Impact of Maintenance Training on Florida's Transit Providers

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PREFACE

The Center for Urban Transportation Research (CUTR) has contracted with the Florida Department of Transportation (FDOT) to research the impact of maintenance training on Florida's public transportation providers. This project was funded by FDOT's "Research Ideas" and managed by the Public Transportation Office of FDOT.

CHAPTER ONE
INTRODUCTION

As the transit industry moves ahead into the 21st Century, four main issues are emerging in maintenance departments: a dramatic increase in new technologies in the vehicles themselves and the diagnostics and tools used to repair them; a number of new external regulations addressing environmental and access issues; an increase in focus on vehicle safety, and the need to attract new and retain existing talent in the industry. All of these issues point to a need for an increased focus on training in transit maintenance departments.

In response to the growing need for maintenance training, the Florida Department of Transportation (FDOT) developed the Florida Maintenance Training Program (FMTP) in 1990. This innovative program, administered since its inception by the Center for Urban Transportation Research (CUTR), provides maintenance training to all of Florida's public transportation providers as a partial solution to maintenance training needs. The program has been well received and supported by FDOT officials, maintenance managers, maintenance technicians, and public transit general managers. It is credited by transit managers and FDOT officials with reducing maintenance expenses by honing the skills of technicians and increasing the accuracy of repairs and the safety of transit fleets.

While the need for maintenance training has been clearly identified, increased scrutiny of operating expenses by transit administrators has left transit maintenance managers with a two-sided task - to obtain funding for internal training activities, while justifying that such an investment is worthwhile and increases system efficiency. The same task is at hand for state officials investing in consortium training programs. This two-part task requires that transit maintenance departments and others who support maintenance training have methodologies in place to evaluate and monitor the success of their programs.

Using the FMTP participants as case studies, the research for this report addresses how statewide training programs and internal training efforts are actually increasing efficiency and reducing maintenance costs among Florida's transit properties. Furthermore, this presents a methodology for public transportation providers and those funding statewide training programs to evaluate and monitor the expenditures for and the benefits of maintenance training. This report presents the methodology, its development, and the results of its application in the Florida case studies.

This report is organized into seven chapters that document the research accomplished, the results from the analysis, and recommendations and issues to be addressed resulting from the research. The chapters are organized as follows:

- Chapter One: Introduction
- Chapter Two: Description of the Florida Maintenance Training Program
- Chapter Three: General Literature on Training Evaluation
- Chapter Four: Methodology for Analyzing Impacts
- Chapter Five: Results from Qualitative Data Analysis
- Chapter Six: Results from Quantitative Data Analysis
- Chapter Seven: Conclusions and Recommendations

CHAPTER TWO
DESCRIPTION OF FLORIDA MAINTENANCE TRAINING PROGRAM

The Florida Maintenance Training Program (FMTP) began in 1990, with a joint participation agreement between the Florida Department of Transportation (FDOT) and the Center for Urban Transportation Research (CUTR). The agreement set into place a new concept for Florida's public transportation providers - consortium training.

Born from the need to provide Florida's maintenance technicians with more current and advanced training, the FMTP immediately set out to establish ongoing training with both classroom and hands-on components, a resource center of training programs and materials, and communication channels among maintenance managers.

Training needs are determined by a quarterly survey of all maintenance managers in the state. From the needs identified in these surveys, a Request for Proposal (RFP) for various courses is produced, and independent training consultants and firms submit proposals for courses. After training contractors are selected, a training schedule is developed, with courses being hosted at various transit properties around the state. The schedule is mailed to each maintenance department, posted on the FMTP web site, and included in the quarterly newsletter.

Maintenance managers share the schedule with their technicians, and through varying methods on each property, select technicians to attend needed training. Travel costs (travel, housing, and food) for class participants is paid for through the FMTP program. The labor hour cost is covered by the participating property. Courses run from two to five days, depending on the topic.

The evaluation process is multi-tiered. Technicians are surveyed at the end of the class to gather information on the quality of instruction, materials, and the overall usefulness of information presented. A pre- and post-class test is administered to each technician to determine individual progress. If the technician scores high enough on the post-test, he is certified as having "completed" the course.

Course records, including which properties and technicians attended, pre-and post- test scores, and all after-class survey results, are kept in the FMTP resource center at CUTR. Each individual property also maintains records on training received by their technicians. The annual bus roadeo, a competition for transit technicians on major component repair, driving skills, and written maintenance knowledge, is another tool used to evaluate the effects of increased technician training. A positive correlation has formed between those properties who have

participated more actively in the FMTP and those who place consistently higher at the annual competitions.

Oversight of the FMTP is conducted by an appointed advisory committee. Members include representatives from at least five maintenance departments around the state and representatives from CUTR and FDOT. At least two members rotate off the committee each year on a staggered basis. This committee oversees the RFP training contractor selection process and generally guides the direction of the training program. In addition, the committee is also directly involved in the wide variety of public transit maintenance issues the FMTP addresses on an ongoing basis. They have guided the FMTP staff in development of communication tools to support training efforts such as a website and quarterly newsletters. The committee has also consulted on related research projects undertaken by FMTP staff looking at issues such as time standards in maintenance facilities and the future of hiring transit technicians.

Other activities of the FMTP include publication of a quarterly newsletter, distributed to maintenance technicians and managers in the state, state officials, and others interested in maintenance training nationally. The program also maintains a web site to aid in increasing communication between transit maintenance professionals, and a list-serve established for the same purpose. The program resource center at CUTR also keeps an up-to-date equipment and inventory list for each of Florida's public transit maintenance departments, which aids in determining future training needs.

CHAPTER THREE
GENERAL LITERATURE ON TRAINING EVALUATION

Before beginning an evaluation of Florida's Maintenance Training Program for transit technicians it was necessary to discover other research that has been completed on the topic.

Although literature exists on general training topics, literature focused specifically on the transit maintenance industry and evaluation of that industry is scarce. Most of the information available focuses on management training, which addresses only one factor in overall efficiency and productivity in maintenance departments.

The existing literature clearly identifies a rising need for transit maintenance training. With rapid changes in the nature of vehicle maintenance, keeping up with the latest technologies (such as multiplexing and electronic diagnostics), the need for a major commitment to training has been clearly identified at the local, state, and even federal levels. In addition to the rising skills gap, revised state and federal regulations concerning the attainment of environmental standards, access to transportation for persons with disabilities, and an increased focus on alternative fuels also highlight the need for an increased focus on maintenance training.

Shared or consortium training has been identified as a potential solution for transit maintenance departments who do not have sufficient resources for effective internal training activities. However, the lack of formal internal training programs is identified by much of the literature as a serious roadblock for closing the knowledge gap and attracting new talent to the transit maintenance field. A need is evident, therefore, for a combination of internal and external training efforts to increase efficiency.

Of the three phases of training (needs assessment, training design, and evaluation), it is evaluation that has been the greatest obstacle to overcome in transit maintenance departments. The impact of maintenance training on expenses and employee retention has proven to be difficult to measure. Training evaluation is most often employee-centered, focusing on the effects training has had on an individual. Until this study, little to no work had been done to assess the group or organization-centered advantages of maintenance training.

The effect of this gap is obvious: evidence is needed that shows the tangible benefits of maintenance training, and to justify increasing expenditures on training programs, whether by individual transit properties, state programs, or federal financial support. Although the case has been made in the literature for the need of such training, and maintenance managers generally support the idea of increased training, convincing a wider audience to support the development of maintenance training programs is difficult without clear quantitative evidence of the benefits.

CHAPTER FOUR
METHODOLOGY FOR ANALYZING IMPACTS

The first step in evaluating the impacts of maintenance training is to determine what the potential impacts of training are. Potential impacts could include decreased labor and parts costs, increased employee satisfaction and retention, increased safety, and decreased service interruptions. Information to measure these impacts can be collected from a variety of sources such as pre- and post-training tests, National Transit Database (NTD) reports, data pulled from transit provider management information systems, interviews with maintenance managers, and employee surveys.

To evaluate the impacts that have occurred, the project first developed a process or methodology to examine data and information from selected public transportation providers who already participate in the statewide training program. Fourteen public transportation providers were chosen to be included in the analysis. Quantitative and qualitative data and information were then gathered from each of the fourteen case studies. The following are descriptions of the types of data that were collected from each public transportation provider included in the analysis.

QUANTITATIVE DATA

The goal of using quantitative data to evaluate the impact of training is to establish whether changes over time in costs, safety, and decreases in absenteeism and turnover, etc. can be partially attributed to the maintenance training that a transit maintenance technician has received. Records of training (both through the statewide program and through internal training) are needed for the same years as historical quantitative data. The following is a description of the quantitative data sources that were collected.

Pre- and Post-Training Test Results

As part of every training course coordinated through the Florida Maintenance Training Program, pre-training and post-training tests are administered to every participant. These tests were created to measure the retention of knowledge related to the specific instruction in each course. The scores from these tests are valuable to determine the immediate impact of training on a technician's knowledge of a specific activity. However, test scores do not measure the transference of that knowledge to increased job effectiveness. Other sources of data are needed to measure training's influence on system effectiveness.

National Transit Database Reports

National Transit Database (NTD) reports from individual transit properties are good sources of general information to determine general operating characteristics such as:

- annual maintenance cost per vehicle mile
- maintenance labor cost per vehicle mile
- parts cost per vehicle mile
- vehicle miles between road calls
- annual fuel efficiency
- spare ratio

The advantages of using NTD data is the consistency of information across transit properties. This is useful when an evaluation of the impact of training is being made on a statewide basis. However, the major disadvantage of relying solely on NTD data is that it is very general information that is collected only annually. Therefore, using only NTD data would not be appropriate for the evaluation of a single transportation provider. More detailed information would be required.

Cost Data from Management Information Systems

A more detailed source of quantitative information for public transportation providers is their own individualized records of maintenance activities. All transit agency maintenance departments track maintenance and repair activities for their fleet. The methods by which these records are maintained by maintenance departments range from simple spreadsheets to customized management information systems. These systems commonly contain maintenance and repair information for all vehicles contained in a public transportation fleet.

The main advantage of this type of data is the detail that it can provide. Cost data for major vehicle systems can easily be extracted and compared to training received in particular areas. For example, if technicians at a particular property have received extensive training in air-conditioning preventive maintenance and repair, this could be compared with the historical trend in overall air-conditioning repair costs.

The main disadvantage of relying on this data, however, is the inconsistency of information when comparing different properties. Of the fourteen properties included in the Florida analysis, fourteen different methodologies of tracking fleet maintenance records were employed. Differences included software, cost categories, and internal reporting requirements.

QUALITATIVE DATA

Limitations of quantitative data require the collection of qualitative data to evaluate the effect of maintenance training on public transportation providers. Qualitative data can support, supplement, and help explain quantitative information. The following are the sources of qualitative data that were employed in this study.

Interviews with Transit Maintenance Managers

CUTR interviewed all of the maintenance managers of the transit properties included in the study. The main purpose of the interviews was to record their perceptions of the value of training for maintenance technicians. Issues that were addressed include training's impact on maintenance costs, safety, employee turnover, and employee satisfaction. Maintenance managers were also questioned on other factors that could affect the operating environment of a transit agency including changes in maintenance technology, changes in bus fleet technology, and changes in management.

Employee Surveys

To measure the perceptions of the individuals directly receiving training, an employee survey was administered to all maintenance technicians employed by the public transportation providers included in the study. The questions in the survey addressed the following topics:

- level of participation in training courses
- perceived effectiveness of training
- perceived need for additional training
- level of satisfaction with training

The main goal of the employee survey was to determine if training or the availability of training contributes to overall job satisfaction.

CHAPTER FIVE
RESULTS FROM QUALITATIVE DATA

In order to determine the overall effectiveness of maintenance training, qualitative information was collected from each of the agencies targeted in the study. This information was gathered through interviews with maintenance managers and supervisors, and through a blind survey distributed to technicians in all locations.

INTERVIEWS WITH MAINTENANCE MANAGERS

Interviews with managers and supervisors were loosely structured. A set of open-ended questions were asked of each manager or supervisor to guide the discussion, but interviewees were encouraged to discuss those issues or perceptions most important to them. The discussions focused on internal training efforts; issues of record keeping; non-training factors affecting maintenance efficiency, such as changes in management, experience level of employees, perceptions on training's effect on attendance and turnover; and the impact of new technologies in vehicles and in maintenance equipment.

Big Bend Transit (Tallahassee, Florida)

Big Bend Transit was the smallest agency included in this survey. Their maintenance staff consists of three technicians, one part-time and two full-time. Their in-house training efforts are usually informal and done on an as-needed basis, although some more structured internal training efforts have been developed recently by the Director of Maintenance. New employees work closely with more experienced technicians to gain skills.

They do not employ a maintenance trainer, and any training expenses incurred come from the overall maintenance budget. Vendor training is utilized, especially for wheelchair lifts. Because their staff is small, sending a technician to training outside the facility is difficult. Despite this, Big Bend has participated in the Florida Maintenance Training Program for several years. It has provided a way for technicians to be trained in major repair areas and in new technology with limited resources.

RTS software is used to track maintenance expenses. The Director of Maintenance is able to periodically assess major costs and ways to reduce these costs with the information RTS provides. Big Bend management has been supportive of maintenance training efforts, and has never questioned any training expenses paid for from the maintenance budget.

The average fleet age has not changed significantly over the time corresponding to the quantitative data collected. The most significant change in technology for the shop has been in wheelchair lifts, and vendor training has enabled technicians to adjust to this.

Overall, the Director of Maintenance felt that training, especially consortium training, is beneficial for smaller agencies. He stressed one major impediment to participation in this type of training, however: difficulty covering the gap created when a technician is attending training.

Broward County Transit Division (Ft. Lauderdale, Florida)

Broward County Transit Division (BCT) provides transit services for a large metropolitan area. They provide internal training opportunities and have also participated in the state-wide training program.

Until 1997, BCT relied solely on vendor classes for their internal training needs. Since then, a training officer was appointed. Recently, a maintenance training committee was formed to oversee training activities. The committee includes the Maintenance Manager, the training officer, two maintenance supervisors, and a union representative from both the technicians' and supervisors' unions. This committee produces the monthly internal training schedule. Which technicians receive training is determined by the committee, and is based on their skill level and performance.

Funding for this internal training comes from the general maintenance training budget. There are no dedicated funds or a budget line item for training. Agency management has been very supportive of new internal training initiatives, but funding is subject to county rules. Funding specifically marked for maintenance training has been extremely difficult for the transit agency to procure.

At the time of the interview, BCT was in the process of changing their maintenance record keeping system. Previously, maintenance costs and work order records were kept in Transit Management Information Systems (TMIS) software. In this system, tracking costs and generating cost reports based on specific repair codes, parts costs, and labor hours used is difficult, and according to the Maintenance Manager, often inaccurate. Because of these factors, quantitative information from BCT is not included in this project. It is anticipated that the new system, TechSpace, will improve record keeping efficiency.

According to the Maintenance Manager, new technology has not significantly reduced maintenance costs. New vehicles present more complicated problems for technicians. Often, technicians' skills have not caught up with the expanding technology. According to the

Maintenance Manager, parts costs have also grown in recent years despite advancements in technology. However, new technology could eventually lead to reduced maintenance costs once the knowledge gap is closed through more specific training in electronics and computer diagnostics.

Overall, the Maintenance Manager felt that training is an extremely important element in dealing with emerging vehicle and equipment technologies. Training should be specific to the systems each agency uses which is best addressed, however, by specialized in-house training efforts.

Hillsborough Area Regional Transit (Tampa, Florida)

Hillsborough Area Regional Transit (HARTline) serves one of the four largest metropolitan areas in Florida. The maintenance department consists of 32 technicians housed in 2 facilities. Technician shortage is a major issue for this agency. According to the Maintenance Training Coordinator, at the time of the interview the maintenance department had 8 technician vacancies. The high turnover rate is accredited to protracted difficulties in establishing a labor contract for technicians.

Two years ago, HARTline created a Training Coordinator position for maintenance. An internal maintenance training program was developed, and a dedicated maintenance training budget was established. An in-house training specialist administers courses on-site. The agency is in the process of developing an internal training program that provides a specific set of courses that a technician must pass. Currently, a self-paced training program is in place. Completion of this internal training sequence was officially connected to promotions in January,1999.

Much of the coursework developed and planned for future development was done with the help of a Reliability Center Maintenance Grant from FDOT. These courses will be available to other maintenance departments within the state when completed according to the Training Coordinator.

In addition to courses, other in-house measures have been taken. Vehicle maintenance books were scanned into .pdf files and are available to all technicians through computer stations on the maintenance floor. Vendor training is also utilized along with internal training efforts. All new vehicle contracts require vendor training, including train-the-trainer training.

Although the Director of Maintenance was constant for the time period covered by this study, the Maintenance Manager position was filled by a new employee two years ago, coinciding with the new focus on maintenance training.

Technology changes in the maintenance department include a 30% replacement of the vehicle fleet since 1996 and addition of new vehicles requiring more electronics knowledge. This has posed challenges to the existing maintenance staff.

The interview revealed that this property focuses most of its training resources and time to in-house efforts. These efforts have received the support of the agency administration, and are perceived to increase the knowledge and efficiency of the technicians by maintenance management. The greatest challenge to increasing efficiency appears to be the shortage of maintenance technicians.

Jacksonville Transportation Authority (Jacksonville, Florida)

Jacksonville Transportation Authority (JTA) has been an active participant in the Florida Maintenance Training Program since its inception. They have also developed an extensive in-house training program, which is used to supplement their involvement with the FMTP, using this training time for vehicle specific courses. The in-house training is funded by a Preventive Maintenance Grant, which ends December 1999. In addition, JTA utilizes vendor training. The Manager of Maintenance estimated that over the past 5 years, approximately two vendor classes have been offered a year, with 5 to 6 technicians participating in each class.

When JTA began to focus on maintenance training in 1990, far more vendor training classes were offered. The scale back was done for two reasons. First, although vendor training was perceived to be beneficial and detailed, it was also seen as limited and specific. This did not allow techniques and information gained in this training to be used in other areas. Second, after the initial group of technicians were trained, the need for training declined.

This also led JTA to scale back its participation in the FMTP. However, very recently, about half of JTA's technicians have been replaced. These waves of new technicians have highlighted the need for continual training opportunities, and the agency expects to once again increase it's participation.

The greatest results from FMTP training were seen in the initial three years, from 1990 to 1993. Road calls declined substantially, and technicians' skills in diagnostics also improved. The Manager of Maintenance reported that the parts inventory was reduced by 50% since the training focus increased. The agency has attempted to track the relationship between cost savings and training in specific areas. This has been difficult, however, due to the maintenance system software in place. Since 1994, JTA's maintenance department has used HT-AS400. Issues with this software sited in the interview were twofold. First, it is not designed for

maintenance procedures and is geared towards finance department needs. Second, although the software does a good job tracking parts costs, it does not work as well tracking labor costs.

Training is connected to wage increases at JTA. Wages for technicians rise every six months if they meet specific criteria which includes training. The agency is proposing adding a Master Journeyman level, and the amount of training a technician has received and continues to participate in will be one criteria to attaining that level.

The Manager of Maintenance receives good feedback from technicians about training. They are eager to participate. Employee turnover in the maintenance department is low, but perceived by the agency to be a product of relatively high wages for the local employment market.

New technology does not seem to have major impact on overall maintenance performance at JTA. The average age of the fleet has not changed in the time period covered by the study. The Manager of Maintenance did feel that as the fleet and maintenance equipment changes in the future, more training will be needed, not only for new employees, but for experienced technicians as well.

Management appears to play a significant role in the success of JTA's training efforts. Agency administration has been very supportive of training in the maintenance department. Additional maintenance supervisors have been incorporated into the maintenance staff. Maintenance management has remained constant since 1990.

Both in-house and consortium training are perceived to be beneficial at JTA. The Manager of Maintenance stressed two factors: first, that consortium and in-house training efforts should work together, to supplement one another; and second, that technicians must have the opportunity to practice the skills and knowledge gained in training immediately following the training period.

Lakeland Area Mass Transit District (Lakeland, Florida)

Lakeland Area Mass Transit District (known as the Citrus Connection) serves a relatively small area of central Florida. At the time of the interview, the maintenance department consisted of a Maintenance Supervisor, a Parts Specialist, 6 full time technicians, and two in training. The existing staff is very experienced, with an average of 25 years maintenance background each.

The Citrus Connection does not have an in-house training program in place, other than courses offered by vendors. There is no training budget. They have increased their participation in the FMTP in the past two years.

Increases in technology have had some impact on the maintenance department. Some new shop equipment was purchased in 1995. The fleet has expanded during the period covered by this project, although many of the added vehicles are refurbished vehicles from other properties. This has reduced the average fleet age, however.

According to the Maintenance Supervisor, the main focus since he moved into this position has been on increasing the efficiency of the shop overall, by reorganizing and improving shop conditions. Participation in the consortium training is seen as very helpful, allowing management to provide technicians with needed training despite budgetary constraints.

The maintenance department is able to access and track cost trends effectively. The Parts Specialist is very knowledgeable of the maintenance system software, FleetMaint 2000. This skill has allowed the maintenance department to track their own expenses and trends, making it easier to decide where training efforts, both internal and consortium, should be focused.

Lee County Transit Division (Fort Myers, Florida)

Lee County Transit Division (LeeTran) provides maintenance services for both the transit and paratransit fleets. The maintenance department employs 9 technicians.

In-house training efforts are limited to vendor training (especially Allison and Detroit Diesel training) and safety training provided by the county. Other training needs have been met through consortium training. New technicians are trained informally by working with more experienced technicians. There is no internal training budget.

Fleet changes have been significant in the time period covered by this study. Before 1994, more than half the fleet consisted of 1979 Bluebird buses. Today, the fleet is comprised of all New Flyers, and the oldest models are from 1989. This has meant that technicians now have to work on more advanced electrical systems and low-floor buses. These fleet changes are perceived by the Transit Manager to have affected parts costs. Low floor buses have meant higher tire costs, for example.

Agency management changed in 1993, and the maintenance department feels that more attention has been give to maintenance issues. Agency management has been supportive of the maintenance department's involvement in consortium training. Although the FMTP has

been useful to LeeTran, the Transit Manager stressed a need for more training nearby. The extra time needed to travel to consortium training when located in another region of the state was seen as detrimental to the maintenance department, and covering the lost manpower is difficult.

Another issue for the LeeTran's maintenance department is record keeping software. The department currently uses TMT. They have only recently gone to a windows-based system. There are no positions within the maintenance department dedicated or partially dedicated to the maintenance of software and data, therefore, the department is dependent on other departments within LeeTran. It is therefore difficult for the maintenance department to access records to analyze cost trends at will.

Central Florida Regional Transportation Authority (Orlando, Florida)

This transit agency (known as LYNX) is the fastest growing in the state. Since 1995, there has been a tremendous increase in focus on maintenance training at LYNX. They have been active participants in consortium training since that time. Their participation includes sending technicians for training, hosting many training classes, and serving on the FMTP advisory committee.

LYNX have developed their own internal training program. In addition to vendor training, LYNX provides internal training classes for technicians on-site and have a trainer dedicated to maintenance training. Training and technician certification through established programs such as ASE is linked to promotion.

LYNX uses a DOS-based software program, Fleetmate, to track costs and keep records. They are able to track trends and run reports for internal review. The software, however, is difficult to queue for specific report features. LYNX does not have a dedicated management information systems position in the maintenance department.

Management changes have affected the status of maintenance training in the past several years. A new Manager of Vehicle Maintenance and Facilities was brought to LYNX in 1995. Agency administration has been very supportive of internal training activities, including allocation of funding. The willingness to provide funding is due primarily to two factors: first, there is an overall support for and encouragement of training activities throughout the organization; and second, due to the rapid population growth within the service, ridership and revenue at LYNX has increased noticeably in the past several years.

According to the Manager of Vehicle Maintenance and Facilities, overall maintenance costs may have increased over the past few years due to the rapid growth of the fleet. Not only is the maintenance staff now responsible for more vehicles, but these vehicles are equipped with a variety of new technologies, requiring more electronics and computer diagnostics knowledge. The increased focus on training technicians, however, is thought to offset these increased costs. The manager felt that overall, the maintenance department has greatly benefited from both internal and consortium training efforts.

Palm Beach County Surface Transportation Department (Palm Beach, Florida)

The Palm Beach County Surface Transportation Department (PalmTran) serves a growing metropolitan area. They employ 32 technicians and have two maintenance locations. Growth in their area has prompted fleet expansion, increasing the need for new technicians. They have been consistent participants in the Florida Maintenance Training Program.

Internal training is provided primarily by vendor training. Training on specific vehicle features and systems is included in specifications for new vehicle purchases. Although the fleet is expanding, the average age of the fleet has not changed significantly in the time period covered by this project.

Internal training is also carried out informally by maintenance foremen, who work one on one with technicians in the shop to increase their skills in specific areas. No formal classroom training existed at the time of the interview, but is planned for the future. A large conference style classroom was included in the new maintenance facility to host such classes. These facilities have also been made available for consortium training.

According to the interview, agency administration has increased their focus on the importance of the maintenance department in recent years. They have been especially supportive of training, and encouraged the addition of the training room in the new facility. They have also allowed for more supervisor positions and hiring of more technicians overall, freeing up some time for technicians to participate in training.

There is an internal training budget for maintenance, but it is usually used to cover any travel expenses incurred for training. The internal training budget is relatively small due in part to the fact that the cost of travel for consortium training is paid for through the Florida Maintenance Training Program.

Training for existing technicians focuses on new equipment and vehicles. Many new hires are well experienced, often relocating to the Palm Beach area after careers in transit vehicle

maintenance in large metropolitan areas in the eastern U.S. The majority of those hired who require training have experience with vehicles, but not transit vehicles. For these, basic bus-specific training through the Florida Maintenance Training Program has been very valuable.

The maintenance department at PalmTran encourages training by tying it to evaluations, promotions, and wage increases. In their first six months, new technicians are evaluated every two weeks based on specific criteria, including their participation in training.

Overall, PalmTran reported that training has been helpful for them as they expand. They have utilized both consortium training and vendor training, but would like to further formal internal training in the future as their maintenance department continues to grow. Increased electrical and electronics training were noted as increasingly important and an area where training resources need to be applied.

Pinellas Suncoast Transit Authority (St. Petersburg, Florida)

The Pinellas Suncoast Transit Authority (PSTA) maintenance department employs 37 technicians and has 2 maintenance facilities. They have been highly active participants in the Florida Maintenance Training Program during the time period covered in this project.

In-house efforts depend largely on vendor training. However, a Maintenance Supervisor for Safety and Training position was established in December 1998 in an effort to expand current internal training efforts. The focus of this internal training has been on preparing technicians in the shop to be hands-on instructors. Most training is on the job at this time, but the agency plans to introduce more classroom training in the near future.

Some courses have been developed at PSTA, including a course on environmental awareness and the federal Right to Know law. Development of this course was aided by grant funding from the Florida Department of Transportation.

Significant fleet changes have occurred at PSTA during the time period covered by this project. The average fleet age has declined. Between 1994 and 1996, a large number of new vehicles were added to the fleet. These vehicles included electronic engines and transmissions and computer controls and diagnostics. According to the Maintenance Supervisor for Safety and Training, although they require more initial training, these technology additions have actually saved labor hours and repair times because diagnosing problems is more efficient with computer technology.

Because of a tight labor market and relatively low starting wages for technicians, filling vacant positions has been difficult recently for PSTA. Because of this, the number of technicians maintaining the fleet has declined from 50 to 37 currently. This has happened at a time of fleet expansion, and has put extra pressure on existing technicians to reduce their repair times. In addition, the maintenance department has been hiring less experienced technicians, with between one and five years of experience, which could further slow repair times and increase the need for maintenance training.

TalTran, (Tallahassee, Florida)

TalTran provides transit service to Florida's capitol city, including many government agencies and two large university communities. It is considered a midsize maintenance operation with eleven technicians and two technician supervisors at the time qualitative information was gathered.

TalTran has participated steadily in the FMTP since the early 1990s. It is their primary source of training for technicians. The Maintenance Director, who held the position several years before the FMTP began, welcomed the program as a way to meet his growing training needs without a dedicated training budget. He has continually sent new technicians through a series of FMTP courses. Although his policy is to hire only experienced diesel technicians, many still have areas in which they are weak, especially those who do not come directly from a transit background. In-house training at TalTran is still provided without a dedicated training budget. Outside of the classes offered by the FMTP, they rely heavily on vendor training.

New vehicle purchase in 1994 and 1996 also increased the need for technician training at TalTran. The Maintenance Director reported that FMTP training was helpful in exposing technicians to the new technology in use on several of the new vehicles. He felt that both vendor training and FMTP training had significantly aided his technicians' abilities to deal with changes in technology.

Record keeping had improved significantly in the three years previous to the data collection for this research. In 1996, the maintenance department was equipped with the Faster/CCG software system. They are able to access cost data easily with this system.

Summary and Conclusions

Overall, the interviews of transit maintenance management revealed that:

- Maintenance managers see both in-house and consortium training as beneficial. They believe that statewide training such as provided by the FMTP is an efficient way to provide training for their technicians.
- In-house training and on the job training is best suited for newly hired technicians. Consortium training is especially important in training experienced technicians on new technology.
- New technologies are both raising and lowering maintenance costs. Parts costs and labor costs are expected to eventually decline due to computer diagnostics, however, at present many technicians, even the most experienced, do not have adequate knowledge of these new electronic and high-tech systems. This lack of training and knowledge causes them to take longer to fix problems.
- Absenteeism and the costs associated are not generally affected by technicians having training opportunities, although most maintenance managers agreed that technicians view training as something positive. Maintenance managers reported that absenteeism is a result of how sick time is structured ("use it or lose it") or extreme demands of overtime when the maintenance shop is understaffed.
- The transit agency administration's attitude towards training has major influence over how organized and effective in-house training programs are.
- Connecting training participation and certification to wages and promotions can be an effective way to encourage technicians. Maintenance managers reported that this connection is increasing in the transit industry but not yet universal.
- One obstacle to utilizing training, especially consortium training, is the lack of opportunity technicians have for in-shop practice after training is completed. Often, technicians return with new knowledge but cannot put it to practical use or sharpen their new skills. This can lead to a loss of new knowledge.
- It is often difficult for maintenance managers to send technicians to needed training due to understaffing.
- Record keeping and maintenance software packages were reported as a major issue by maintenance managers. Few managers were satisfied with their systems or what information and reports could be generated from these systems by the maintenance departments. This does not allow maintenance managers to adequately track those cost measures which might help them assess the impact of their internal training efforts over time.

SURVEY OF TRANSIT MAINTENANCE EMPLOYEES

As part of the qualitative analysis of examining the impact of maintenance training on Florida's transit properties a survey was conducted with maintenance employees of the transit properties included in the study. A written survey was mailed out to the transit properties with the request that the surveys be distributed to all of the maintenance employees. Of the surveys that were mailed out, 123 were returned from 12 transit properties.

The purpose of this survey was to evaluate employees' satisfaction with the training that they have received and whether they believe the training is a benefit to them in their jobs. A copy of the survey instrument is included in Appendix A.

Employee Survey Analysis

A variety of multiple choice and open-ended questions were included in the four sections of the survey. The sections are the following: (1) general information, (2) evaluation of training, (3) level of satisfaction with training, and (4) further comments.

General Information

In order to gain general information about employment tenure and the amount of training each respondent has received, four questions were asked in this section.

Employment Tenure – To understand the perspectives of the respondents of this survey, Question One was asked: "How long have you been employed by your current employer?" As shown in Figure 1, the most common response was that employees have been with their current employer from one to five years (28.7 percent), with 24.6% responding 5 to 10 years. In addition, the data indicates that more than half of respondents (54.1 percent) have been employed at their current location for five or more years with almost 20 percent employed for more than 15 years.

Training Participation – In Question Two, respondents were also asked to report how many training courses they have participated in for the past three years, in Question Two. The majority (57.5 percent) of respondents, as illustrated in Figure 2, have taken one to three training courses. Only 14.2 percent of survey respondents have taken no classes in the past three years.

FMTP Participation – To further clarify as to the type of training respondents have received, Questions Three and Four relate specifically to participation in the Florida Maintenance Training

Program. Question Three asks maintenance employees if they have taken any of the training courses offered through the FMTP. Of the 123 respondents, 52.5 percent have participated in the program. The 52.5 percent who have taken a course were further asked which courses they have participated in. The list of these courses is included in Appendix B.

Figure 1
Question 1: How long employed by your current employer?

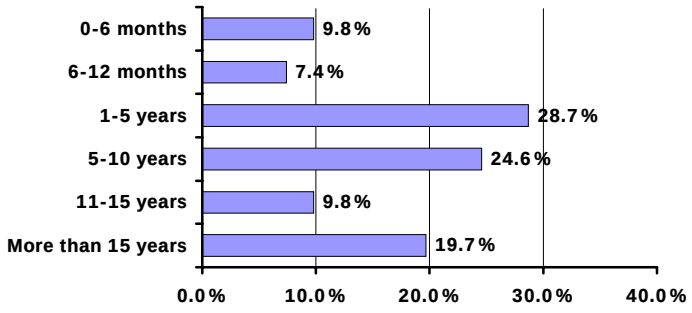
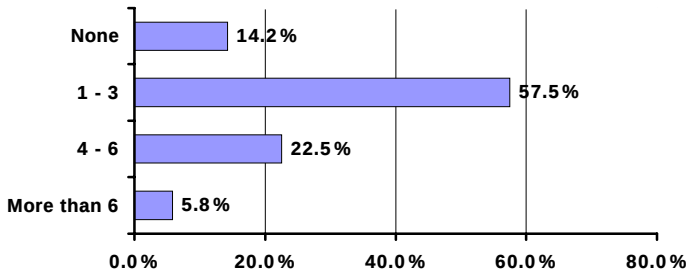
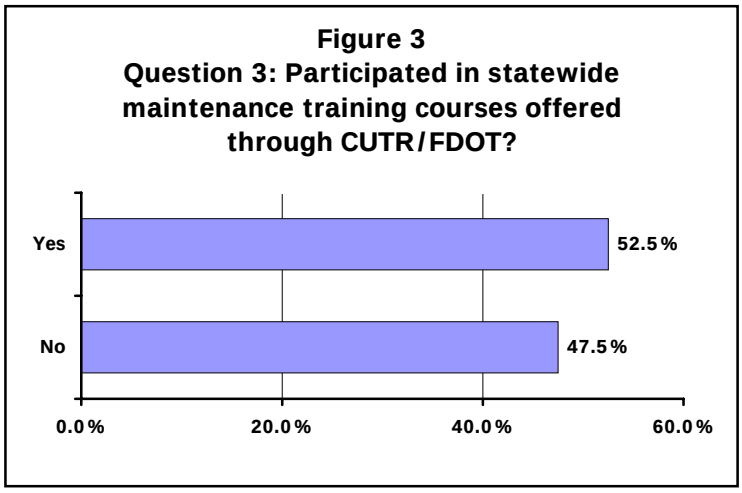


Figure 2
Question 2: How many training courses have you participated in?





Evaluation of Training

In this section respondents were asked to evaluate the training experience through a series of questions. These questions help to address one of the main goals of the survey: Do maintenance employees consider training to be beneficial? In addition, which methods of training are most effective. Questions Five through Nine of the survey address these issues.

Training as a Benefit

In Question Five maintenance technicians were asked to comment on whether training helped them do their job better. Of the 123 respondents, an overwhelming percentage, 87 percent, believe that training helps them do their job better. These results are also shown in Figure 4.

In addition, more than 99 percent of respondents answered that they would attend training if it were offered again (Question Six), as illustrated in Figure 5.

Finally, Question Seven asked if respondents think of training as a benefit. As shown in Figure 6, 96.6 percent of respondents view training as a benefit.

Figure 4
Question 5: Did the training you received help you do your job better?

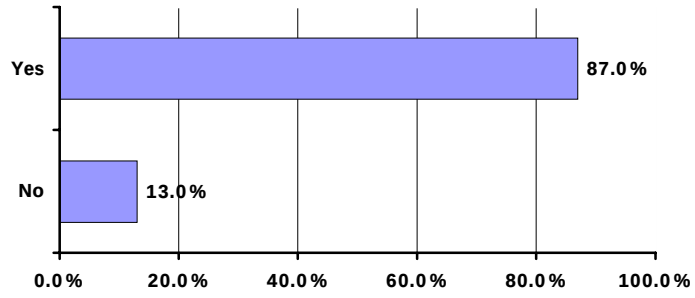


Figure 5
Question 6: If training was offered again, would you attend?

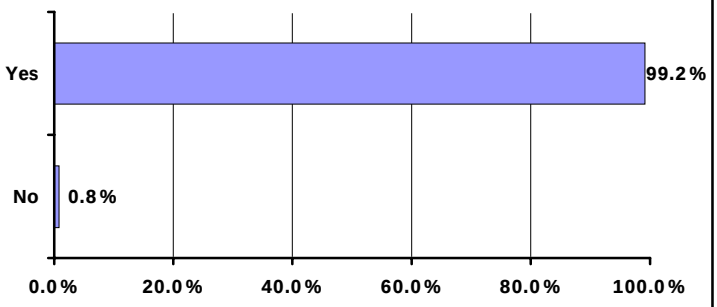
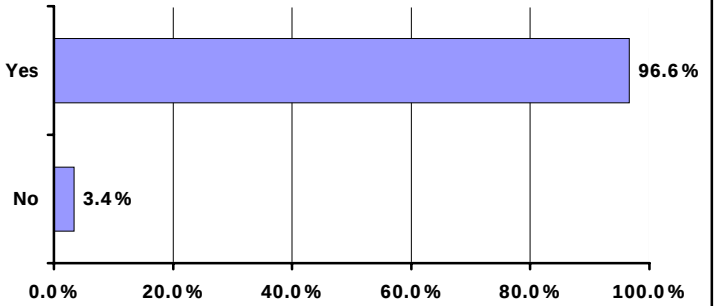


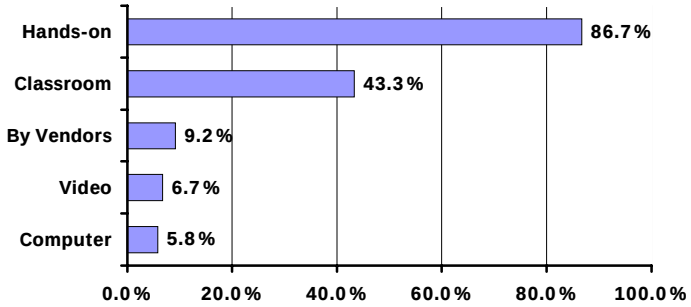
Figure 6
Question 7: Do you think of training as a benefit?



Most Effective Form of Training

Questions Five through Seven do not distinguish between methods of training, however, the method of delivery can be instrumental to the effectiveness of the training. Therefore, respondents were asked, in Question Eight, to select the most effective form of training. Many respondents selected multiple forms of training; the results are contained in Figure 7. Hands-on training was selected as the most effective form of training by 86.7 percent of responding maintenance technicians. The second most common response was classroom courses (43.3 percent), followed by vendors, video, and computer.

Figure 7
Question 8: Most Effective Forms of Training.



Future Training

The final question in the "Evaluation of Training" section asked respondents to list what type of training they think is needed in the future. Respondents interpreted this question in two different ways. They either answered this question with a suggested method of training or with a suggested vehicle system that requires additional training.

The most commonly suggested methods of training included computer, hands-on, and classroom. However, most respondents suggested vehicle systems or types of vehicles for which additional training is needed. The most commonly suggested training in order of those with the most responses include: electrical, transmission (diagnosis, overhaul), engine (diagnostics, overhaul), electronics, air conditioning, wheelchair lifts, ATEC/DDEC, and brakes. In addition, some respondents commented that training should focus on new types of vehicles and new systems within those vehicles. All of the responses are included in Appendix C of this document.

Level of Satisfaction with Training

Based on their individual training experiences, maintenance technicians, in the "Level of Satisfaction" section of the survey, were asked to rate a series of statements by choosing whether they "strongly disagree", "disagree", "have no preference", "agree", or "strongly agree." Figures 8 through 11 illustrate the results of the rating of these statements.

The first statement that respondents were asked to rate asked whether the training that they attended was needed. As shown in Figure 8, 71.5 percent of responding maintenance technicians strongly agreed or agreed with this statement. All of the other statements in this section that respondents were asked to rate received similar ratings. For the statement, "I learned valuable information from the training.", 72.9 percent strongly agreed or agreed. Similarly, 71.3 percent of respondents strongly agreed or agreed with the statement, "I acquired new skills from the training I attended." Finally, the statement, "Having the opportunity to get training makes me like my job.", received a rating of "Strongly Agree" or "Agree" from 71.1 percent of responding technicians.

Figure 8
Question 10A: The training I attended was needed.

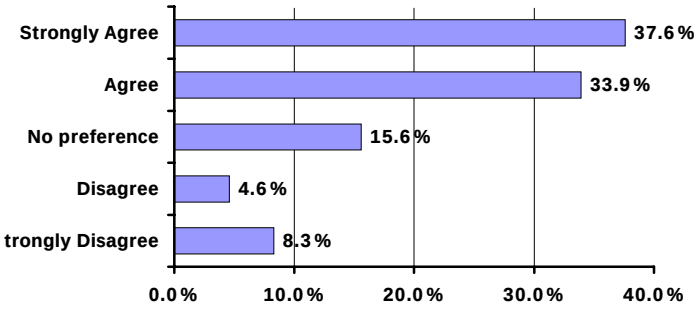


Figure 9
Question 10B: I learned valuable information from the training .

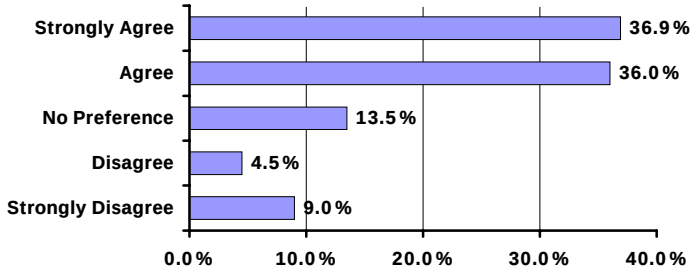


Figure 10
Question 10C: I acquired new skills from the training I attended.

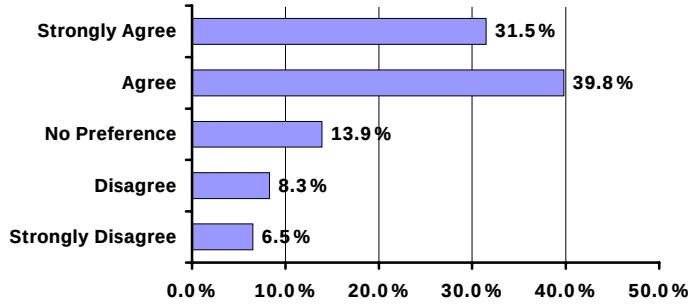
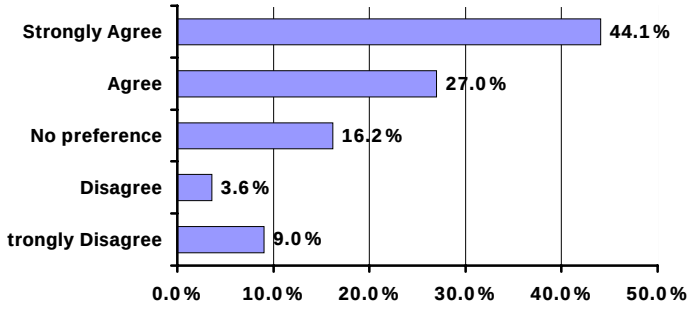


Figure 11
Question 10D: Having the opportunity to get training makes me like my job.



Other Comments

In addition to the stated questions, maintenance technicians were asked to provide any other comments or suggestions they may have regarding training for mechanics. Most of the comments focused upon the need for more types of training for more people. There was much praise for the program but a desire to see more training on specific vehicle systems and specific new vehicles. In addition, the responding technicians commented that training was needed for all technicians at a transit agency, particularly new employees. Also, a few comments focused on the need to cross-train technicians in a maintenance department.

Many respondents also provided comments on suggested methods of training. The need for more hands-on training was a common theme in the open-ended comments. In addition, respondents suggested that more training be provided by vendors and factory representatives.

A complete list of the open-ended comments is included in Appendix D.

Summary and Conclusions

Overall, the survey of transit maintenance employees revealed that:

- Employees perceive training as a benefit that helps them do their job better.
- The most effective form of training is hands-on and classroom training.
- Training should focus on specific vehicle systems and specific types of new vehicles.

SUMMARY OF QUALITATIVE DATA

Based on input from Florida's transit maintenance managers and maintenance technicians, the Florida Maintenance Training Program is considered a benefit to Florida's transit properties.

CHAPTER SIX
RESULTS FROM QUANTITATIVE DATA

This chapter contains results from quantitative data that CUTR was able to successfully collect from FMTP and individual transit agencies. The first section contains a comparison of pre- and post-training test scores for participants in the Florida Maintenance Training Program. The second section contains results from an analysis of maintenance cost data for three Florida transit properties.

COMPARISON OF PRE- AND POST-TRAINING TEST SCORES

As part of every training course coordinated through the Florida Maintenance Training Program, pre-training and post-training tests are administered to every participant. These tests were created to measure the retention of knowledge related to the specific instruction in each course. The scores from these tests are valuable to determine the immediate impact of training on a technician's knowledge of a specific activity.

An analysis of the training and test scores was performed for all participants since the inception of the program. Since the start of the program, 1,958 people have taken classes in the program. Table 1 presents the testing results from these classes.

Table 1
Pre- and Post-Training Test Results

Repair Category	Avg. Pre-Test Score	Avg. Post Test Score	Avg. Pt. Improvement	Avg. % Improvement
Air Brakes/Systems	59.89	87.31	27.42	45.78%
Air Conditioning	50.63	91.83	41.20	81.36%
Bus Paint & Body Repair	57.40	96.40	39.00	67.94%
Electric	51.50	82.35	30.85	59.90%
Engine	50.20	88.24	38.04	75.78%
Preventive Maintenance	66.15	92.08	25.93	39.20%
Wheel Chair Lifts	58.07	84.45	26.39	45.44%

ANALYSIS OF DETAILED SYSTEM COST DATA

A detailed source of quantitative information for public transportation providers is their own individualized records of maintenance activities. All transit agency maintenance departments track maintenance and repair activities for their fleet. The methods by which these records are maintained by maintenance departments range from simple spreadsheets to customized management information systems. These systems commonly contain maintenance and repair information for all vehicles contained in a public transportation fleet.

The main advantage of this type of data is the detail that it can provide. Cost data for major vehicle systems can easily be extracted and compared to training received in particular areas. For example, if technicians at a particular property have received extensive training in air-conditioning preventive maintenance and repair, this could be compared with the historical trend in overall air-conditioning repair costs.

The main disadvantage of relying on this data, however, is the inconsistency of information when comparing different properties. Of the fourteen properties included in the Florida analysis, fourteen different methodologies of tracking fleet maintenance records were employed. Differences included software, cost categories, and internal reporting requirements.

Because of these differences each property has varying degrees of access to the data that they collect. As such, data in a useful form was not available for all properties. Therefore, to illustrate this method of analysis three properties from the fourteen case studies were chosen for detailed data analysis (Citrus Connection, Lakeland; TalTran, Tallahassee; Hillsborough Area Regional Transit (HARTLine), Tampa.) These three properties represent small, medium, and large systems in Florida. (Note: Chapter Seven contains recommendations on how individual transit systems can use their own data to compare with training received.)

Citrus Connection

Citrus Connection, in Lakeland, was able to provide CUTR with four years of maintenance cost data. This data was easily extracted from the maintenance data software that Citrus Connection uses: Fleetmaint 2000.

Training Information

Since the inception of the Florida Maintenance Training Program, the Citrus Connection has participated extensively in many training courses. The following are the courses that representatives from the Citrus Connection maintenance department have participated in:

- Electrical Systems;
- Air Brakes;
- Air Conditioning;
- Engine;
- Preventive Maintenance;
- Wheelchair Lifts;
- Bus Paint and Body Repair; and
- Maintenance Management.

TalTran

TalTran, in Tallahassee, is an example of a medium-sized Florida transit system. TalTran was able to provide CUTR with three years of maintenance cost data: Fiscal Years 1997, 1998, and 1999. An analysis of this data compared to training received by TalTran's maintenance department is included in the following sections.

Training Information

Since the inception of the Florida Maintenance Training Program, TalTran has participated extensively in many training courses. The following are the courses that representatives from the TalTran maintenance department have participated in:

- Electrical Systems;
- Air Brakes/Systems;
- Air Conditioning;
- Engine;
- Preventive Maintenance;
- Wheelchair Lifts; and
- Maintenance Management.

Maintenance Cost Information

As stated above, TalTran was able to provide CUTR with three years of detailed maintenance cost information for Fiscal Years 1997, 1998, and 1999. The information contained in Table 2 was extracted from the data that TalTran provided. Contained in the Table are ratios of labor maintenance cost divided by both the total number of vehicles operated by and total number of vehicles available to TalTran during the same fiscal year (as reported in each year's National

Transit Database report). Dividing maintenance labor cost by these two variables allows costs to be compared over multiple years even with changes in vehicle inventories. This calculation was done for areas in which TalTran has participated in training. As shown in the table there has been a reduction, over the three-year period, in maintenance labor cost per vehicle operated and vehicle available for: air conditioning repairs, brake repairs, and total repairs. There have also been reductions in engine repairs and wheelchair lift repairs, but not as consistently.

Table 2
TalTran Selected Maintenance Cost Information

		FY 1997	FY 1998	FY 1999
Air Conditioning	Labor Cost/Veh. Operated	$587.67	$539.61	$439.01
	Labor Cost/Veh. Available	$436.56	$416.97	$339.25
Brakes	Labor Cost/Veh. Operated	$1,299.71	$1,241.69	$1,139.91
	Labor Cost/Veh. Available	$965.50	$959.49	$880.84
Engine	Labor Cost/Veh. Operated	$378.40	$380.38	$341.96
	Labor Cost/Veh. Available	$281.10	$293.93	$264.24
Wheelchair Lift	Labor Cost/Veh. Operated	$206.50	$292.04	$167.55
	Labor Cost/Veh. Available	$153.40	$225.67	$129.47
Total	Labor Cost/Veh. Operated	$8,631.84	$8,249.54	$8,241.83
	Labor Cost/Veh. Available	$6,412.22	$6,374.64	$6,368.68

Comparison of Training and Maintenance Cost

Many areas, for which TalTran has received training, coincide with reductions in maintenance labor cost. While there are many other non-quantifiable factors that can contribute to a reduction in maintenance labor cost over this time period, such as changes in personnel, management, age of vehicles, or on-the-job training policies, etc., some of this change can be attributed to training endeavors.

As mentioned previously, only three years of maintenance cost data were available to be examined. In order to establish a reliable downward trend in maintenance costs more years of data would be preferred.

HARTLine

HARTline, in Tampa, is an example of a large-sized Florida transit system. HARTline was able to provide CUTR with three years of maintenance cost data: Fiscal Years 1997, 1998, and 1999. An analysis of this data compared to training received by HARTline's maintenance department is included in the following sections.

Training Information

Since the inception of the Florida Maintenance Training Program, TalTran has participated in many training courses. The following are the courses that representatives from the TalTran maintenance department have participated in:

- Air Brakes/Systems;
- Air Conditioning;
- Electric;
- Bus Paint and Body Repair;
- Engine;
- Preventive Maintenance;
- Wheelchair Lift;
- Maintenance Management; and
- Monitoring Performance to Improve Maintenance Efficiency.

In addition to the training through the FMTP, HARTline maintenance employees have also received training through extensive internal training efforts.

Conclusions

For one of the three systems (TalTran), for which detailed maintenance expense data was examined, maintenance expenses in identified repair categories have decreased. However, a trend of decreased maintenance expenses could not be identified for the other two transit systems. This lack of an identifiable trend, however, does not indicate that there is no connection between training and decreases in maintenance expenses. Overall, the quantification of the positive impacts of the FMTP and internal training initiatives is difficult due to limitations of the data that was used in the analysis of these three systems. Only three years of data were available for analysis. More years of data are preferred to determine a long-term trend.

CHAPTER SEVEN
CONCLUSIONS AND RECOMMENDATIONS

This final chapter contains conclusions from the research and recommendations based on the research. The recommendations are further separated into those recommendations that will help fill in the gaps of this research, and recommendations for individual transit agencies to track the impact of training on their own system.

CONCLUSIONS

1. While quantitative conclusions are somewhat inconclusive due to the lack of data available, the benefits of maintenance training are clear from qualitative sources. Both maintenance managers and technicians responded positively when interviewed and surveyed. Both groups attest to the merits of their internal training efforts and their participation in the FMTP in making maintenance departments more efficient and effective.
2. The development of the methodology and the final analysis of data from all sources revealed areas for improvement within transit agency maintenance departments. What can clearly be argued as a result of this research process is that there is a tremendous need for record keeping improvements within transit agency maintenance shops. Keeping this record keeping consistent from transit property to property will also make communication and cooperation with outside oversight agencies easier as well. These issues are discussed in detail below.

RECOMMENDATIONS

- *Individual transit systems should be encouraged to use maintenance cost tracking software that allows for the separation of costs (labor and parts) by major repair categories.* Many maintenance departments that were interviewed for this study either did not have the capability to extract maintenance cost information from their cost tracking software, or they did not have the tools to do this. In many cases, software was either outdated or was originally purchased for the transit agency based on the needs of their finance department not the maintenance department.

- *As part of the Florida Maintenance Training Program maintenance management should receive training on data collection and data management.* Based on

interviews with maintenance managers, it is evident that training would be beneficial for managers in the areas of data collection and data management. Most maintenance managers have enormous amounts of information at their fingertips but do not take advantage of it.

- *A survey should be distributed every six months to all managers of technicians who have participated in the FMTP to determine what the effects of the training have been.* There is currently no follow up in the FMTP to determine the benefits of specific training that technicians receive. It is recommended, therefore, that a survey be sent to maintenance managers every six months that would ask maintenance managers how and if specific training for specific technicians has benefited their organization.

- *Based on qualitative and quantitative analysis in this report, it is evident that the Florida Maintenance Training Program has been a success and future and continued participation by all Florida public transportation properties should be encouraged.*

RECOMMENDATIONS FOR INDIVIDUAL TRANSIT AGENCIES TO EVALUATE THE IMPACT OF TRAINING

In addition to tracking the impact of maintenance training on a statewide basis, individual transit agencies may find it helpful and beneficial to be able to measure the impact of maintenance training on their own system. The following is a suggested method of collecting and analyzing the data necessary to evaluate the impact of training.

Track Historical Maintenance Cost Data

The first step in evaluating the impact of training on maintenance expenses is to track maintenance expense information in a manner that can be compared to training that has been received.

- ✓ First, maintenance expense data on an annual basis should be separated into major repair categories such as electric, brakes, air conditioning, wheelchair lift, engine, etc.

- ✓ In addition, maintenance expenses should be separated into labor costs and parts costs. The important factor is labor costs because conceivably this would be the expense that would be most affected by training.

- ✓ Data from multiple years should be collected. Multiple years of data will allow managers to detect trends in these costs.

- ✓ To be able to compare this data over multiple years, it is necessary to divide that by a normalizing factor. Examples of these factors include "number of vehicles available," "number of vehicles operated," "annual vehicle miles", and "annual vehicle hours." The purpose of dividing these cost figures by one of these factors is to take into account changes in vehicle inventory or level of use of vehicles from one year to the next.

Track Historical FMTP Training and Internal Training

The second half of the equation is the type and amount of training that maintenance technicians have received. This includes training under the Florida Maintenance Training Program as well as internal training, vendor training, and any formalized on-the-job training.

- ✓ Record participation in FMTP courses by maintenance employees.

- ✓ Record participation in vendor training including subject, date, participation level.

- ✓ Record other internal training efforts.

- ✓ Record formalized on-the-job training.

Compare Costs over Time versus Training over Time

Using information gathered in the two previous steps a comparison of maintenance costs with training can be accomplished.

APPENDICES

APPENDIX A

MAINTENANCE TRAINING EMPLOYEE SURVEY

APPENDIX B

EMPLOYEE SURVEY: COURSES TAKEN BY RESPONDENTS

Q4: Which Florida Maintenance Training Program Courses have you participated in?

- 608 A/C
- 608 cert course
- 608, air brakes
- 608-609 AC Training
- A/C
- A/C
- A/C Training
- A/C, air brakes
- A/C, Basic Elec, Air System, Brakes, lift operations
- A/C, Brakes
- A/C, fuel inspection, Brakes
- AC-Electrical, 1 & 2 Prev-Maintenance, Brakes, computer
- Air Brake Systems, Air Conditioning
- Air Brake, A/C, ATEC-DDEC, W/C Lift
- Air Brake/Air Systems, Air conditioning, Basic & Advanced 608 certification class, electrical systems
- Air Brakes
- Air Brakes
- Air Brakes and air systems
- Air brakes, advance elec., AC, Lift, D Dec
- Air Brakes, ATEC-DDEC, Basic Elect, Advanced Elect, AC
- Air Brakes, Basic Electric
- Air Brakes, Coach AC, Basic Elect, Intermediate Elect
- Air Brakes, Safety
- Air conditioning (Bus), Intermediate electric, advanced electric, Lift U
- Air conditioning, brakes and air systems, P.M., electrical sys, ATEC/DDEC, Wheelchair lifts
- ASE, EVT
- ATD School, M-11 School, Elect.
- Atec
- Atec
- ATEC/DDEC, 50 Series Overhaul, electrical
- Basic elec, A/C
- Basic electric
- Basic electric, intermediate electric, advance electric
- Basic electrical systems, diesel tune up
- Basic electrical, 608
- Body work, engine tune up, brakes, air system
- Brake and A/C
- Brake system, air
- Brake, S-Cam, Wedge air system
- Brakes, A/C, electrical, wheelchair, DDEC
- brakes, a/c, pre, tune-up (detroit), w.c. lifts, ATEC DDEC, electrical-basic and advanced, fleet magmt.
- Brakes, A/C, W/C Lift

- Brakes, tune up, p-maintenance
- Braun Lift, Ricon Lift
- CDL defensive driving
- D-Dec, Electrical
- Effective Supervisor Training
- Elec. Courses
- Elect training, Lift U Training
- Electrical
- Electrical I, A/C, Preventive Maint.
- Electrical, A/C, DDEC
- Electrical, brakes, air conditioning
- Electrical, maintenance
- Ford Fleet electrical
- Ford Fleet electrical Basic, UTI Basic Electrical (does not even come close to Ford, would not recommend UTI)
- Ford Training (electrical)
- General Maint., Electrical Basic, Brake System
- I sign up for most classes, am rarely selected for participation
- Intermediate electrical
- Maintenance Seminar in Orlando
- N/A
- None
- PM Maintenance
- PM Maintenance, 608
- PM, Electrical, Lift-U, Ddec, Supervisor Training
- Preventive Maint
- Preventive Maintenance, electrical
- Preventive maintenance, electrical
- w/c lift
- Wedge Brakes, 608 Testing

APPENDIX C
EMPLOYEE SURVEY: FUTURE TRAINING NEEDS

Q9: What type of training do you think is needed in the future?

- 50 series
- 50 series eng school
- 609 cert class, u lift, electrical
- A/C and Brake
- A/C Systems
- A/C Training
- A/C Trouble shooting & repair
- A/C, Computer on 9900s
- A/C, Electrical, computer, engine & transmission
- A/C, Wheel Chair Lift
- A/C, Wheel Chair Lift, Electrical, Trans Diagnosis
- A-Deck, D-Deck, engine over hauls, Trans over hauls
- Air brakes, wheelchair lift
- Air Conditioning, Transmissions
- All available
- All kinds
- All of them
- All of what's available
- All type
- All Types
- All types, as every part is new & newer
- All upgraded system training
- As much as possible
- ASE Certified
- ATEC-DDEC, computer
- Automatic Trans, Electronic Engine Controls
- Body shop
- Bus Tech
- Classroom and hands on
- Classroom, video
- Computer
- Computer
- Computer
- Computer
- Computer

- Computer Diagnosis, Sensor Diagnosis/Troubleshooting
- Computer, electrical, air
- Corrective Action Training
- Cummins (Celect), DDEC III, IV, ZF Transmission, PLC (Programmable Logic Control)
- DDEC IV, Cummins Elect, ENG. Controls (Celect), ZF Trans, PLC
- DDEC IV, ZF Transmissions, world trans and electronic controls for all elect., WABW ABS
- Diesel Engine mechanics course
- Elec and DDEC
- Elec., and anything about buses
- Elect
- Elect Electronic
- Electric troubleshooting
- Electric, electronic, diagnostic
- Electrical
- Electrical and A/C, Bus Electrical
- Electrical Courses (Bus)
- Electrical troubleshooting
- Electrical Troubleshooting, brakes, steering and suspension systems, air condition HVAC Systems
- Electrical, Computer Controls
- Electrical, computer, eng. 50 series
- Electrical, electronic all levels
- Electronic
- Electronic diagnostics and control systems
- Electronic engine tune-up and problem solving electronic trans problem solving
- Electronics
- Electronics
- Electronics and its application
- Electronics, computers, engines, transmission
- Electronics, schematic analysis, safety, diversity
- ENG Diagnostics, Trans Training
- ENG, Tran, Rear Ends
- Eng. Repair
- Engine and Tran's, computer training and repair
- Engine Diagnostic, Transmission Training, DDEC, Advanced Electronic

- Engine diagnostics, Tranny diagnostics, electrical troubleshooting in depth
- Engine tune-up, CNG classes, ZF Transmissions
- Everything
- For your dept. information on newest and latest products on the market to make the job you are doing even better.
- Hands on A/C & Electrical, trouble shooting
- Hands-on
- I think safety training would be helpful in the future.
- In House, Cross-training
- Inspection Training
- Lap Top Training
- Light Rail
- More advanced electrical, AD Tech, Engine diagnose and overhaul, transmission diagnosis and overhaul.
- More elec, A/C, W/C Lift
- More Elect and Drive Line
- More generalized training to widen skill area.
- More hands on training
- More training with other mechanics on the floor
- New electronic
- On Computer controls
- On the computer
- On the job, emphasis placed on electrical trouble shooting
- Open
- P.M. Inspection, computer
- PLC Diagnosing, Computer Training, Steering Suspension, Industrial Safety, DDEC IV
- Safety training that directly reflect my job.
- Same training categories: brakes, AC, electrical, W/C Lift, etc. But more training time spent on newer equipment.
- Small Bus (Ford Cutaway) Engine controls & ABS
- Stay up with the time on new buses
- Training contained to buses
- Training in all aspects of bus repair
- Training on all the bus system that we work on or will be working on.
- Training on all the new type bus and motors
- Trouble shooting air systems, brake systems, and door motors

- Trouble shooting Wheel Chair Lift System, Troubleshooting and diagnostic of engine problem.
- w/ Chair, MTR, Transmission
- W/C Repair (A/C 608 Recovery Machine) body work-related courses, welding
- W/Chair, electrical
- Welding, P.C.
- Whatever is available that is relevant to my job and any changes that come with equipment
- Wheel chair
- Wheel chair lifts, electrical, electronics
- world trans

APPENDIX D
EMPLOYEE SURVEY: OTHER OPEN-ENDED COMMENTS

Q11: Please provide any comments or suggestions about training for mechanics.

- A lot of the training that is needed should be presented by vendors or manufacturers for the simple reason, who else should know their product and be able to answer technical questions as them.
- A strong training program makes for a strong maintenance team.
- All mechanics need to be cross trained on all bus system and anyone who goes to training needs to come back and train everyone in the shop on what new info was given out to him in the class.
- All of the course was at different jobs but none in Palm Tran
- Can't do a proper task without proper training.
- Classroom should have good A/C
- Cross-train technicians to be more diverse. Don't target all or most of the training on techs with less than one or two years seniority. The turn around rate seems high. Give incentives, rewards (patches, hats, jackets).
- Cummins Troubleshooting, hands on I/O controls.
- Don't send me to class unless you intend to let me use my knowledge on the job site. In the past I've attended schooling but was not given the opportunity to use it at work.
- Electronic, on computers, safety devices
- Electronics
- Everybody needs training
- From a limited perspective I can not recommend the basic electrical class I had with UTI
- Get it in gear
- Giving others the opportunity
- Hands on training by other skilled mechanics is a better way
- I agree to give more training in the present (future)
- I feel like the younger employees need an opportunity to get more varied on the job training rather than just doing inspections.
- I feel the need for in house training at the smaller facility as only one person can attend when it is away. More hands on.
- I feel you are never too good for training. There is something you can always learn from it to better your abilities.
- I strongly believe in cross training. Too many of us are specialized in certain areas. If one of us is out that area suffers
- I think the training is good with more hands on.
- I would like to attend all training that will be available for equipment and other general hand's on classroom learning.

- If a mechanic can go for training, he or she should go to help with he or she job.
- I'll being home for two years and have had no training at all.
- In-depth bus coach w/chair training, Diesel MTR training, more transmission training.
- It is a good opportunity For each man to better himself, and in general each man should be evaluated to find his or her weak points so they might require training in these areas.
- It is a very good program that the state of Florida has for any one that wants to better themselves at the job they are doing.
- Keep the training (hands on) coming.
- Less Classroom time and more hands on.
- Let the mechanics use the skills learned in courses to further their knowledge as well as other employees. Computer skills are going to be needed in the near future (start training now).
- Mechanics always need training!
- More training makes job easier.
- More training.
- More trouble shooting and hands on. More cross training. Strongly agree.
- Need continuous training and when requested and more accessible to information
- Need from A to Z
- Need more hands on electrical troubleshooting, also should be offered more often
- Need more training on everything. Electric, brakes, wheelchair
- Need real training. Need to be certified ASE!!
- Need to be allowed to go to more training
- Not receiving training!
- Our company is lucky to have Richard Dey as a trainer.
- Preventive Maint Mechanics should go every year.
- PSTA should send more mechanics for training
- PSTA should send more mechanics to more training classes.
- Question #8- Hands-on and classroom in combination is best training.
- Schools and classes are very important to keep diesel mechanics up to date with the new laws and new technology!
- Send more mechanics to brakes schools (wedge & s-com) and engine classes.
- That there should be more hands on in all classes.
- The more the better.
- The new buses are coming. I strongly recommend you get your people trained so they can do the job.
- The Training I have received has helped me to do a better job for my company.

- There is no substitute for factory training. UTI training courses are not affective. Too generic.
- Training as a whole should be implemented towards safety, services, and upgrading mechanical status for example from Class C mechanic to Class B from Class B to Class A
- Training for Mechanics should be at least 5 days (1 week) once a year or every 6 months to help the mechanic learn about all the new equipment and technology that are being put on and in the new vehicles.
- Training helps everyone
- Training is a valuable tool. When distributed evenly and fairly it is a morale booster. It should occur more than just annually for some mechanics.
- Training is extremely important. You can never know too much.
- Training is good. I think it should happen more often.
- Training is only useful if you get to use what you've learned. If you're stuck doing the same type of project every day, then what ever is learned will be soon forgotten! So what's the point?
- Training more relevant to the specific types of equipment found in our fleet.
- Training on systems and operation is the only way to service in the correct way
- Training provides uniformity for diagnostic and maintenance procedures. We have received three different makes of coaches in three years, getting all maintenance workers on the same page seems imperative to me.
- Training should always be encouraged because it makes better mechanics and saves a lot of time and money by proper troubleshooting.
- Use in shop Tech's. Outside Tech's are book trained and do not know weather condition and terrain.
- Very good classes, have improved greatly in last couple of years.
- We need more classes away from our shop. Possibly a training center out of state.
- We need more training