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Product Name: **LRT SYSTEM TESTING AND START-UP PLAN**

PMP Appendix: APPENDIX T

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ABSTRACT: This deliverable sets forth that the goal of the CRC LRT system testing and start-up program is a revenue service opening that incorporates the lessons learned and builds upon the successes achieved on previous LRT extension start-ups in the Portland metropolitan area. This product focuses on the testing and start-up aspects of *only the LRT system portion* of the CRC program, and describes the processes to be used in order to achieve the stated goals and objectives.

LRT SYSTEM TESTING AND START-UP PLAN

Draft Report

May 2013



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ACRONYMS

CO	Change Order
CRC	Columbia River Crossing
C-TRAN	Clark County Public Transit Benefit Area Authority
LRT	Light Rail Transit
LRV	Light Rail Vehicle
MAX	Metropolitan Area eXpress
ODOT	Oregon Department of Transportation
PMP	Project Management Plan
PSU	Portland State University
PMP	Project Management Plan
RAP	Rail Activation Plan
SSO	State Safety Oversight
TES	Traction Electrification System
TriMet	Tri-County Metropolitan Transportation District
TSEM	Transit Systems Engineering Manager

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1. LRT System Testing and Start-Up

1.1 Overview

The primary goal of the CRC LRT system testing and start-up program is a revenue service opening that incorporates the lessons learned and builds upon the successes achieved on previous LRT extension start-ups in the Portland metropolitan area. The CRC Program will leverage TriMet's successful integration of new and existing service on the Metropolitan Area Express (MAX) light rail system on prior extension start-ups including:

- Westside/Hillsboro Light Rail (Blue Line) Extension, September 1998
- Airport Light Rail Extension (Red Line), September 2001
- Interstate Light Rail Extension (Yellow Line), May 2004
- South Corridor Extension (Green Line), September 2009

In each case, start-up culminated over a year or more of ever-intensifying pre-revenue testing, training, and other preparatory activities.

In addition, the 7.3-mile Milwaukie extension is currently under construction from the south terminus of the Green and Yellow Lines on the Portland Mall near PSU to a Park Ave. terminus south of Milwaukie. That extension is designated as the Orange Line and is scheduled to open in the fall of 2015. Preparations for the start-up of the Orange Line are under way, and start-up activities will commence on or before January 2014.

1.2 System Testing Procedures, Analysis, and Results

This section describes the objectives, methodology, management controls, and major milestones in the conduct of a test program intended to verify LRT's readiness for revenue operations.

1.2.1 Objectives

Listed below are the objectives of the system testing and start-up program:

- Development and execution of an integrated comprehensive system testing program.
- Verification of contract compliance.
- Validation and demonstration of system performance.
- Verification that the extension performs as an integrated member of an entire system.
- Demonstration of safety, security, and service characteristics.

- Training of TriMet and/or C-TRAN personnel, and integration of personnel, equipment, and procedures into TriMet's overall operations.
- Full collaboration with TriMet and C-TRAN operations.

1.2.2 Types of Tests

Five types of tests will be required under the CRC Program system testing and start-up program. The following definitions include examples to distinguish the general uses of each of these tests.

Qualification or Proof of Design Testing

Proof of design tests are designed to verify that a proposed design can meet the specification requirements. They are usually performed on pre-production units or the first unit of a production run; for example, substation load test or LRV crash worthiness test. The CRC Program may choose to limit design qualification tests to types and manufacturers of equipment not currently in service in the existing TriMet system.

Manufacturing Tests

Manufacturing tests are a general category of tests that are performed by the contractor and suppliers on a sampling basis or routine basis to verify the quality control and manufacturing process. They usually represent milestones for further assembly or construction activity, or as a prerequisite to the shipping of materials or equipment.

Acceptance Tests

Acceptance tests are performed by the contractors on each individual item, thereby verifying performance at the equipment/subsystem/system level, after installation or assembly. These tests are normally used as advanced milestones for contract progress payment on equipment type contracts. At the system level, these tests require interface with other system elements; for example, vehicle acceptance or ticket vending machine acceptance.

System Tests or Integrated Tests

Systems, or integrated, tests are any test or series of tests that requires the interface of more than one system or civil element and are designed to verify the integration and compatibility among individual elements. These tests are usually beyond the contractual responsibility of any single contractor. They are planned, performed, witnessed, reported, and documented by TriMet and C-TRAN. These tests are generally required as a validation of total system performance. A detailed test plan for each test and the required sequence will be included in the Integrated Test Plan.

Pre-Revenue Testing

Pre-revenue tests utilize the complete functional capabilities of all system elements. Such tests are beyond the contractually required tests of individual contractors, are required to be performed prior to the introduction of revenue service, and will utilize and evaluate representative system schedules, personnel, procedures, and equipment. These tests will begin after system elements

relating to systems operations are complete and accepted. A detailed test plan for each test and the required sequence will be included in the Integrated Test Plan.

1.2.3 Test Management Approach

The management of the test program has been adapted to the organization of the CRC Program and is divided into two categories.

The first category includes proof of design, manufacturing, and acceptance tests. These tests are managed by the contractor, with oversight by the Project Engineer responsible for the contract to which they relate.

The second category of tests—systems integration and pre-revenue—is the responsibility of the CRC Test Program Coordinator. Typically, before testing activities begin, the Test Program Coordinator is selected from within the CRC Program’s systems engineering team.

The Test Program Coordinator reports to the Systems Manager, who has the duty to implement the overall test plan. During the latter phases of the Program, the tasks of schedule coordination and organization of other facilities or support elements will be the responsibility of the Test Program Coordinator.

There are three major activities in performing both categories of tests:

1. Establish requirements;
2. Perform tests (including remedial measures necessary to achieve successful results);
and
3. Report test status, and document and analyze results, noting any discrepancies.

The general approach to the utilization of TriMet personnel will be to encourage maximum test witnessing as a means of training opportunities while at the same time avoiding the imposition of contractual obligations and costs. These objectives must be consistent with the assumption of responsibilities relating to various stages of contract acceptance and within the limits of TriMet personnel resources.

1.2.4 Establish Requirements

The requirements for testing system elements are established based on several factors:

- Functional criticality;
- Verify safety functionality;
- Developmental nature;
- Procurement/installation relative to construction sequences; and
- Historical experience.

Each element of the system must be examined in terms of these factors and test requirements established. When the requirements relate directly to contract performance specifications, the tests shall be contractor tests and will be included as part of the contract requirements.

When test requirements are established that are beyond the contractual responsibility of any system or civil element contractor, the tests shall be termed “District” tests and shall be managed by the Test Program Coordinator.

The process of establishing test requirements differs between contractor and District tests. The definition of contractor tests, since they will become contractual requirements in specifications, is the responsibility of the Project Engineer for the contract. The designer, Systems Manager, and TriMet and C-TRAN Operations staff provide technical support. Coordination of support requirements (system facilities and interfaces with other system elements) is also the responsibility of the Project Engineer; the Test Program Coordinator will provide coordination assistance. The Test Program Coordinator will ensure that all contractor tests are compatible with TriMet and C-TRAN policy, system-wide schedules, and the requirements of other contracts.

The definition of District tests, and the specific objectives and method of accomplishing them, will be developed by the Test Program Coordinator based on input from Project Engineers, TriMet and C-TRAN Operations, Safety, and others.

1.2.5 Perform Tests

Tests will be executed in one of three ways:

1. Contractor off-site tests;
2. Contractor on-site tests; or
3. TriMet and C-TRAN tests.

Contractor Off-Site Tests

Tests assigned to the contractors that are not performed at the point of final installation are termed off-site testing. Examples include most qualification and manufacturing tests. There are four basic activities involved in off-site testing:

1. Contractor preparation of test plans, procedures, and reports;
2. Execution monitoring of the tests;
3. Verification of test performance and results; and
4. Status reporting of submittals and tests, and test completion reporting.

Review of test plans, procedures, and reports is the responsibility of the contractor, with oversight by the Project Engineer. The Test Program Coordinator may provide technical support. Test plans and procedures may be reviewed by the Project Engineer to ensure that the specification requirements are met, including all technical and District requirements.

The contractor will perform execution of the tests with Project Engineer oversight. Execution will be in accordance with the contract specifications and the test plan and/or procedures, as approved. The contractor shall provide test specimens, equipment, and operating personnel.

Monitoring of the tests, including corrective action, will be the responsibility of the contractor, with Project Engineer oversight. Members of the design team and TriMet and C-TRAN Operations may be requested to support or witness these tests. Auditing or witnessing of tests by QA staff will be performed on a spot check or random sample basis. Status reporting of all significant contractor off-site tests shall be the responsibility of the contractor, with oversight by the Project Engineer.

Contractor On-Site Tests

Tests assigned to the contractors that are performed at the point of final installation are termed on-site testing. Examples include acceptance tests and contractor system tests. Basic activities involved in contractor on-site testing include:

- Review of test plans, procedures, and reports;
- Scheduling of tests;
- Equipment operation or use of other system elements;
- Execution monitoring of tests; and
- Verification of test performance and results.

Review activities are the responsibility of the contractor, with oversight by the Project Engineer, supported by the Test Program Coordinator.

Scheduling of on-site tests begins during the review process, and continues through test execution and completion of the documentation of test results. In all phases, those tests, which require interfaces with other system elements, must be identified for individual attention and additional resource support.

The Test Program Coordinator, in conjunction with TriMet and C-TRAN Operations, and designated CRC Program staff, will meet on a regular basis to coordinate the schedules and resolve potential problems associated with the on-site testing. As test plans and procedures are reviewed, the need for other system elements to be functioning will be identified and resources coordinated.

Actual test execution will be the responsibility of the contractor, who must provide the necessary test equipment, test operators, and data recording. Where operation and/or maintenance of other system elements (equipment outside the contractor's responsibility) are required, such operation shall be provided by TriMet and C-TRAN personnel or by other contractors through coordination by the Test Program Coordinator.

Monitoring, execution, verification, status, and completion reporting are performed with similar responsibilities as described in off-site testing.

District Tests

The major activities in District tests (system and pre-revenue) are as follows:

- Identification of requirements;
- Preparation and review of procedures;
- Test supervision and execution; and
- Test status and completion reporting.

Responsibility for these activities rests with the Test Program Coordinator. Responsibility for certain aspects of these tests is also vested in the Transit Systems Engineering Manager (TSEM), and TriMet, and C-TRAN Operations personnel. In general, the role of the CRC Program's Test Program Coordinator will vary and will have increasing responsibilities, particularly during the pre-revenue test phase.

Three types of District tests are required and occur in sequential order:

1. Light rail vehicles (LRVs) acceptance testing and burn-in;
2. Systems testing (integration of equipment, facilities, personnel, and procedures); and
3. Pre-revenue testing (operations of total system, simulating normal, abnormal, and emergency conditions).

Preparation of test procedures for LRVs acceptance testing will be the responsibility of the TSEM. The Test Program Coordinator and TriMet Operations will review the procedures.

Preparation of procedures for systems tests will be the responsibility of the Test Program Coordinator. TriMet and C-TRAN Operations, and other TriMet and C-TRAN staff, as required, will review procedures.

TriMet and C-TRAN Operations and the Test Program Coordinator will coordinate preparation of test procedures for the pre-revenue tests. Test supervision and execution responsibilities will vary according to the type of test. The Test Program Coordinator will be responsible for system verification tests. Pre-revenue tests will be planned, managed, and executed by TriMet and C-TRAN Operations staff, with the Test Program Coordinator acting in an advisory and coordination role.

Test result reports of all District tests shall be the responsibility of the person conducting the test. The Test Program Coordinator will keep documentation of all tests performed.

1.2.6 Report Test Status and Document Results

Effective test reporting has two objectives. First, an overall knowledge of test progress is vital for an understanding of the status of individual contracts and the system as a whole. Second, the status of tests that have relationships with other contracts or tests must be closely monitored to ensure coordination and prevent delays.

The primary responsibility for providing the input on test documentation submittals (test procedures and test results) and status of individual contractor tests will be with the Project Engineer who will submit such data to the CRC Test Program Coordinator for compilation.

The CRC Test Program Coordinator, in turn, is responsible for closely monitoring testing and for notifying the Project Engineers when late or unsuccessful tests may interfere with other program activities. The reporting of test status, test results, and test completion of systems tests will be done by the Test Program Coordinator or designee. Reporting of test status, test results, and completion of pre-revenue tests will be done by TriMet and C-TRAN Operations.

Test Documentation

The Project Engineers and the Test Program Coordinator are responsible for ensuring that all of their test documentation is prepared and available for review. Documentation shall include a description of each test required in the contract documents, the results of each test including fail and pass dates, names of test witnesses, test reports or dates, and the acceptance of the test by the Project Engineer or Test Program Coordinator. The Test Program Coordinator will be responsible for maintaining a master log of all tests required and their status. This log will become part of the backup documentation necessary for safety certification.

Test Completion Reports

At the completion of each test, the individual responsible for approval of the test results will complete a test summary report and submit it to the Test Program Coordinator. Approval of, and exceptions to, the test results will be reported on this form and any need for additional retests will be identified. The CRC Program's Test Program Coordinator will compile test completion reports.

1.3 Modifications or Retrofits

During system or pre-revenue testing, necessary changes to various project elements may be identified. Any such change will take the form of a modification or retrofit. Determination of the need for any modifications or retrofits will be based on the results of the system testing and start-up program, will incorporate engineering input and judgment, and must be carefully coordinated with the management of COs and warranties.

The Project Engineer will negotiate and administer agreement on the scope of and assignment of financial responsibility for modifications and/or retrofits.

1.4 Start-Up Planning

Start-up of the light rail line is an inherently complex process requiring exceptional intra-agency coordination and planning. Anticipated challenges are:

- The construction and integrated testing phases will be nearing completion, a point in the overall process that is often exceptionally time-sensitive and for which few "workarounds" are available to deal with unresolved issues. These will be coordinated through the track access program, with weekly (or more frequently, if

necessary) meetings to prioritize access to the alignment for completion of critical activities.

- Additional operations personnel are needed to operate the new line as an extension of the existing light rail line.
- General growth in other transit service areas is needed in order to support growth in rail, fixed-route bus, and paratransit operations well in advance of the commencement of new light rail operations.

Approximately two years before revenue operations, TriMet and C-TRAN will each designate a Start-up Coordinator, who will report to the TSEM. The Start-up Coordinators will be responsible for managing the identification, critical path scheduling, coordination, and progress reporting of all activities directly supporting the commencement of revenue operations. Key coordination is required with the Transit Design Manager and Project Delivery Director to manage interfaces. An initial task will involve ensuring that a coordinated training program is implemented.

TriMet and C-TRAN divisions will be involved with CRC Program transit staff during start-up. This includes staff from Rail Transportation, Bus Transportation, Transportation Planning, Safety and Security, Rail Maintenance, Facilities Maintenance, and Marketing and Customer Service.

1.4.1 Start-Up Plan

The Start-up Coordinators will convene a Start-up Steering Team to oversee the start-up effort. The first priority of the Start-up Steering Team will be to guide the development of a comprehensive Start-up Plan. The plan will outline the procedures and policies necessary to activate and operate the light rail line and the key steps (testing, staffing, training, etc.) and timetable required.

Preparation of the Start-up Plan will be the responsibility of the Start-up Coordinators. It will be based on the successful plan and implementation process used on TriMet's previous start-ups. The plan will be used as a guide during the activation of the rail line and as a reference manual in future operation of the entire route.

The start-up activities program will continue past the date of commencement of revenue operations until all identified open items in the program have been closed.

1.4.2 Start-Up Schedule

The schedule for implementation of the Start-up Plan will be prepared as a separate document, referred to as the "Start-up Schedule." Functional groupings of start-up activities will be represented. Activity groups will include:

- Completion of construction.
- Bus/rail service planning.

- Operating budgets programming.
- Personnel hiring and training.
- Maintenance of facilities/equipment.
- System safety and security certification.
- Systems activation.
- Marketing/customer services/community relations activities.

CRC Program transit staff will coordinate closely with TriMet and C-TRAN divisions to prepare the sequence and timing of activities in this Start-up Schedule. The stated sequence and timing of events will be followed closely to meet the established date for the start of revenue service.

1.4.3 Start-Up Target Date

An initial target date for start-up of light rail service will be established early in the overall program scheduling. Progress toward this date will be continually evaluated during the testing and start-up phases. The ultimate decision on the start-up date for revenue service will be made by the TriMet General Manager, in consultation with the CRC Director and C-TRAN, only after assurance of the system's safety and reliability. A fundamental requirement for determining the opening date will be the availability of the entire length of the line, including all line segments, operations facility, vehicles, and system elements for a period of approximately four months for purposes of testing, training, and simulated operation. Depending on the actual segment completion dates, the TriMet General Manager, in consultation with the CRC Director and C-TRAN, will determine whether certain segments can be operated for either special or demonstration services. Full-revenue rail start-up will be integrated with the existing light rail system and bus service.

1.5 Operations Planning

Rail operations and maintenance plans are described below.

1.5.1 Basic Operating Plan

The basic operating plan as to through-line operations, the location of stations, headways required to carry the expected passengers, and other similar information is determined during preliminary engineering and is set forth in the FEIS. Details can be found in Appendix U – Operating Plan.

1.5.2 Rail Activation Plan

The Rail Activation Plan (RAP), consisting of the Start-up Cost Estimate, the Rail Activities Timeline and Responsibility Matrix, will define the personnel and training needs required to accomplish the start-up of the CRC light rail line, meeting objectives while maintaining existing service. Changes in the basic operating plan are expected to be made as additional information

becomes available regarding ridership levels, vehicle characteristics, legal and regulatory directions, and other factors that may affect the operation.

Rail Transportation hiring and training needs by time periods will be set forth in the RAP, including consideration of the continuation of existing service, as well as demands for supporting CRC systems testing and training.

Rail Maintenance and Facilities Maintenance hiring and training needs by time periods will be set forth in the RAP. Because of the long lead-time for filling skilled-craft positions that require apprenticeship training, hiring efforts for such positions begin from two to four years ahead of start-up. A complete timeline for support to CRC systems testing and for CRC systems training for all involved Rail Maintenance and Facilities Maintenance personnel will also be set forth in the RAP, considering sustainment of all ongoing maintenance activities in continuation of the present service.

1.6 Operations Staffing

Since the CRC light rail line will be physically and operationally an extension of the existing light rail system in Portland, staffing of functions for train operators, maintenance of LRVs, and facilities maintenance-of-way will be organized as additions to organizational units within existing TriMet and C-TRAN Operations. Personnel requirements for the start-up and operational phases will be developed as part of the RAP.

The CRC light rail line will combine with the existing light rail system and will function as a fully integrated system. Operations personnel, particularly maintainers and train operators, required for the CRC line will be at least partly drawn from existing personnel. New personnel—whether from outside the District or from TriMet’s Bus Operations—will augment existing personnel. Training programs will be developed that recognize the needs of both new and existing personnel for both the new and existing lines.

Generally, the CRC Program’s portion of the combined light rail operations will be aligned under existing management positions for the vehicle maintenance, facilities maintenance-of-way, and rail transportation functions.

Actual hiring practices for the new positions and all training/retraining practices are subject to collective bargaining agreements. Staff hiring will follow standard procedures as identified in current TriMet personnel policies and procedures. Operations staffing must be available to respond to the needs of the Start-up Plan and Schedule. Key activities include:

- Completion of facility modifications in time to accept delivery of the new LRVs;
- Acceptance of the new LRVs;
- System verification testing;
- Operational Safety and Security Certification components; and
- Simulated or pre-revenue service.

1.7 Operations Training

During the start-up phase, an outline of the education and training program for the TriMet and C-TRAN Operations staff will be developed through a combined effort of suppliers, vendors, consultants, and the TriMet/C-TRAN training staff. The training program will ensure all operations personnel are cross-trained for both existing service and new system components. The training will also reinforce for trainees the importance of the safety of the system to TriMet and C-TRAN staff as well as the public.

TriMet has in place training programs for all rail operations, rail transportation, and maintenance personnel. These training programs will be updated based on recent experience and modified to include any new or unique CRC line features. Specific course requirements, lesson plans, and detailed training materials for the CRC line will be created by TriMet and C-TRAN training staff with support from the CRC engineering staff, equipment suppliers and contractors, and engineering consultants. The training program will be finalized and ready to support the testing and start-up efforts.

Most systems contracts will contain a “train the trainer” program to educate TriMet and C-TRAN supervisory personnel in all details related to the safe operations and maintenance of their respective equipment. Supervisory personnel, initially trained by the contractor, will train other TriMet and C-TRAN personnel who are operating and maintaining equipment related to their disciplines.

Any training provided by contractors or suppliers as requirements of each contract will be the responsibility of that contractor, and coordinated and monitored by the Project Engineer. The training program will include, at a minimum, training manuals and instructor workbooks, and will focus on equipment and components that are new to the TriMet system. TriMet and C-TRAN will be responsible for maintaining and updating the training programs following the completion of initial contractor training.

1.7.1 Contractor-Provided Training and Manuals

The contractor will develop training courses and class schedules, as well as all other appropriate manuals and training materials, for approval by TriMet and C-TRAN. Emphasis will be on components from the CRC Program that are new to the TriMet system. Included as part of the training and materials will be sample lessons, proposed training aids, hours of instruction to be provided, and a preliminary training schedule. Sign-in sheets will document trainee attendance. Elements of contractor-provided training and manuals may include, but are not limited to, the subject matter described below. Detailed requirements will be contained within the technical specifications.

Training Manuals

For components that are new to the TriMet system, contractors and suppliers will provide training manuals that will present a step-by-step introduction to equipment functions and operation, including basic safety and other design principles on which the system is based. These manuals will be suitable for use in the contractor-run training program and for future staff training by the District.

Maintenance Manuals

Maintenance manuals will be provided for components that are new to the TriMet system that detail procedures for all aspects of servicing, adjusting, testing, and repair. They will cover all levels of maintenance from field adjustment and test and component replacement to shop adjustment, overhaul, and testing of components or apparatus. The manuals will contain systematic failure isolation procedures.

Standard manufacturer maintenance instructions may be used for individual components or equipment, however specific instructions and additional details in an operations and maintenance manual form will be provided for the integration of overall system maintenance.

Light Rail Vehicle Training

The light rail vehicle supplier will be required to provide TriMet with an educational program to ensure satisfactory use, service, and maintenance of equipment furnished. The educational program will be designed for trainees having no prior knowledge of light rail vehicles or their features, and will bring trainees to a level of knowledge sufficient to ensure employee safety and knowledgeable performance of vehicle operations and maintenance. Training will be provided for three categories of personnel:

1. Engineering and Administrative personnel;
2. Maintenance personnel; and
3. Train operating personnel.

Contractor-provided instructions must include physical analysis and functioning of the equipment under discussion, but also the essentials of routine maintenance, including lubrication schedules, maintenance materials, and maintenance methods and procedures where applicable. The contractor's recommendations for test frequency, limits, and methods, including instruments required, will be covered in detail where applicable. When methods of access, removal, dismantling, or application are not self-evident, the instructions will cover these matters. Overhaul procedures are required, since they are to be supplied in detailed maintenance manuals.

Traction Electrification System (TES) Training

The contractor will provide a training program to ensure satisfactory inspection, use, servicing, and maintenance of the TES. The program will include:

- Substation training demonstrating equipment operation, inspection, routine maintenance, TES test procedures, switching, emergency operations, and safety procedures;
- Overhead line training demonstrating handling and making safe downed wires, emergency and permanent repair for every type of overhead line construction used in the light rail system, routine and surprise inspection procedures, identification of overhead line materials and tools, and safety procedures; and

- Return circuit training demonstrating description of problems, inspection procedures, identification of return circuit materials and equipment, and safety procedures.

Signal System Training

The contractor will provide a training program to ensure satisfactory inspection, use, servicing and maintenance of the signal system. The program will include:

- A thorough explanation of the function of the system and the basic safety principles involved, its various safety features, and the basic levels of required maintenance;
- Detailed instruction on all special maintenance functions required: relay test and adjustment, switch mechanism and adjustment, track circuit maintenance and adjustment, and highway crossing protection equipment maintenance and adjustment; and
- Hands-on experience with maintenance and adjustment of equipment, including participation in simulated installation and preliminary testing and actual adjustment where possible.

Fare Equipment Training

The contractor will prepare instruction programs and materials and provide instruction in the operation and maintenance of the fare collection equipment. The training anticipated is for:

- Revenue service personnel to collect monies, replenish ticket stock and change, and accumulate record data;
- Maintenance personnel to perform scheduled maintenance and equipment field repairs; and
- Shop personnel to perform detailed overhaul and repair of components.

Shop Equipment Training

Any equipment manufacturers or suppliers will provide initial operation and maintenance instruction to appropriate LRT maintenance personnel for equipment, such as car washer equipment, jacks, and turntables. Operating, maintenance, and spare parts manuals must be provided for all equipment.

Non-Revenue Equipment Training

The supplier will provide a complete training program for appropriate maintenance personnel. The training program will include operation instructions of the equipment and all appurtenances specified. In addition, the supplier will be notified prior to the date training is to be performed. This general training requirement should apply to equipment such as line trucks, car mover (e.g., Unimog or Trackmobile), forklifts, hi-rail vehicles, autos, vans, lawn mowers, and snow blowers. Contractors outside the District may maintain this equipment.

1.7.2 TriMet Provided Training

Rail Transportation Training

The training program for the CRC line operations will include both classroom and field work for all controllers, supervisors, and train operators. Principal reference documents that will be used for the controller, supervisor, and operator training courses are TriMet's *Rail Operations Rule Book* and *Rail Standard Operating Procedures*. Additional training materials will be identified and obtained as necessary. Course descriptions, lesson plans, and related detailed training materials will be developed and documented by TriMet operations management.

Rail Vehicle Maintenance Training

Maintenance personnel will be trained to maintain and operate the vehicles and facilities during delivery, initial testing, and burn-in operations. The vehicle mechanic group will also perform vehicle inspections, operate test vehicles as required, set up and use shop equipment, and perform other related functions. These personnel will be involved in car maintenance, testing, and modification as much as possible while working side-by-side with the car supplier's personnel.

Maintenance training will be provided through specialized courses prepared and conducted by equipment manufacturers and suppliers in accordance with the contract provisions. This training will include both classroom instruction and on-the-job training. Additional training to supplement contract training and for ongoing maintenance functions not covered by contractor training is TriMet's responsibility.

Track Maintenance Training

TriMet will update its training course for track maintenance personnel as necessary to incorporate the CRC line's system requirements. The courses must cover all aspects of track and special work, inspection requirements, and repair procedures for all the various rail and track components used in the rail system, with emphasis on components that may be new to the existing TriMet system.

The training course must include review of proper methods of track and switch inspection; Federal Railroad Administration, Association of American Railroads, and American Public Transit Association standards; gauging; tie renewal; paving; and safety precautions. Discussions of the specialized requirements for rail construction and maintenance on an electrified transit system using running rails for return circuits and track circuit signal control must be included. Written and practical demonstration will be developed for certification.

Other Training as Required

As the LRT design and this LRT System Testing and Start-Up Plan is further developed, additional training may requirements may be identified, for which training plans and procedures will be developed.

1.7.3 CRC Alignment Systems Training

A CRC light rail line systems training program will be developed for all TriMet and C-TRAN Operations and selected other employees to enable them to function effectively and safely within the system. The orientation program may include activities in the classroom and in the field.

Other agency employees and contractors who may need to work on or near the CRC line facilities or right-of-way will be required to receive training in transit safety and procedures, with emphasis on the need to notify and obtain permission before entering upon TriMet and C-TRAN property or doing any work on the system.

1.8 Spare Parts and Inventory Control

TriMet has established strict procedures for the receipt and storage of all spare parts and material procured, and these procedures will be followed on the CRC Program. The CRC Program's TSEM and Project Engineer will coordinate timing and location for receiving inspections on all incoming material and supplies. Once spare parts are delivered and accepted, the material will be securely stored and issued in accordance with TriMet inventory procedures.

All capital assets procured by TriMet are controlled and managed in accordance with the Office of Management and Budget requirements. The TriMet parts database provides automated materials management that is capable of tracking receipt of goods, inventory accounting, and procurement forecasting.

1.9 Pre-Revenue Operations

The operational testing program—including simulation of regular operations, emergency drills, and other special situations—will be scheduled well before the start of revenue service.

All TriMet rail transportation and maintenance personnel will participate in the operational testing program. For some tests, TriMet and C-TRAN bus employees will be required. Some of the tests will call upon fire, police, and other emergency responders, as well as state highway and utility personnel. Various operating situations will be simulated, and the adequacy of response relative to system security, safety of people, protection of property, and maintenance of service will be measured.

Pre-revenue testing and simulated revenue operations will be performed in accordance with the requirements specified under Section 1.2, System Testing Procedures, Analysis, and Results of this LRT System Testing and Start-Up Plan. The CRC Program's Test Program Coordinator and TriMet and C-TRAN Operations share responsibility for pre-revenue testing.

In analyzing pre-revenue performance and results, several items will be given consideration:

- Notification procedures
- Security coordination
- Central Control response
- Transportation supervisory response
- Maintenance response
- Police/fire/rescue performance

- Power sectionalization
- Performance of re-railing equipment
- Accident investigation procedures
- Simulated bus substitutions (“bus bridging”)
- Assumption of authority
- Rescue train or Hi-Rail towing dispatch
- Continuation of service
- Simulated public notification
- Single-tracking performance
- State Safety Oversight (SSO) assessment
- Emergency drills
- Safety and security certification

A baseline start-up schedule will be established based on previous start-up experience and current operations.

1.10 Crossing Order Approvals

The Transit Design Manager will coordinate with state and city agencies, including ODOT’s Rail Division and the City of Vancouver, responsible for approving and certifying certain safety elements of the LRT system, namely, railroad-type (gates and flashers) grade crossing protection equipment.

1.11 System Opening and Revenue Service

The primary goal of the system testing and start-up program is a revenue service opening that incorporates the lessons learned and builds upon the successes achieved on previous extension start-ups.

The final decision to open the extension for revenue service will be made by the TriMet General Manager in consultation with the CRC Director and C-TRAN only after assurance of the system’s safety and reliability and all necessary testing and training has been completed. That assurance is made possible by the development, implementation, and management of the system testing and start-up program and cooperation from the many departments within TriMet and C-TRAN, including but not limited to:

- Rail Transportation
- Rail Maintenance
- Capital Projects
- Safety and Security
- Treasury (fare collection)
- Human Resources (hiring and staffing)
- Information Technology
- Grants Administration
- Transportation Planning
- Marketing/Customer Services
- Elderly and Disabled Access
- Bus Operations
- Facilities
- Programs and Communications

In addition, other agencies and groups contribute as partners in completing related improvements and providing oversight throughout the new rail line's progression to start-up. This ongoing collaboration ensures the safe and timely integration of new transit services.

1.12 Operations Description

The proposed 2.9-mile CRC light rail extension will be constructed from the north terminus of the Yellow Line (Interstate MAX) at the Expo Center in North Portland to a new terminus at Central Park and Ride near Clark College in Vancouver, WA. This Yellow Line extension is currently anticipated to open in 2019.

A detailed description of the MAX service design, including this CRC Yellow Line extension, can be found in Appendix U – Operating Plan.

1.12.1 Routing and Frequencies

A detailed description of the MAX routing and frequencies, including this CRC Yellow Line extension, can be found in Appendix U – Operating Plan.

1.12.2 Travel Time and Ridership

A detailed description of the MAX travel time and ridership, including this CRC Yellow Line extension, can be found in Appendix U – Operating Plan.

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