

7. MAINTENANCE – ENHANCED REVIEW MODULE

PURPOSE OF THIS REVIEW AREA

Recipients must keep federally funded vehicles, equipment, and facilities in good operating condition. Recipients must keep Americans with Disabilities Act (ADA) accessibility features on all vehicles, equipment, and facilities in good operating order.

USE OF THIS MODULE

This enhanced review module (ERM) questionnaire presents recommended questions for an enhanced review of maintenance. Based on the scope of the approved ERM, all or a selection of the sections of this module will be conducted. The actual questions asked and the items sampled and observations made will be determined during the scoping meeting. The Federal Transit Administration (FTA) regional office and/or the Office of Transit Safety and Oversight may ask the reviewer to develop a unique scope of work for the ERM. Additional questions may be asked and additional sampling and observations may be performed as directed by FTA. The scope, questionnaire, sampling, and observations will be subject to final review and approval by the respective regional FTA office and the Office of Transit Safety and Oversight.

QUESTIONS TO BE EXAMINED

1. Does the recipient have a written maintenance plan(s) for FTA-funded assets (including vehicles/vessels, locomotives, rail cars, facilities, and equipment)?
2. Is the recipient following its program for preventive maintenance inspections for FTA-funded assets?
3. Does the recipient commit sufficient resources to maintain FTA-funded assets during their useful life?
4. Does the recipient have a system for tracking warranty issues and does the recipient actively pursue warranty claims?
5. Do recipients have an effective, documented mechanism for monitoring subrecipients', contractors', and lessees' maintenance activities?

INFORMATION NEEDED FROM RECIPIENT

Recipient Information Request

- Maintenance budgets
- Detailed maintenance departmental organization chart(s)
- Maintenance job descriptions
- Maintenance plans for all modes
- Written vehicle (including vessels) and equipment maintenance plans
- Written facility maintenance plan

Recipient Follow-up

- Recruitment efforts
- Training programs and files
- Maintenance records
- Warranty records
- Driver vehicle inspection reports

MERM1. Does the recipient have a written maintenance plan(s) for FTA-funded assets (including vehicles/vessels, locomotives, rail cars, facilities, and equipment)?

BASIC REQUIREMENT

Recipients that control FTA-funded assets must have maintenance plans for those assets.

APPLICABILITY

Recipients with direct control over FTA-funded assets

DETAILED EXPLANATION FOR REVIEWER

Refer to question M1 in the baseline review.

INDICATORS OF COMPLIANCE

a. *Do the maintenance plans include the following elements?*

Review Response

| Fleet Maintenance Plan(s) | Evaluation/Comments |
|--|---------------------|
| 1. Describes goals and objectives, including the following: | |
| a. Vehicle life | |
| b. Reducing the frequency of road calls | |
| c. Tracking maintenance costs compared to total operating costs | |
| 2. Describes how goals and objectives are achieved | |
| 3. Reflects the newest rolling stock/ technology and/or latest manufacturers' recommended maintenance intervals and programs | |
| 4. Incorporates ADA maintenance elements into the regular maintenance plan or addressed separately with specific checklists | |
| 5. Is consistent in maintenance procedures and checklists with the manufacturers' recommendations for those vehicles under warranty | |
| 6. Describes a system of periodic inspections and preventive maintenance to be performed at certain defined intervals (may be part of a maintenance management information system) | |
| 7. Describes a record-keeping system that maintains adequate permanent records of maintenance and inspection activity for building and equipment | |
| Facility and Equipment Maintenance Plan(s) | Evaluation/Comments |
| 1. Describes the organization and assignment of responsibilities for facility and equipment maintenance | |

| | |
|---|--|
| 2. Describes required inspections and routine maintenance actions to ensure proper care and maximize useful service life | |
| 3. Describes a record-keeping system that maintains adequate permanent records of maintenance and inspection activity for building and equipment | |
| 4. Addresses mission critical and safety items, including but not limited to the following: | |
| a. Buildings | |
| b. Elevators | |
| c. Escalators | |
| d. Passenger Stations/Shelters | |
| e. Parking Lots | |
| f. Right-of-way (guideway, track, ballast, etc.) | |
| g. Electric distribution and control equipment | |
| h. Plumbing systems | |
| i. Overhead doors | |
| j. Vehicle maintenance lifts | |
| k. Vehicle washers and wash water recycling systems | |
| l. Heating and/or air conditioning units, and | |
| m. Power substations | |
| 5. Describes a system of periodic inspections and preventive maintenance to be performed at certain defined intervals (may be part of a maintenance management information system). Review the procedures and verify the following: | |
| a. Measure of interval times (i.e., daily, monthly, annually) | |
| b. Usage (i.e., hours of use) | |

b. Is there a different plan/procedure for each vehicle fleet or is a generic plan/procedure used across all fleets?

- i. *When new vehicles, equipment, or facilities are acquired, how are these plans revised or appended?*
- ii. *How does the recipient initiate and benchmark service plans for its mixed fleet of buses?*

INSTRUCTIONS FOR REVIEWER

For a detailed discussion of FTA's expectations in determining compliance with indicators *a* through *b*, review the "*Determining Compliance*" under question M1 in the baseline review. In addition, obtain and review training records to determine if staff received training on the current fleet and equipment.

POTENTIAL DEFICIENCY DETERMINATIONS

The recipient is deficient if its vehicle maintenance plan(s) omits some requirements (i.e., goals and objectives), does not address the latest additions of vehicles, or is not consistent with the current fleet.

DEFICIENCY CODE MERM1-1: Vehicle/vessel maintenance plan incomplete or out of date

SUGGESTED CORRECTIVE ACTION: The recipient must submit to the FTA regional office an updated maintenance plan for FTA-funded vehicles.

The recipient is deficient if its facility and equipment maintenance plan(s) omits some requirements (i.e., goals and objectives) or its plan(s), does not include the latest additions of FTA-funded assets (i.e., major equipment), or facilities or is not consistent with current facilities.

DEFICIENCY CODE MERM1-2: Facility and equipment maintenance plan incomplete or out of date

SUGGESTED CORRECTIVE ACTION: The recipient must submit to the FTA regional office an updated written maintenance plan for FTA-funded facilities and equipment.

GOVERNING DIRECTIVES

Refer to question M1 in the baseline review.

MERM2. Is the recipient following its program for preventive maintenance inspections for FTA-funded assets?

BASIC REQUIREMENT

Recipients that use FTA assistance to purchase assets must keep those assets in good condition and good operating order.

APPLICABILITY

Recipients with direct control over FTA-funded assets

DETAILED EXPLANATION FOR REVIEWER

Refer to question M2 in the baseline review.

INDICATORS OF COMPLIANCE

- a. *Calculate the following fleet maintenance performance indicators.*

Review Response

| Performance Indicators | Evaluation/Comments |
|--|---------------------|
| 1. Review maintenance records to determine if the system provides sufficient data to generate trend analyses and performance indicators such as preventive maintenance on schedule and vehicle reliability and availability. | |
| 2. Review disposition records and overhaul plans to determine if there is evidence of early retirement of assets related to maintenance or indications of early mid-life overhauls related to maintenance | |
| 3. Utilizing the most recently submitted National Transit Database (NTD) report, compute the following maintenance ratios: | |
| a. Mean distance between failure (total revenue vehicle system failures divided by total scheduled revenue miles) | |
| b. Maintenance cost per mile (total maintenance cost divided by total scheduled revenue miles) | |

b. Provide the following operating information for the past three years for each mode: (rail, fixed route, paratransit) examined.

Review Response

| Mode: | | | |
|--|--------|--------|--------|
| Operating Information | FY2015 | FY2016 | FY2017 |
| 1. Total current annual operating miles and hours for vehicles funded by FTA | | | |
| 2. Spare ratio | | | |
| 3. Number of vehicles that have been replaced in the last three years | | | |
| 4. Average age of fleet | | | |
| 5. Mean distance between mechanical failures (MDBF) | | | |
| 6. Maintenance cost per vehicle mile | | | |
| 7. Revenue hours and miles lost due to mechanical failures | | | |
| 8. Number of vehicles out of service for at least one month during the year | | | |

c. *How does the recipient plan and schedule maintenance work?*

Review Response

d. *How does the recipient use trend analyses such as Mean Distance Between Failures (MDBF) to assist in maintenance planning?*

Review Response

e. *What methodology is used to determine how and when each type of preventive maintenance activity will be performed?*

Review Response

f. *Does the recipient use predictive maintenance as part of its preventive maintenance plan? What percentage of the preventive maintenance is predictive?*

Review Response

g. *Does the recipient use more than one shift for maintenance work? If yes, describe the type of work accomplished per shift.*

Review Response

h. *How does the recipient ensure adequate spare parts are available to support scheduled maintenance activities?*

iii. *Has a lack of spare parts negatively impacted the on-time performance for scheduled maintenance or vehicle availability for service?*

iv. *In review of bus maintenance records, can it be found that life cycle parts replacement is occurring on a regular and systematic basis?*

v. *Are parts ordered from major supply houses or local providers?*

Review Response

i. *What system indicators (i.e., preventive maintenance on schedule, reliability of fleet or equipment, availability of fleet or equipment, etc.) has the recipient developed to measure the effectiveness of the maintenance program? Are these indicators used across all modes?*

Review Response

j. *What tools does the recipient use to generate performance on these system indicators? Are these tools used for all modes?*

Review Response

- k. *How and how often does the agency measure the effectiveness of its preventive maintenance program?*

Review Response

- l. *Is management required to submit reports to senior management and the governing body on the status of the FTA program assets?*

i. *If yes, please describe the type of information conveyed and how often information is provided.*

ii. *What is the outcome of the governing body's review of these reports?*

Review Response

- m. *How are deferred maintenance and/or maintenance backlogs identified and addressed?*

Review Response

- n. *Have there been early retirements and/or mid-life overhauls to FTA-funded assets due to maintenance? What process is used to determine the appropriateness of maintenance related early retirement of assets or early mid-life overhauls?*

Review Response

- o. *Describe the procedures/process to determine how, when and how often preventive maintenance inspections are scheduled for vehicles. Provide evidence of documentation (i.e., screen shots, forms, reports, etc.)*

Review Response

- p. *How and how often does the agency measure the effectiveness of its plan? (i.e., frequency, deficiencies, turnaround time for repairs, etc.)*

Review Response

- q. *Is any vehicle preventive maintenance performed by a department or contractor, outside of transit? If yes, how is that activity monitored and recorded?*

Review Response

Vehicles

- r. *For an expanded sample of vehicles (beyond the baseline review) provide the on-time maintenance percentage. Provide system-wide on-time performance if such a report can be generated.*

Review Response

| Mode | Vehicle/ Vessel | Plan Identified Maintenance Interval | Date of PM | Actual Vehicle/ Vessel Mileage/ Hours | Actual Interval between inspections | PM on time? Y/N |
|------|--------------------|--|------------|---|--|-----------------------|
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- s. *Is the completed service and repair work reviewed by a supervisor before the bus is released for passenger service? How are service times and quality reflected in the records review? If re-work is required after a procedure, does the recipient have a procedure and schedule that covers this activity?*

Review Response

- t. *How does the recipient measure/track MDBF? Does the recipient monitor the relationship between preventive maintenance performed and road failures?*

Review Response

- u. *Has the maintenance department listed MDBF improvement as a goal under its FTA written maintenance plan?*

Review Response

- v. *What is the trend for MDBF for its fleet over the past three years? Have road calls increased with the addition of newer buses with more computerized systems?*

Review Response

Facilities

- w. *Describe the procedure/process to determine how, when and how often preventive maintenance inspections are scheduled for facilities and equipment. Provide documentation (i.e., screen shots, forms, reports, etc.)*

Review Response

- x. *Is any facility or equipment preventive maintenance performed by a department or contractor, outside of transit? If yes, how is that activity monitored and recorded?*

Review Response

- y. *How and how often does the agency measure the effectiveness of its plan? (i.e., frequency, deficiencies, turnaround time for repairs, etc.)*

Review Response

- z. *For an expanded sample of facilities (beyond the baseline review) provide the on-time maintenance percentage.*

Review Response

| Facility/Equipment | Maintenance Interval | Date of PM | Actual Interval between PM inspections | PM conducted on time? Y/N |
|--------------------|----------------------|------------|--|---------------------------|
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- aa. *Are all defects identified during maintenance inspection repaired before vehicle is returned to service?*

Review Response

INSTRUCTIONS FOR REVIEWER

Review the physical set-up and procedures governing the organization of the maintenance records and observe whether preventive maintenance records, work orders, warranty claims, etc., are kept in an organized, logical, and controlled manner that is easily accessible. Select a sample of vehicle maintenance records and perform the following:

1. Examine the maintenance checklist, ensure it's the same checklist listed in the plan. Verify that updates provided by the manufacturers are addressed in the maintenance checklists. Verify that the checklist is consistent with the current operating fleet.
2. Compare the interval for the change of engine oil and filters in the maintenance plan and checklist with the maximum interval specified in the engine manufacturer's maintenance manual.
3. Check vehicle condition reports, compare defects noted during preventive maintenance inspections with work orders to verify that maintenance is not deferred.
4. Inspect a sample of vehicles returned to service after a preventive maintenance inspection to determine if there is a backlog of repairs from inspections.
5. Ensure defects are addressed prior to returning vehicles to revenue service.

6. Review the records and status reports to determine if accessibility features such as lifts, ramps and annunciators are repaired promptly if they are damaged or out of order.
7. Review the list of parts on back order to determine the effect of missing parts on fleet status

In addition, obtain vehicle reports to verify the spare ratio. Obtain the number of working vehicles in the fleet and compare to the peak requirement.

Select a sample of preventive maintenance records for each type of facility and a sample of equipment. Examine the facility/equipment maintenance history for the review period for the following:

1. Examine the maintenance checklist to ensure it is the same checklist listed in the plan. Verify that updates provided by the manufacturers are addressed in the maintenance checklists. Verify that the checklist is consistent with any changes made to the facility or equipment.
2. Note the date when each inspection was accomplished and record the interval from the previous inspection.
3. Compare the interval with the recipient's definition of an "on-time" inspection to determine if the inspection was in accordance with the facility and equipment maintenance plan.
4. Review maintenance records and status reports to determine if accessibility features such as elevators, escalator, etc., are repaired promptly if they are damaged or out of order?

For commuter rail locomotives and cars, in lieu of selecting a sample of preventive maintenance records, examine Federal Railroad Administration (FRA) inspection records to determine if FRA compliance letters indicate that the recipient does not meet the FRA scheduled maintenance intervals. If the recipient is unable to provide a compliance letter from FRA, then sample the commuter rail fleet.

Refer to question M2 in the baseline review for additional information.

POTENTIAL DEFICIENCY DETERMINATIONS

The recipient is deficient if it is experiencing frequent or prolonged service interruptions that are caused by lack of adequate maintenance of vehicles. This deficiency is made after consultation with the FTA regional office and the FTA Subject Matter Expert (SME) for Maintenance. Work with the FTA regional office and the FTA SME for Maintenance on a corrective action(s).

DEFICIENCY CODE MERM2-1: Inadequate vehicle maintenance

DEFICIENCY CODE MERM2-2: Inadequate facility maintenance

Refer to question M2 in the baseline review for additional information.

GOVERNING DIRECTIVES

Refer to question M2 in the baseline review.

MERM3. Does the recipient commit sufficient resources to maintain FTA-funded assets during their useful life?

BASIC REQUIREMENT

Recipients must commit sufficient resources to maintain FTA-funded assets during their useful life.

APPLICABILITY

Recipients with direct control over FTA-funded assets

DETAILED EXPLANATION FOR REVIEWER

Maintenance issues can impact service operations, safety, and useful life of rolling stock and equipment.

The way in which the recipient’s maintenance function is organized and staffed, along with the experience of maintenance staff should be commensurate with its size and complexity. The type, frequency, and method of training provided to staff regarding FTA requirements and industry best practices are important indicators of the recipient’s technical competency in the management of FTA assets.

Maintenance budget performance tracking is an indication of the recipient’s commitment to effective asset management. Asset deterioration may occur in small increments each year, but a multi-year analysis can reveal negative trends. This is most often an indication that preventive maintenance is being deferred.

Refer to questions M2 and TC-PJM1 in the baseline review for additional information.

INDICATORS OF COMPLIANCE

Staffing

- a. *Describe the resources (organizational structure, staffing levels, experience, etc.) assigned to maintenance of FTA-funded assets. This includes resources of a third party contractor if maintenance is contracted. What technical training have maintenance employees had? Does the recipient have certification requirements for employees or contractors?*

Review Response

| Responsibility | Number of Staff | Number of Staff with Less Than Three Years’ Experience in Their Position | Staff Vacancies | Type/Frequency and Method of Training for Responsibilities | Required Certifications (such as ASE) |
|-----------------------|------------------------|---|------------------------|---|--|
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- b. *How does the recipient structure and manage the maintenance staff resources for FTA funded assets?*
 - i. *What percentage of work hours per week are allocated for scheduled maintenance?*
 - ii. *What percentage of work hours per week are used for unscheduled maintenance?*
 - iii. *What percentage of work hours per week are used for mini-and/or mid-life overhaul or major component upgrade/replacement?*

Review Response

- c. *Describe the training program for staff that directly supports maintenance functions (i.e., technicians, mechanics, shop forepersons, shift supervisors, maintenance planners/ schedulers, etc.). How does the recipient ensure competency of staff performing maintenance tasks?*

Review Response

- d. *Describe the type of training that maintenance management and front-line supervisors receive.*

Review Response

- e. *How does the recipient address the need for training when changes are made (such as new original equipment manufacturer (OEM) requirements) that impact maintenance procedures, process, parts, and/or techniques? Have maintenance employees received any training on modern electronic and mechanical bus systems, such as Cummins INSITE, electric engine cooling fan systems, diesel exhaust fluid (DEF), and selective catalytic reduction (SCR) systems, etc.?*

Review Response

- f. *Describe maintenance staff turnover during the past three years. Other than internal resources, what additional resources (i.e., consultants) and tools (i.e., technology) are utilized in managing FTA-funded assets?*

Review Response

- g. *What diagnostic tools are used to monitor modern bus electronic systems with a newer fleet?*

Review Response

Budget

- h. *What is the process for developing the maintenance budget? What factors are considered when developing it? Is performance against goals and objectives an established factor?*

Review Response

- i. *What percentage of the total budget does maintenance represent?*

Review Response

- j. *What percentage of the maintenance budget is for scheduled preventive maintenance? For unscheduled maintenance? For repair?*

Review Response

- k. *What is the current maintenance budget?*

Review Response

- l. *Have there been any budget reductions since the last Comprehensive Review?*

Review Response

m. *Are there any projected reductions to the maintenance budget for the next two years? Please explain.*

Review Response

n. *Describe the process used to collect, analyze and prepare documentation showing the actual versus budgeted cost of maintenance.*

i. *Which staff gathers the information needed?*

ii. *How and how often?*

iii. *Which staff reviews this variance analysis and how are these costs considered for future maintenance budgets?*

Review Response

INSTRUCTIONS FOR REVIEWER

Review the organization and staffing of the maintenance department. During onsite interviews, determine the level of support provided by the organization's leadership and/or governing body, and other departments. Determine the number of vacancies. Discuss staff turnover and recruitment challenges. Review position descriptions of maintenance department personnel to determine required years of experience and certifications. Discuss the training program. Determine how much the recipient spends on training. Discuss and review documentation of training provided since the last Comprehensive Review. Discuss current training needs. Through interviews and tours of the facility, obtain an understanding of the level of sophistication of the tools used to assist with the implementation of the maintenance program. Determine if the recipient has the tools necessary to diagnose and maintain advanced technological features.

Compare the maintenance budget against actual to determine if the recipient deferred maintenance cost or exceeded the budget due to unscheduled repairs. Large variances in budget versus actual should be explained. Discuss with the recipient whether it is devoting adequate resources to implementing the maintenance program.

Review information from the past three years (if available) in the National Transit Database (NTD), including the following specific metrics, to determine if the data indicate a negative trend:

- Miles between major and minor service interruptions
- Total vehicle maintenance expense per mile
- Average fleet age

Refer to questions M2 and TC-PjM1 in the baseline review for additional information.

POTENTIAL DEFICIENCY DETERMINATIONS

Work with the FTA regional office and the FTA SME for Maintenance on a deficiency code(s) and a corrective action(s) for the indicators that may lead to a deficiency in this question.

GOVERNING DIRECTIVES

Refer to question M2 and TC-PjM1 in the baseline review.

MERM4. Does the recipient have a system for tracking warranty issues and does the recipient actively pursue warranty claims?

BASIC REQUIREMENT

Recipients must establish procedures for adequately recording, tracking and pursuing warranty claims.

APPLICABILITY

Nonstate recipients with direct control over FTA-funded assets

DETAILED EXPLANATION FOR REVIEWER

Refer to question M4 in the baseline review.

INDICATORS OF COMPLIANCE

- a. *How does the recipient determine that a warranty claim should be filed?*

Review Response

- b. *What is the recipient’s system for identifying and tracking warranty issues and recovering warranty claims for FTA-funded assets?*

Review Response

- c. *Are warranty claims for FTA-funded assets pursued?*

Review Response

- d. *How are fleet defects determined?*

- i. *Has the recipient identified any fleet defects since the last Comprehensive Review?*

- ii. *If yes, how were these handled with the manufacturer and what impact have they had on the overall maintenance activities of the recipient?*

Review Response

INSTRUCTIONS FOR REVIEWER

Review the recipient’s warranty procedures and ensure the following:

1. The procedures adequately address identifying warranty repairs
2. The procedures adequately address how to record a warranty claim
3. The procedures adequately address how to submit a claim to the manufacturer
4. The procedures adequately address how to follow-up on unpaid claims

Refer to question M4 in the baseline review for additional information.

POTENTIAL DEFICIENCY DETERMINATIONS

Refer to question M4 in the baseline review.

GOVERNING DIRECTIVE

Refer to question M4 in the baseline review.



MERM5. Do recipients have an effective mechanism for monitoring subrecipients', contractors', and lessees' maintenance activities?

BASIC REQUIREMENT

States must develop maintenance requirements for subrecipients, contractors, and lessees for FTA-funded vehicles/vessels. Other recipients must require that subrecipients, contractors, and lessees meet FTA maintenance requirements.

APPLICABILITY

Recipients with subrecipients, contractors, and lessees with FTA-funded assets

DETAILED EXPLANATION FOR REVIEWER

Refer to question M5 in the baseline review.

INDICATORS OF COMPLIANCE

- a. *How are maintenance requirements communicated to subrecipients, contractors, and lessees of FTA-funded assets?*

Review Response

- b. *What are the procedures used to generate reports for monitoring maintenance of FTA-funded vehicles, equipment, and/or facilities performed by service providers under contract or subrecipients?*

Review Response

- c. *How does the recipient ensure that contractual obligations for maintaining FTA-funded assets are met? What are the consequences for non-compliance?*

Review Response

- d. *Does the recipient collect and report the same performance measures for service providers or subrecipients that it does for its directly maintained assets??*

Review Response

- e. *What are the consequences of non-performance?*

Review Response

- f. *How does the recipient evaluate the effectiveness of its oversight program?*

Review Response

INSTRUCTIONS TO REVIEWER

Obtain the recipient's oversight procedures and sample documents used for providing assistance to its subrecipients. Determine how the recipient:

1. Determines the level of assistance to provide
2. Determines the type of assistance, i.e., documents, training, instructions to provide
3. Assesses the effectiveness of its assistance program

Obtain the recipient's procedures (and sample documents) for providing oversight of its contractors.
Determine how the recipient:

1. Ensures compliance with contractual obligations
2. Collects maintenance reports for compliance with FTA maintenance requirements including ADA requirements
3. Enforce consequences for non-compliance

Refer to question M5 in the baseline review for additional information.

POTENTIAL DEFICIENCY DETERMINATIONS

Refer to question M5 in the baseline review.

GOVERNING DIRECTIVES

Refer to question M5 in the baseline review.