transcripts that are included in the Instructor Guide, Instructional Media and Masters section.

**Writing style**

Follow these guidelines when writing lesson plans and instructional material:

- Use the active voice unless there is good reason to use the passive.

- Write in the present tense.

- Strive for clarity and simplicity. Use short sentences and simple vocabulary.

- Spell out an acronym or abbreviation followed by the abbreviation in parentheses the first time it is used.

- Use gender neutral, bias free language and images.

- Write at a sixth to eighth grade level. This may be difficult to achieve with technical content. Use common sense.

**Word processing/ presentation software requirements**

Rail transit systems should require a standardized software suite to be used to develop all curriculum material such as Microsoft Office 2000.

Along with the Instructor Guide binder, all course text and graphics should be provided on CD-ROM's, 3.5" diskettes or other appropriate data storage media.