

# Site Assessment Instrument for Regional Maintenance Center

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## **Abstract**

*To minimize maintenance cost and improve rural transit vehicles services, a Regional Maintenance Center (RMC) concept is being considered by Texas. Currently, rural transit vehicles are maintained and repaired by local garages, where service fees and quality of work performed often are questionable. RMCs are designed to maintain and repair rural transit vehicles within a geographical region. A cost-efficient method to create an RMC is by upgrading an existing maintenance operation. The objective of this study is to create a site assessment instrument to assist in the process of selecting potential maintenance operations that could be upgraded to an RMC. Upon interviewing various rural transportation experts and visiting the benchmark RMC in Illinois, a list of criteria crucial for a successful RMC was compiled and classified into various categories. The result of this benchmarking was used in a preliminary study of Lubbock County, Texas, and vicinity.*

## **Introduction**

Rural transit's role in transporting Americans has grown over the past years. The ridership in small urban and rural areas had seen an increase of 32 percent since 1990 (APTA 2003). In rural counties across the nation, 41 percent of small urban

and rural communities have no access to transit, whereas another 25 percent of the rural population resides in regions where transit services are below average (APTA 2003); approximately 1,200 public transit systems are available, which provided about 50 percent availability in public transit (Stommes and Brown 2002).

Rural transportation services consist of various programs such as rural transit, special services for the elderly and disabled, human services, and intercity bus and rail that may service rural passengers. These programs are usually funded through Federal Transit Agency Grants Section 5310, Section 5311, and the Rural Transportation Assistance Program (RTAP).

Rural transit vehicles often require frequent maintenance and repair, as rural road conditions vary greatly and are often in less-than-satisfactory condition. In an effort to minimize the maintenance and repair cost for rural transit providers, a centralized maintenance center seems to be one solution. Throughout America, only three rural transit regional maintenance centers exist, and all are located in Illinois.

To create such regional maintenance centers, a benchmark of Illinois regional maintenance centers was performed. The requirements from all aspects including personnel, equipment, preparedness, and buildings are crucial to the success of a regional maintenance center. A site assessment instrument to study and determine the viability of maintenance locations to become an RMC was created through this study. This paper discusses the work performed and the critical reasoning behind the requirements included in the site assessment instrument. This paper is organized as follows: background information, a detail discussion of the site assessment tool, result of the preliminary study, general discussion of the study, and potential future work. The site assessment instrument developed in this study is available at <http://www.depts.ttu.edu/jeweb/research/JPTv13iss12010.pdf>.

## **Project Background**

This study is part of a project commissioned by Texas Department of Transportation (TxDOT) to benchmark the RMC concept and study the feasibility of potentially implementing RMCs in Texas. Beruvides et al. (2009) provide a detailed explanation of the concept and benefits of an RMC for rural transit vehicles. The remainder of this section provides a brief description of RMCs. Beruvides et al. (2009) define an RMC as:

a centralized public transportation maintenance facility that provides general maintenance and services to rural transit providers:

- Provides preventive maintenance (PM), preventive inspection, major components repair, and replacement services to rural transit agencies that service within a designated radius rural transit agencies, counties, and/or districts of the maintenance facility.
- Provides maintenance and repair services beyond the scope that a local garage would provide.
- Provides services to specialized transit vehicles and equipment including but not limited to wheelchair lifts, electric, propane, and hybrid vehicles.
- Serves as a technical information center and provides technical expertise to rural transit agencies and other transit providers.
- Acts as a warranty recovery center for all parts and labor and possibly as a designated warranty center to work on authorized original equipment manufacturing (OEM) parts.
- Provides loaner vehicles to rural transit agencies if necessary.

To provide all the services listed above, the location of an RMC is critical for its successful operation. In addition, upgrading an existing maintenance facility is probably the most cost-efficient approach. Prior to upgrading, determining the most appropriate location and analyzing which of the existing facilities is most suitable for upgrade to an RMC is crucial. TxDOT is exploring if state DOTs can provide grants for the upgrade required for a maintenance facility to become an RMC. After the initial grant, an RMC should be self sustainable.

## **Objectives**

Creating an RMC is a hefty investment in public transportation. Though the success of any RMC is not a given, an effort to eliminate candidates that are clearly not suitable to be upgraded into an RMC is necessary to minimize the risk of failure. With 36 urban transit systems (National Transit Database 2007) and 41 rural transits systems (Turnbull et al. 1999) in operation in Texas, a selection method is required to identify maintenance operations that are most appropriate for RMC operations.

As a part of the project commissioned by TxDOT, a minimum essential specification that defines the basic requirement for an RMC facility was created. Based on

the minimum essential specifications developed, a site assessment instrument was created to assist the process of determining a transit maintenance facility's ability and desire to become a regional maintenance center. In addition, this site assessment instrument could be adapted in the future to be used as an evaluation technique for existing RMCs and their readiness to meet future growth demands.

## **Components of Site Assessment Instrument**

A site assessment instrument was developed based upon five general categories: (1) Background Information/Determining Location, (2) Requirements for a Regional Maintenance Center, (3) Technical Expertise for a Regional Maintenance Center, (4) Documentation Necessary for a Regional Maintenance Center, and (5) Future Needs for a Regional Maintenance Center. A discussion on each of the categories will be provided in the following sections. Please visit <http://www.depts.ttu.edu/iweb/research/JPTv13iss12010.pdf> for the actual site assessment instrument.

### ***Location and Basic/Background Information***

The RMC should be strategically located such that most rural transit vehicles would pass by or be in close proximity to it on a regular basis. Beruvides et al. (2009) identified the considerations for strategic RMC location as follows:

- Locate routes in close proximity to the RMC on a regular basis to facilitate vehicle repair and maintenance.
- Maximize number of rural transit agencies that could utilize and benefit from the facility.
- Minimize overlap in coverage by each RMC.
- Maximize market and population service.

The location of an RMC is the most important aspect for success because the location determines the accessibility for rural transit providers. The ideal location for an RMC will be in a hub city, where surrounding rural populations visit on a regular basis for business, medical, and leisure (shopping, sporting or cultural events etc.) purposes. The basic/background information is further divided into three categories: Facility Background, Current Operating Procedure, and Existing Facility Building Condition.

Facility Background includes the establishment date, grantee of various Federal Transit Agency grants, history of federal and state grants awarded, hours of operation, number of employees, and number of vehicles serviced. Current Operating

Procedure is further divided into two classifications: RMC and Non-RMC. Currently, there are no RMCs in Texas. The questions in this instrument for evaluating an existing RMC are intended as a validation and verification method of the instrument (i.e., benchmarking to a successful RMC, such as those in Illinois) and as a future instrument to assess the readiness of established RMCs. The common questions for both RMC and non-RMC are the advantages and disadvantages of the location, types of vehicle serviced, preventive maintenance scheduling capabilities, work scheduling capabilities, use of fleet maintenance software, and types/frequency of major repair provided/required. An existing RMC will have to provide the ratio of urban to rural populations serviced, number of counties serviced, current clients list, and vehicle information; non-RMC will have to provide the most frequent destinations of rural riders they service and the visit frequency on a weekly basis.

The last category assesses existing building conditions, which include the construction year; square footage; building material; building details such as bay doors, washing bays, parking availability, etc.; and any known major problems such as structural, plumbing, and electrical problems. The purpose of this category is to assess the current condition and efficiency of the existing maintenance process. For example, the ratio of mechanics to number of vehicles serviced could reveal the efficiency of the maintenance operations. The most frequented locations by various providers could reveal a potential RMC location that might be overlooked. The existing maintenance and work scheduling practice and the utilization of fleet maintenance software will reveal the existing administrative capabilities. An assessment of the potential investments needed in administrative training, if the facility is chosen to be an RMC, could and should be conducted.

## **Requirements for a Regional Maintenance Center**

The category “Requirements for an RMC” consists of requirements that are not organized into other categories. This category assesses the current maintenance practices in the facility and inventories the equipment that the facility owns. As a maintenance facility for a larger transit provider, the facility should have some form of historical data on their preventive maintenance program and safety inspection procedure for all the vehicles maintained by the facility. In addition, the equipment and tools that a facility owns define the repair capabilities of the facility.

The “Existing Maintenance Practice” category consists of the preventive maintenance program and safety inspection. Potential RMC facilities to be surveyed will have to describe the current preventive maintenance program in details, which includes preventive maintenance procedures and safety inspection procedures. The existing preventive maintenance program is indicative of the transit agency’s general administrative practices and will expose any potential problems if the facility were to be upgraded to an RMC. For example, an agency that does not have a sound preventive maintenance program already in place implies that the agency places lower priority on preventive maintenance. The agency’s mission is thus not consistent with the mission of an RMC. Upgrading the facility might entail additional cost and effort in aligning management’s approach with the RMC’s mission.

An inventory of all equipment will provide the analyst an estimate on the amount of investment required for the upgrade. In addition, a list of existing equipment in the maintenance facility will reveal the types of repair that the existing facility could provide and the extent of the repair services.

### **Technical Expertise for a Regional Maintenance Center**

One of the main functions of an RMC is to provide technical expertise to rural transit providers. With the maintenance and repair services that an RMC provides, RMC mechanics should have higher technical expertise compared to local garages. In addition, administrative personnel should have a basic understanding of the repair and maintenance procedure in order to provide high-quality customer service when interacting with rural transit providers. This section of the site assessment instrument examines the human resources capabilities, specifically, mechanics, administrative personnel, and non-technical personnel.

The general questions in this category are the availability of continuous education for employees, availability of in-house training, recommended/required professional certification, employee turnover rates, and any plan to address the turnover problem, if present. Mechanics’ abilities are highly related to years of experience, as are mechanics classifications (Peters 2007). This part of the assessment also requires the transit agency to describe the classification method and number of technicians per classification being used by the facility.

Information collected enables the analyst to project the maximum capacity of a facility to handle the potential workload increases and/or projects and the num-

ber of additional mechanics and administrative personnel needed. For example, a high turnover rate implies that human resource management requires improvement. The turnover rate and existing in-house training program will reveal the potential cost to recruit and train new employees or to develop an employee retention program.

## **Documentation for a Regional Maintenance Center**

Good documentation practices allows the transit agency to keep track of the age, condition, and maintenance requirements of each vehicle, the ability to provide sufficient documentation to recover the warranty for defective parts, assess the performance of the facility and individual employees, evaluate the workplace safety level, and conduct better inventory management. Documentation could be accomplished through written records or the use of a software package. This section of the site assessment instrument studies the documentation practices on vehicle records, warranty recovery records, performance measurement records, workplace safety records, and inventory tracking practice.

Keeping record of each vehicle and the history of all maintenance and repairs performed on the vehicle is important as this will ensure that each vehicle gets the preventive maintenance and safety inspection when necessary. This also allows the transit agency to project vehicle life, estimate potential replacements required, incorporate vehicle replacement in the annual budget, and address the possibility of obtaining federal or state grants for the replacement. Additionally, successful warranty recovery is highly dependent on documentation that an agency provides, for example, the mileage of a vehicle when a part failed and the installation date of a particular part that failed. Proper and timely documentation is crucial in the success of recovering warranty for defective parts (Van Sickel et al. 1997).

A record of all assets and inventories in the facilities provides a method to track and replenish inventories on time and thus provide good service to clients. The inventory reordering policy is highly related to documentation as well. With the performance measurement system and historical data that the maintenance facility provides, analysts can evaluate the accuracy and effectiveness of the existing performance system.

## **Future Needs for a Regional Maintenance Center**

Any RMC is expected to expand over time with the growth of rural transit ridership. The capability to expand and grow is important in assessing the potential of each facility to become an RMC. The ideal RMC should have the capability to provide a vehicle loaner program and road call and wrecker services to rural clients. This section of the site assessment instrument explores the readiness of a facility to incorporate a vehicle loaner program, road call service, and wrecker service. General questions include any foreseeable problems or anticipated problems if vehicle loaner, road call, and wrecker services were to be incorporated into the facility, and additional equipment and vehicles that will be required to provide such services. Other questions address the risk of providing a vehicle loaner program and the cost sharing issues to provide loaner vehicles, road calls, and wrecker services.

## **Preliminary Study**

The site assessment instrument developed in this study can be conducted in two ways: the analyst is present and conducts the interview with a representative of the maintenance facility, or the questionnaire is given to the maintenance facility to complete on their own and the analyst reviews and evaluates the completed questionnaire. In this preliminary study, analysts were present and conducted the interviews with a representative from various transit agencies. Three transit agencies in Lubbock and its vicinity were interviewed to conduct the preliminary pilot site assessment.

### ***Citibus***

Citibus owns a fully-equipped, centralized maintenance facility in downtown Lubbock, Texas. The maintenance facility is located in a 20,000 sq ft building built in 1932 and last remodeled in 1981. Citibus services 64 buses, 28 paratransit vans, 7 supervisor vans, 4 cars, 3 service trucks, and 4 trolleys. The maintenance facility consists of 10 mechanics of various classifications and experience, and a training program (apprentice program) is provided to all newly-hired mechanics. The most frequent and major repairs performed by Citibus are air conditioning and brake systems. Citibus uses iMaint™ software to manage inventory control, preventive maintenance records, and other documentation. It is estimated that with the existing number of mechanics and amount of building space available, Citibus could service up to 200 vehicles per month. If expansion is required, Citibus could purchase an adjacent building and close a side street. The initial result of the site assessment showed that Citibus would be an ideal candidate to become an RMC.



### ***South Plains Area Rural Transportation Assistance Network (SPARTAN)***

The South Plains Area Rural Transportation Assistance Network (SPARTAN) is located in Levelland and provides services for the elderly, handicapped, and general public in 11 counties: Bailey, Cochran, Garza, Hockley, Lamb, Lubbock, Lynn, Mitchell, Scurry, Terry, and Yoakum. SPARTAN has 32 vehicles, 10 of which run on propane gas. A frequent destination for SPARTAN riders is Lubbock. SPARTAN does not perform any in-house vehicle maintenance and repair, but it does perform pre-trip and post-trip inspections. The 10 propane vehicles require certified technicians to perform maintenance, with the closest certified mechanics located in Lubbock, which is 31 miles away. Major repairs on SPARTAN vehicles are related to brakes systems, wheels, and repair of propane vehicles. SPARTAN outsources the repair and maintenance to local garages or vehicle dealers. Initial site assessment showed that SPARTAN is neither ready nor suitable to be upgraded into an RMC for several reasons. SPARTAN is located in a small town, and there is not enough transit activity nor the technical expertise at this time to justify the investment. However, SPARTAN expressed interest and enthusiasm in using an RMC if one exists in the West Texas region.

### ***Caprock Community Action Agency (Cap-Trans)***

Caprock Community Action Agency (Cap-Trans) is located in Crosbyton and provides rural transportation services to six counties: Crosby, Floyd, Dickens, Hale, Motley and King. Cap-Trans provides three types of services: fixed route, dialysis route, and paratransit. Cap-Trans has 24 vehicles in service, and frequent destinations are Plainview and Lubbock for medical services. Cap-Trans does not perform any in-house maintenance and does not have a facility to perform such activities. All maintenance and repairs are outsourced to local garages. Major repairs for Cap-Trans' vehicles include propane van repair and wheelchair lifts. Cap-Trans expressed interest in using an RMC if one is established in the West Texas region.

## **Discussion**

Upon completing the preliminary studies, several inadequacies in the site assessment instrument were addressed. The first version of the site assessment instrument consisted of 151 questions, divided into 7 sub-categories. The revised version consists of 138 questions, divided into 15 sub-categories. This reduction/reorganization of questions and sections was a result of working with rural transit providers and maintenance providers to streamline the assessment process.

The following sections discuss the revisions to the site assessment instrument, the limitations of the instrument, future work required for the site assessment instrument, and potential applications and knowledge sharing from this study.

## **Revisions**

A major revision to the Documentation section was made after the preliminary study. The first version of the site assessment instrument grouped vehicle records practice, warranty recovery practice, inventory control, performance measurement systems, and workplace safety into one category under Documentation. While performing the preliminary site assessment, the analysts encountered problems in actually obtaining all the information required, and some information was not required for the assessment. Due to the lessons learned in applying the initial instruments, each activity that requires documentation is now addressed as a separate category.

The Future Need for an RMC section was expanded to include road call service and wrecker service, rather than grouping all the future needs into one cluster. Through the initial site assessment, one of the maintenance facilities informed the interviewer that road call service was already in use at their facility. This implied that some maintenance facilities might be well advanced in meeting RMC requirements. By including vehicle loaner program, road call, and wrecker service together, the initial site assessment instrument failed to cover all the different operating procedures and policies and, thus, this was addressed in the revision.

## **Limitations**

This site assessment instrument was developed to assess the existing condition of a maintenance facility for suitability to convert to an RMC. Due to the nature of the design, this site assessment instrument is not recommended to be used as a routine assessment instrument, though with alterations it could be modified as a readiness assessment instrument. Used as a routine assessment instrument, the site assessment lacks the capability to track the differences or the changes over time.

To select a maintenance facility to be upgraded to an RMC or to create an RMC, the site assessment instrument alone is insufficient to ensure the successful selection of an RMC. This site assessment instrument has to be coupled with an economic analysis model that assesses the financial readiness and uncover poten-

tial financial peculiarities of any RMC candidate. Using both the site assessment instrument and the economic analysis model will ensure the selection of an RMC candidate that has the highest probability of success.

## **Future Work**

The site assessment instrument for determination of an RMC is a part of a larger study commissioned by the Texas Department of Transportation. To successfully create an RMC for rural transit vehicles, three aspects of an RMC must be explored and studied in detail. The overall concept of RMCs was introduced and explained in detail by Beruvides et al. (2009) in this journal. This paper explores the importance of the RMC selection process and creates a site assessment instrument to assist in the selection process. The financial aspect of creating an RMC is the final and possibly most important part determining if and where an RMC should be developed. The following section will discuss future work required to complete the RMC study.

## **Site Assessment Instrument**

The next steps for improving the site assessment instrument would be the development of a weighting scale for the various sections and a rating system with various subject matter experts. This would allow a numerical/quantitative summary score that could be applied objectively to assess a rural transit agency's capability to become a regional maintenance operation. The ideal method is to develop weights for each category and then perform a site assessment on existing RMCs (such as the ones located in Illinois) and then develop the appropriate weights based on the successful operation.

The need exists for a tool to serve as an assessment instrument of existing RMCs, such as those in Illinois. After the formal analysis using this site assessment instrument, discussions with Illinois RMC directors will be beneficial. Any shortcomings of this site assessment instrument to assess important aspects of a successful RMC could be identified and incorporated into the next revision of this instrument.

The site assessment instrument developed in this study could be modified to incorporate measurement of changes over time for routine performance evaluation. A method to chart progress over time could be incorporated into the site assessment instrument for the purpose of tracking the progress of any implementation done at the facility.

## **Economic Analysis for RMC**

A preliminary study on the economic factors that are crucial to the success of an RMC is discussed in detail by Beruvides et al. (2008). The ultimate economic goal of an RMC is to be self-sustainable after the initial investment to commence operations. The preliminary economic modeling conducted by Beruvides et al. (2008) discussed the factors to be considered in forecasting the financial performance of RMC candidates based on workload capacity and cost factors. The economic model will consist of various modules that address different economic aspects of an RMC. The analyst could disable modules that do not apply to the situation at hand.

Workload capacity includes factors such as existing workload and surrounding rural transit agencies' existing number of vehicles and condition. These factors will then be used to forecast the maintenance demand on the RMC and capacity and personnel required to meet the demand. Cost factors include capital investment, startup cost, operating expenses, revenue for the RMC, and savings realized by rural transit agencies using the RMC. Following the forecasts on workload and costs, engineering economic analyses such as breakeven analysis, benefit-cost ratio analysis, rate of return analysis and payback period analysis, and a sensitivity analysis will be performed. Recommendations will be provided based on the site assessment instrument and the economic evaluations.

Each RMC is unique. The financial performance of one RMC maybe different from another. The initial investment for each RMC will be different as well, depending on whether the RMC is an upgrade from an existing maintenance facility or a new operation. The economic model that will be created will be a generic model that allows analysts to input information and customize the model if required.

One important question that state DOTs interested in creating an RMC will raise is defining the radius (distance) or coverage area that an RMC would serve. The economic model addresses the distance on a case-by-case basis. The type of repair required, the cost to the repair location, the distance to the closest RMC, the number of days required for repair, and loaner vehicle usage will be considered in the economic analysis, and the model will identify the alternative with the lowest cost.

## **Conclusions**

The site assessment instrument developed in this study requires some future work and refinements. Once completed, this instrument could be used in a variety of ways, including use by other states that are interested in creating centers similar to the RMC concept. In addition, this instrument could be modified and used to assess other major transportation related facilities. Considering the increasing cost that maintenance operations are exerting on organizations (profit, non-profit, and governmental), an instrument like this could prove to be vital in managing these operations.

Illinois DOT created RMCs in response to the need for reliable maintenance and repair for rural transit agencies. Tools and instruments to select RMCs such as a site assessment tool and economic analysis model were not available at that time. This study provides a tool that could assist other state DOTs interested in the RMC concept to explore and potentially implement this maintenance concept in their state. The culmination of information that this study provides will not ensure the success of any RMC but will eliminate candidates that are not suitable and reduce the risk of such investment.

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