

Electric Transit Circulator Feasibility Study

Miami-Dade Metropolitan Planning Organization



FINAL REPORT

Prepared by
The Center for Urban Transportation Research



ELECTRIC TRANSIT CIRCULATOR FEASIBILITY STUDY

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INTRODUCTION

Electric and hybrid-electric transit vehicles have many benefits, many of which are due to the uniqueness of the propulsion system. These benefits include an improvement in air quality due to significantly reduced or eliminated emissions; a quiet, smooth ride; reduced maintenance costs over the life of the vehicles due to the simplicity of the electric motors; reduced operating costs due to greater fuel efficiency; an improvement in the image of public transit; increased ridership (some of which can be directly attributed to the "futuristic" feel of the vehicles); and leadership opportunities for the transit operator within its community in terms of recognition as a "pioneer" and an "innovator." With these benefits, electric and hybrid-electric vehicles can help transit operators achieve their basic goals of providing reliable, safe, clean, and efficient public transportation services.

With the documented successes of electric transit shuttle programs in other areas of the country such as Santa Barbara and Chattanooga and, locally, the great success of the Electrowave operating on Miami Beach, interest in electric vehicle technology is growing significantly in South Florida. A number of areas in Miami-Dade County currently operate circulator services and several more are planning or considering such services. Increased interest in local circulators and the growing interest in electric vehicle technology has prompted studying of the feasibility of using electric or hybrid-electric vehicles as explored in this report.

The Miami-Dade Metropolitan Planning Organization (MPO) contracted with the Center for Urban Transportation Research (CUTR) to conduct this Electric Transit Circulator Feasibility Study. The objective of the study is to assess the feasibility of using electrically-powered vehicles as the mode of choice for municipal, neighborhood, and other transit circulator services in Miami-Dade County. The county-wide focus and the exclusive emphasis on electric vehicles, as opposed to other types of alternative-fuel vehicles, are unique aspects of this study.

Public transportation agencies across the United States, including the Miami-Dade Transit (MDT), must carefully and continually allocate very scarce resources (in the form of tight budgets) within their service areas to provide transit services for their populations. As such, MDT, like other agencies, largely utilizes its limited resources to focus the provision of transit service during morning and evening peak periods and on major corridors within the county. Midday and off-peak trips and peripheral areas and neighborhoods situated away from main thoroughfares are usually underserved. MDT operates most of its Metrobus service with conventional full-size diesel vehicles while some routes are served by diesel minibuses.

Typically, local circulator services are not offered in Miami-Dade County. There are a few exceptions: Aventura, North Miami Beach, Sunny Isles Beach, Bal Harbour, Surfside, and Miami Beach (Electrowave) do currently offer scheduled fixed-route transit circulator or shuttle service. However, there are many other cities and communities within the county that are currently studying or otherwise considering the implementation of transit circulator services. These areas all desire to offer a locally-tailored service that will enhance the mobility of residents, employees, and visitors and provide improved access to other existing and planned transit services in the region including MDT's Metrobus, Metrorail, and Metromover, the South Dade Busway and its planned expansion, the regional Tri-Rail system, and Broward County Transit.

In addition, these areas have recognized the success of the Electrowave in Miami Beach and have noted the attractiveness of the clean and quiet electric vehicle technology. The operation in Miami Beach has provided a unique case study for other areas in the county that have pedestrian-oriented commercial districts and/or are undergoing redevelopment efforts. Clearly, the electric vehicles are an attractive option to serve areas characterized by outdoor shopping, dining, and other pedestrian activities due to their quietness, lack of dark tailpipe smoke and foul fumes, and their overall non-intrusive nature.

This report consists of five chapters. The first chapter describes some basic information regarding electric vehicle technology, including the characteristics of pure electric vehicles and hybrid-electric vehicles; battery technology is also discussed. Infrastructure requirements for the operation and maintenance of electric vehicles are also included in Chapter 1, along with a summary of some of Miami Beach's experiences related to infrastructure. Chapter 2 provides detailed information on the 18 study areas included in this feasibility study. The study areas were selected collaboratively among CUTR, the MPO, and members of the Study Advisory Committee. For each study area, a brief description of the area is provided, along with either existing or potential circulator service characteristics, vehicle requirements (if known), and a synopsis of opportunities available for the general provision of electric transit circulator service and, specifically, for any sharing or combining of resources with other areas. Chapter 3 contains a comprehensive listing and discussion of funding sources that can potentially be used for the electric vehicle circulators. The chapter includes sources from federal, state, and local levels of government. Chapter 4 is included to provide additional insight in experiences of implementing, operating, and maintaining an electric vehicle circulator system. As a summary, this fourth chapter presents some lessons learned by those agencies that have implemented service with electric vehicles. The final chapter, Chapter 5, provides concluding thoughts and recommendations regarding the feasibility of using electrically-powered vehicles for transit circulator services in various areas of Miami-Dade County.

CHAPTER 1: ELECTRIC VEHICLES – TECHNOLOGY AND INFRASTRUCTURE

An overview of electric vehicle technology and the infrastructure required to operate and maintain it is provided in this chapter. First, the basics of electric vehicles are described, and the characteristics of both pure electric and hybrid-electric vehicles are summarized. Recommendations are presented as to what types of service and operating characteristics would better match pure electric vehicles' capabilities versus those of hybrid-electric vehicles. Next, battery technology is discussed. Infrastructure requirements are then described, along with the necessary support equipment; as the only area in the County currently operating electric vehicles, Miami Beach's experience with infrastructure is specifically addressed. The operation and maintenance of electric and hybrid-electric vehicles poses certain safety risks, which are outlined as well, along with ways of mitigating those risks. Finally, a brief summary reviews the relevant technology issues and infrastructure requirements related to the feasibility of operating electric or hybrid-electric transit vehicles in Miami-Dade County.

BASICS OF ELECTRIC VEHICLES

An electric vehicle (EV) is simply a vehicle that uses a rechargeable battery in place fuel, thus replacing other fuels. Pure EVs do not have an internal combustion engine or a transmission: the major components are at least one electric motor, a battery pack, a transfer gear (instead of a transmission), and a controller. Hybrid-electric vehicles use more than one fuel for propulsion, one of which is a rechargeable battery. The other fuel in a hybrid-electric vehicle can be gasoline, diesel, propane, compressed natural gas (CNG), or another fuel that will drive the auxiliary power unit (APU). The chassis, interiors, and accessories of electric vehicles are usually the same as other vehicles. EVs are quite simple: the electric motor has only one moving part, while a typical internal combustion engine has 847 moving parts. This results in reduced routine maintenance and parts inventory.

Recharging an electric vehicle consists of plugging the vehicle's charge plug into a specifically-designed power outlet. Recharging time varies depending on battery type, capacity, and the voltage output of the charger. Most EVs, those with lead-acid batteries, can be recharged in about six hours. Electric vehicles reduce the amount of noxious emissions released into the atmosphere as a result of combustion processes of an internal combustion engine. EVs can

greatly reduce or even eliminate on-street engine emissions. Overall, when compared to a gasoline engine, emissions are reduced 98 percent, even when considering the source of the electric power, the generating plant. Experiences have shown that the cost to charge a battery is only one-third the cost of purchasing the equivalent amount of diesel fuel to run an engine over the same distance (Miami Beach has found that it costs even less).

In addition, EVs are significantly more efficient than internal combustion engines. Internal combustion engines result in only 16 of 100 power units actually driving the wheels. With an EV, nearly 85 of 100 power units are used for driving the vehicle. While the propulsion system itself is more efficient, EVs also do not have any energy losses through transmission and idling. And, because there is no transmission, acceleration on an EV is quiet and smooth. Another way that EVs are more efficient than internal combustion engines is through the advantage of regenerative braking. When an electric vehicle slows down, the motor becomes a generator and provides energy back to the batteries. This process also helps reduce brake wear, which is another benefit.

Due to the overall simplicity of the technology, the lack of a transmission and the need to shift gears, and the fact that the fuel is electricity, EVs provide a very quiet, smooth ride; many are so quiet, in fact, that the only noise can be the air conditioning, power steering, and/or air compressors. A hybrid-electric vehicle might have a low noise from its APU. Also, EVs emit no offensive odors or exhaust. Electric transit vehicles are also low-floor vehicles which provide easy access, another advantage. Wherever they have been used, electric transit vehicles have been excellent in terms of rider acceptance and public relations. These characteristics make electric vehicles excellent candidates for the provision of transit service, especially in residential areas, downtowns, and other pedestrian-oriented areas where noise and fumes are not welcome.

Characteristics of Pure Electric Vehicles

Pure electric vehicles use only an electric motor for propulsion and only a rechargeable battery for fuel. Operation, however, can be limited by the range and storage capacity of the batteries. (Batteries and recharging are fully discussed in the next section). All-electric vehicles can provide a range of between 40 and 80 miles on lead-acid batteries, one of the most common types, depending on the skill of the operator and the operating conditions. Operators of EVs must learn to accelerate and slow down appropriately; they must be even and smooth. Special training is required for drivers, not just the vehicle technicians. Range is, of course, also

dependent on the topography of the service area. While EVs can climb hills, climbing draws more energy from the batteries. While hilly topography is not generally a problem in South Florida, some beach communities have access bridges over the Intracoastal Waterway that must be considered. Gauges in the vehicle that display battery power indicate to the driver when recharging is appropriate. Before losing all its power, an EV using lead-acid batteries will gradually slow down; the vehicle will not abruptly stop in the middle of a route if it is losing power.

Pure electric minibuses typically cost about \$215,000, nearly twice as much as a conventional vehicle of the same size. Currently, conventional lead-acid battery packs can cost \$20,000, due to tariffs (however, this cost may change in the future if tariffs are reduced or eliminated). More advanced batteries such as nickel-cadmium (NiCD) and nickel-metal-hydride (NiMH) provide significantly increased power and range, and recharge much faster; however, the nickel batteries are also significantly more expensive at this time. Each year, electric power storage technology advances and more advanced batteries are being developed. Battery technology is discussed in greater detail later in this chapter.

Characteristics of Hybrid-Electric Vehicles

A *hybrid*-electric vehicle uses electric power plus another energy source. The additional energy source, a fossil fuel, is used to run auxiliary power units (APUs), usually small turbine engines. The purpose of the APU is to provide constant recharging to the battery packs and to also help power an air conditioning unit. Since they operate at a rather low and constant speed, rather than accelerating and decelerating, APUs run very efficiently.

There are actually three types of hybrid-electric vehicles (HEVs). The Series HEV is a range-extending vehicle, the Parallel HEV's electric motor assists the engine during start-up and acceleration, and Dual-Mode HEVs are basically Parallel HEVs that also have a separate generator to recharge the batteries. The hybrid-electric vehicles operating in Chattanooga, Tennessee, and the new vehicles ordered for Miami Beach, are Series HEVs.

Hybrid-electric vehicles can also be charge-sustaining or charge non-sustaining. A charge-sustaining HEV has an APU that is capable of providing enough energy, independent of the battery, to drive the vehicle. As long as a charge-sustaining HEV has fuel for its engine, the vehicle will operate. The APU in a charge non-sustaining HEV can only provide recharging power to the batteries and cannot supply the energy needed to drive the vehicle on its own. A

charge non-sustaining HEV is also considered to be a range-extender (Series HEV), because its purpose is to extend the range of the vehicle. The APU charges the batteries up to approximately 80 percent capacity during operations. Batteries are fully charged and equalized overnight. In this study, the focus is on charge non-sustaining series hybrid-electric vehicles.

Because of the range-extending capability, hybrid-electric vehicles can provide transit operators with greater flexibility when compared to pure electric vehicles. The range of a series HEV is considerably greater than a pure electric vehicle because it does not have to be taken out of service for recharging as long as the APU has fuel. Industry representatives note that the typical range for an HEV is between 150 and 300 miles compared to between 40 and 80 miles for pure electrics, depending on the size of the APU's fuel storage and the operating conditions. Another factor characterizing the range of an HEV is the type of hybrid it is: parallel hybrids use more energy since both fuels (electric power and the APU) are providing drive power to the vehicle, thereby reducing the range. Series hybrids have a longer range since the APU simply provides power to the batteries, and less energy is expended.

Hybrids are more expensive than pure electric vehicles, however, and currently cost approximately \$245,000, which is twice the cost of a conventional bus of similar size, though only exceeding the cost of pure electrics by about \$30,000.

Pure Electrics Versus Hybrid-Electrics

In choosing which type of vehicle to operate, whether pure electric vehicles or hybrid-electric vehicles, several factors must be considered. First, it is essential to fully know the operating characteristics of the service. The routes, schedules, frequency of service, layovers (locations and lengths), number of vehicles required plus spares, and facility location(s) are all factors used in determining which type of vehicle to use.

Pure electric vehicles cost less (though they are still 15-20 percent more than conventional heavy-duty buses), but require extra batteries and staff. Rapid recharging equipment can eliminate some of the need for additional batteries and staff, but is also expensive, at about \$40,000 per unit. As noted earlier, pure electric vehicles have a limited range of between 40 and 80 miles, depending on operating conditions including operator skill.

Hybrid-electric vehicles do not need rapid recharge equipment or extra staff for battery swapping, but are approximately 15 percent more expensive than pure electrics. Series hybrids

can provide a range of between 150 and 300 miles, a mileage increase ranging between 80 and 100 percent more than pure electrics.

If the proposed or existing transit circulator routes are relatively short, the somewhat lower range of pure electric vehicles might be sufficient, and the more expensive hybrids would not be necessary. Also, pure electrics would be a good choice if the initially configured routes are short and the operating agency does not expect the service coverage to increase significantly (thus, no or very little additional range will be required of the vehicles in the foreseeable future). Hence, pure electrics work best when the current or desired transit circulator service is concentrated in a relatively small area with shorter routes.

If routes are relatively longer, or the coverage of the circulator service area might be expected to increase during the life cycle of the vehicles, hybrid-electric vehicles might be the better choice. Hybrids work best wherever there is an existing need, or reasonably expected future need, for extended range on the vehicles. Another consideration is whether an area anticipates the vehicles to be used in fire or hurricane evacuations, other emergencies, or other events. For multi-use applications, hybrid-electric vehicles would be best. Existing alternative-fueling infrastructure in an area should be considered. For example, while CNG infrastructure is quite expensive, if it already is in place in a particular area, that area might consider the use of hybrid-electric vehicles with a CNG-powered APU. The operating agency in the area would be taking advantage of existing alternative fuel resources and realizing the benefits of the increased range available with hybrids.

If headways are improved to provide additional trips within the same service area, an additional vehicle or vehicles would be required, regardless of the type of vehicle—pure electric or hybrid-electric—being used. The number of additional vehicles required would be dependent on the increase in frequency. Ultimately, the decision regarding which type of vehicle to operate will rest with each area that either currently operates circulator service or is examining the possibility of such service. The factors outlined above will need to be considered and evaluated in the decision-making process, as well as the availability of funds for the purchase of the vehicles.

BATTERIES

There are many types of batteries that can be used to power electric vehicles. The most common are lead-acid (flooded lead-acid, which require regular maintenance; and sealed lead-acid, which only require maintenance about every six months), nickel cadmium (NiCD) and nickel metal hydride (NiMH). There are other types of batteries that are less common at this time, such as lithium batteries. Newer battery types have significantly longer lives but are still cost-prohibitive. Currently, the battery is considered the most immature component of the electric vehicle technology. Ongoing research and development in battery technology for use in electric vehicles not only continues today, but is accelerating as this increasingly promising source of energy becomes progressively more economically feasible and therefore more competitive with conventional fossil-fueled sources.

Other technologies, such as fuel cells and ultracapacitors, are still being developed and will not be available for widespread use for several more years. At least one full life cycle of the current propulsion technology can be achieved before these other technologies become feasible.

Flooded lead-acid batteries cost the least, but require the most maintenance as they must be watered regularly. Sealed lead-acid batteries are becoming more common and require maintenance only every six months; the new vehicles ordered for Miami Beach, manufactured by Advanced Vehicle Systems, Inc. (AVS) of Chattanooga, will have sealed lead-acid batteries. Lead-acid batteries can take approximately six hours to slow-charge, and can last between 800 and 3,000 cycles (a cycle consists of a charge and a discharge); maintenance and operating techniques will determine how long they last in that range of cycles. Miami Beach's pure electric vehicles can last about six hours between charges. Their batteries last an average of two years, although some have gone longer.

In comparison to lead-acid batteries, nickel batteries can be charged up to 80 percent in only 20 minutes, and they can last for 15,000 cycles of charging and discharging. In spite of these impressive characteristics, they are still not cost-effective. They also, when low on energy, have a much shorter slow-down period before running completely out of energy as compared to lead-acid batteries, which can cruise for a longer period on a low battery.

A very important component of electric propulsion systems is a battery management system. This system is meant to maximize the life of the battery, as well as optimize its performance. The battery management system monitors the energy level, temperature, individual cell

voltage, and total battery pack voltage. The temperature of the battery is crucial; it is essential that batteries do not become too hot, otherwise their lives are significantly shortened.

While the typical lead-acid battery takes about six hours to fully slow-charge, the industry is now producing “rapid recharge” equipment. This equipment, which can cost approximately \$40,000, can fully charge a battery pack in about 25 minutes. Rapid recharge is an option for pure electric vehicles, but is not needed for hybrid-electric vehicles since the hybrid’s APU keeps the batteries charged. The Buckhead Area Transportation Management Association in the Atlanta, Georgia, area will utilize rapid recharge technology for its fleet of 10 all-electric vehicles. With rapid recharge, an electric transit vehicle could be *fully* recharged over a slightly longer layover period, about 30 minutes, and could be quickly ready to go back in service. An advantage is that there is no need to have personnel on hand to swap out battery packs (replacing a battery pack that needs to be charged with a fresh one so that a vehicle can return to service), and it might be possible to reduce the number of batteries in the inventory. It should be noted that battery swapping itself is not a lengthy process (about eight minutes), but the vehicle does need to come out of service and off its route to complete the switch.

Without rapid recharge equipment, pure electric vehicle operations using lead-acid batteries need to have at least one set of batteries available for each cycle. The number of battery packs that need to be available for each vehicle is dependent on the use of the vehicles. In Miami Beach, three sets of batteries are needed for each vehicle because they are used up to 20 hours per day. Any area that plans to use their vehicles for more than 12 hours per day will need three sets of batteries per vehicle; one in the vehicle, one charging, and one fully-charged resting battery. There must always be one set of batteries that is resting; a fully charged battery should not be immediately placed into a vehicle that is going into service, as this subjects the battery to too much heat, shortening its lifespan and reducing its economy.

A charging technique called “opportunity recharge” is something employed using rapid recharge equipment. For an opportunity recharge, a vehicle pulls up alongside a rapid recharger and the operator plugs the battery pack into the rapid recharge equipment for about five minutes. During this short time, the batteries can be recharged up to about 60 percent. This process can be continued throughout the time a vehicle is in service. With this technique, there is no need to have as many spare battery packs, or as much personnel to swap out battery packs. This type of rapid recharging might be quite “healthy” for the batteries; rapid recharge gets the batteries substantially recharged before damaging heat builds up.

There are cost trade-offs between using rapid recharge techniques and simply swapping out batteries in each full discharge-recharge-rest cycle. A set of rapid recharge equipment, as mentioned previously, costs about \$40,000. Currently, lead-acid battery packs cost about \$20,000 each, and slow-charging equipment can cost between \$6,000 and \$8,000. Another factor to consider is the labor costs of personnel required to swap out batteries if no rapid recharge equipment is available.

As with diesel and other fuels, agencies must develop procedures for handling, storing, and disposing of batteries. Agencies should have systems in place to handle broken or leaking batteries (safety is discussed further later in this chapter). Batteries are 98 percent recyclable, and recycling infrastructure is well-developed, at least for lead-acid and nickel cadmium batteries.

INFRASTRUCTURE REQUIREMENTS

Whether constructing a new facility or retrofitting an existing building to be able to handle electric or hybrid-electric vehicles, there are a number of issues to consider when planning infrastructure for storing and maintaining these vehicles. First, there must be adequate electrical service at the facility; power quality and load management are very important as well. The planning of a new or modified facility should be undertaken with consultation from a licensed commercial electrician and involvement from the local electric utility. Electricity billing rates are also an issue; it may be possible to get reduced rates for overnight recharging of batteries, when overall demand for power is low. In addition, if the vehicles are hybrid-electrics, or if gas, diesel, or CNG vehicles are fueled and maintained in the same location, there must be an awareness of the additional safety hazards and steps should be taken to mitigate these dangers. All local safety codes must of course be observed.

Regarding the size of a facility, a rule of thumb that can be observed is to allow approximately 4,200 square feet of space for every 5 vehicles in the fleet. The amount and configuration of space is important because there needs to be adequate room to maneuver a fork lift around the vehicles to insert and remove battery packs. There must be adequate floor storage space for battery racks; due to their weight, batteries can be stacked no more than two high. Space is also needed for parts, charging, and offices. Other characteristics of a facility should include ceilings that are at least 20 feet high to allow space for a vehicle raised on a hydraulic lift, and non-slip floors for safety. In addition, adequate ventilation must be provided in the facility.

As briefly mentioned above, separate areas are required to store parts and to charge batteries. There should also be a separate, environmentally-controlled area for the repair of electronics, and another area for cleaning batteries (to capture and neutralize waste). If a fare is charged to ride the system, a vault or a secure room is also a necessity. Finally, an emergency eye-wash, shower, and scrub area is also specifically needed because personnel will be handling corrosives.

Several pieces of equipment are needed in a facility to store and maintain electric vehicles. These include:

- one hydraulic vehicle lift (for up to 20 vehicles);
- one set of jack stands (for between 5 and 15 vehicles);
- vehicle washing equipment;
- fork lift (for inserting and removing battery packs from the vehicles);
- large fans for air circulation within the facility;
- gas detection and automatic deactivator system;
- air compressor;
- battery testing and maintenance equipment;
- computer equipment (hardware and software);
- multimeter; and
- 50A 208-240VAC, 3-phase outlets (with a standard recharger), or 480 VAC outlets with rapid recharge equipment.

Miami Beach is the only city in Miami-Dade County currently providing transit service with electric vehicles, and their experiences with the infrastructure are briefly summarized below.

The representative to the Study Advisory Committee from Miami Beach stressed the need to have all infrastructure in place and ready for operation *prior* to the delivery of any vehicles. The original facility built for Miami Beach's Electrowave vehicles was constructed in 1998. The pre-fabricated structure cost \$400,000, and included foundation, water, drainage, wiring, flooring, and other basics. The facility also meets hurricane standards, which is an important and required feature in South Florida. An additional \$300,000 was expended for support equipment, including battery storage, a fork lift, diagnostic equipment, a hydraulic lift, and a bus wash. Also, Miami Beach needed to secure a propane tank to power the air conditioning in its pure electric vehicles. With hybrid-electric vehicles (which Miami Beach will acquire in its

next round of vehicle purchases), the air conditioning will be powered by the electric motor, and will run significantly more quietly.

Since Miami Beach has expanded its service area and will be obtaining new hybrid-electric vehicles, a new maintenance facility is being planned along with a new Intermodal Facility for the City of Miami Beach. The consultants on the project have recommended that the maintenance facility be separate from the intermodal facility. Since the primary purpose of the maintenance facility will be to store and maintain the Electrowave vehicles, it does not need to be designed with public access in mind like the intermodal facility; indeed, exclusion of the public from industrial sites such as the Electrowave maintenance facility is eminently desirable. The current recommended location for the new maintenance facility is at Dade Boulevard and Pine Tree Drive (near 25th Street).

The Miami Beach representative indicated that maintenance for the vehicles will be contracted out and, additionally, at least one member of the staff of AVS (the manufacturer of the Electrowave vehicles) or the Electric Transit Vehicle Institute (ETVI) will be located on-site to assist with training, etc. This development presents the opportunity for the sharing of resources among other cities and communities in the area that wish to operate electric or hybrid-electric transit fleets, as there would be a centralized location for heavy full-vehicle maintenance (other than simple vehicle storage and battery charging).

SAFETY ISSUES

The presence of electric drives and large battery packs introduces novel hazards in the transit operations and maintenance workplaces. Hazards include electric shock, fire, explosion, acid spills, and chemical burns. Of course, these hazards can and should be managed through appropriate design, monitoring, operations, and maintenance procedures. Standards have been developed by the National Electric Code (NEC), Society of Automotive Engineers (SAE), and others. The primary source for information in this section is the *Transit Cooperative Research Program (TCRP) Report 59, Hybrid-Electric Transit Buses: Status, Issues, and Benefits* (2000). The issues addressed here in this section also apply to pure electric transit vehicles.

Electric shock can occur with virtually any motor vehicle if an individual comes into direct contact with a live circuit under normal or fault conditions. With an electric vehicle, the contact can occur during charging or discharging of the batteries. The risk can be managed with proper

engineering, labeling, and safe maintenance procedures. Standards have been developed that address electrical isolation, insulation, grounding, ground fault circuit interrupters, and personnel protection systems. The Electric Power Research Institute (EPRI) has developed language specific to transit buses. See the List of References at the end of this report for more information.

While fossil fuels are clearly flammable, electric vehicles also have materials that can burn. Fire can result from improperly charged or vented batteries, or from a loss of electrical insulation caused by damaged connectors or chafed wires that spark and set fire to nearby flammables. Sealed lead-acid batteries, if exposed to too much heat, can burn but are unlikely to cause a fire. Safety design and regulations can help prevent these situations, and to detect them early if they do occur. It is very important to have appropriate fire-retardant materials in the compartment walls around the battery boxes. Proper fire suppression and electrolyte neutralization materials must be available as well.

Under normal conditions, properly-managed batteries will not produce or release hydrogen gas. However, if they are stressed or over-charged, certain batteries (such as flooded lead-acid, nickel cadmium, and nickel metal hydride, but not sealed lead-acid) can produce and release hydrogen. If just the right amount of hydrogen mixes in the air, an explosion can occur. This danger can be mitigated through the use of advanced battery technology and safe building design and maintenance procedures, such as sealing and valve regulation and charge cut-off control mechanisms to prevent over-charging.

The sulfuric acid in typical flooded lead-acid batteries and the potassium hydroxide in nickel metal hydride batteries can cause burns if they come in direct contact with skin. This hazard is mitigated with advanced battery technology and safe maintenance procedures. As with hydrogen gas release, most batteries are designed to limit or exclude electrolyte from spilling (one example is the use of sealed lead-acid batteries). Spills should be contained with non-combustible materials such as vermiculite, dry sand, or material bags. Lime, soda, or sodium bicarbonate can also neutralize sulfuric acid, as can ammonium hydroxide ("ammonia"), sodium hydroxide, or any number of other bases.

The TCRP Report 59, referenced above, contains a list of safety standards and regulations that apply to the operation and maintenance of electric and hybrid-electric vehicles (see the List of References at the end of this report for more information). It is important to remember that, of course, most accidents can be prevented through a combination of proper operator and

technician training, proper vehicle operating and maintenance procedures, sound preventive maintenance, and automated detection systems.

SUMMARY

This chapter introduced the technological aspects of electric vehicle propulsion and discussed the infrastructure typically required to operate and maintain a fleet of electric or hybrid-electric vehicles. From a technological point of view, and based on the infrastructure requirements, the implementation of electric vehicle technology, as opposed to conventional diesel power for local transit circulators, is certainly possible. This has been convincingly demonstrated by the implementation of the successful Electrowave service on Miami Beach. Safety hazards novel to electric-powered vehicles are manageable. The expense for a single facility can range from \$700,000 to approximately \$2,000,000 depending on the size of the facility, the location, and whether property must be acquired. The cost to retrofit an existing facility would be less. The table below summarizes some costs associated with electric vehicle technology.

Table 1: Summary of Estimated Costs

Item	Estimated Cost
Pure electric minibus (22-foot)	\$215,000
Hybrid-electric minibus (22-foot)	\$245,000
Lead-acid battery pack	\$20,000
Charging equipment (slow-charge)	\$6,000 - \$7,000
Rapid recharge equipment	\$40,000

For now, pure electric is the only proven technology, and it keeps maintenance and inventory simpler because there is no APU. As more hybrid-electric vehicles are put into service, experience will accrue and more information will become available on their overall performance. While progress is being made in propulsion technology, it still appears that no major breakthroughs are expected over the next three to five years. As such, it is expected that at least one full life cycle of the current propulsion technology can be achieved before a more cost-beneficial technology is potentially available.

CHAPTER 2: STUDY AREAS

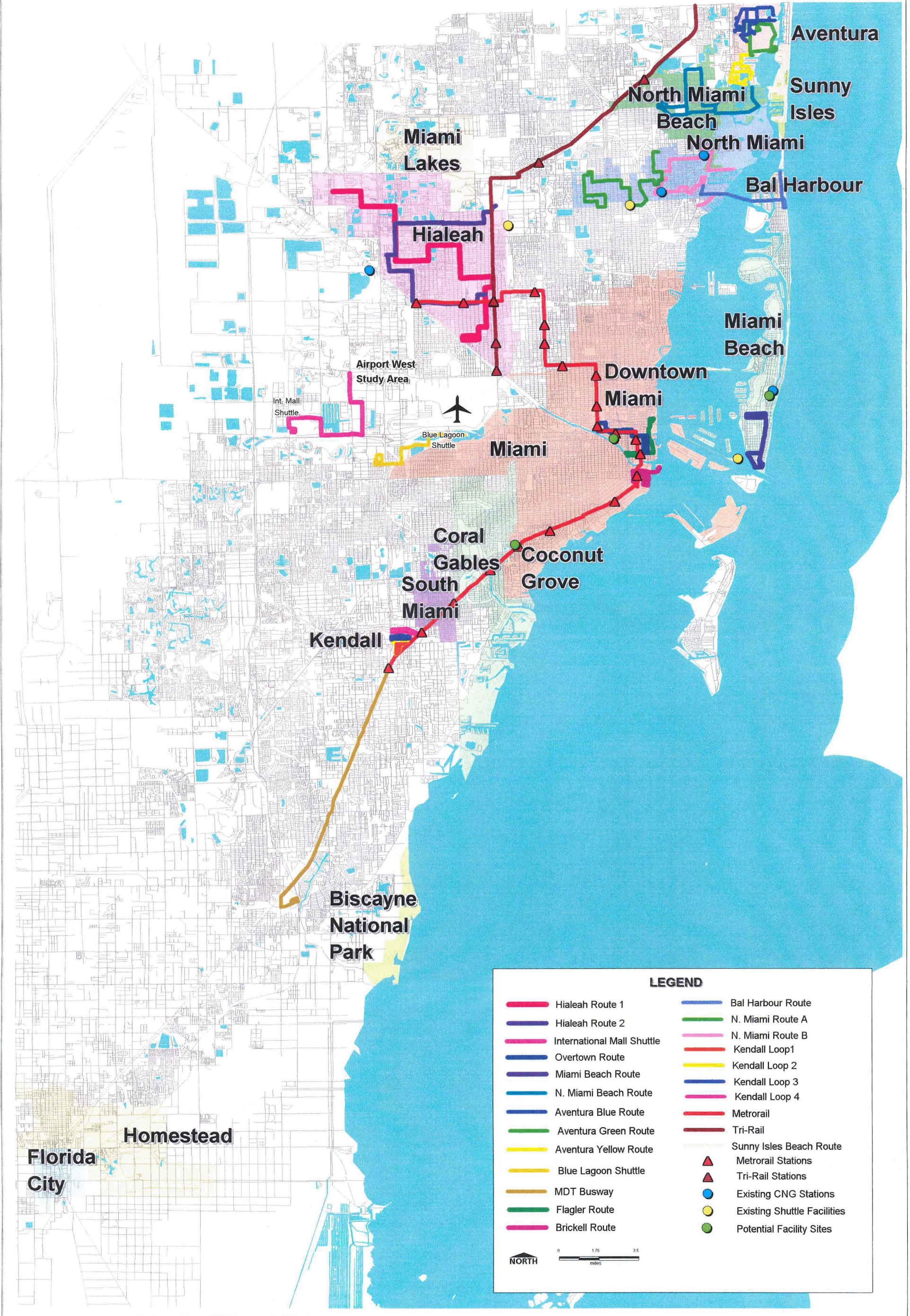
A number of cities and other areas within Miami-Dade County were examined for potential suitability for electric transit circulator services as a part of this feasibility study. The selection of areas to be included began with a listing of the cities and communities that were known to already be providing some type of circulator service, or were currently studying the possibility of such service. With assistance from the Study Advisory Committee, other areas where electric vehicle transit circulator services are desired, requested, or may be feasible were nominated and reviewed. The number of areas examined continued to grow throughout the study period as additional information was obtained by the CUTR project staff and the Study Advisory Committee. The complete list of areas included in this feasibility study is shown below:

- Aventura
- North Miami Beach
- North Miami
- Sunny Isles Beach
- Bal Harbour
- Surfside
- Miami Lakes
- Hialeah
- Airport West
- Overtown
- Downtown Miami
- Brickell
- Coral Gables
- Coconut Grove
- South Miami
- "Downtown" Kendall/Dadeland
- Homestead/Florida City
- Everglades/Biscayne National Parks

Figure 1 shows the areas being studied and outlines existing and potential circulator services. Also depicted on the map are some existing vehicle facilities and alternative-fuel stations (CNG), as well as a number of potential sites for facilities.

The sections following Figure 1 describe the areas listed above in more detail and provide information regarding the characteristics of existing or potential circulator services and address service coverage, route alignments, service span, frequency, and vehicle requirements. More importantly, whether, and how well, these service characteristics and operating requirements are compatible with the performance capabilities of electric vehicles is also evaluated. Finally, and perhaps most importantly, the level of interest in electric vehicle technology exhibited by the local decision-makers and the local citizens is also discussed.

Figure 1
Miami-Dade
Electric Transit Circulator Feasibility Study



A few of the areas originally included in the study were not examined in great detail due to either a lack of imminent plans for circulator services or a general lack of interest shown by area representatives. For example, the Town of Surfside now operates a short circulator service; however, after contacting the Town, the CUTR project staff discovered that Surfside prefers to continue operating the service as it is and expressed no interest in the use of electric vehicle technology.

CITY OF AVENTURA

The City of Aventura is located in the northeast corner of Miami-Dade County. Incorporated in 1995, it refers to itself as the “City of Excellence.” This city of over 20,000 people is characterized by high-rise condominiums and a relatively high median income and, while half of the city’s residents were over the age of 65 in 1990 (according to the 1990 U.S. Census), the population has gotten younger over the past 10 years. Aventura Mall, a large regional retail center serving North Miami-Dade and Southeast Broward, doubled in size in 1997 with the addition of two new anchors, Bloomingdale’s and Burdine’s. Aventura Mall includes a 24-screen movie theater, a food court, several restaurants, and a hotel. There are numerous other shopping centers located along US 1, and a major hospital is located within the city as well.

Existing Service Characteristics

The City of Aventura’s Shuttle Bus Transit System, the *Aventura Advantage*, began operating in January 1999. Coach USA has been contracted to provide the fare-free minibus service, which operates three routes that allow residents to easily access buses and travel to retail, grocery, and medical centers within the city. All three routes connect at a central transfer point at Aventura Mall. The Mall also serves as a major transfer point to routes in MDT’s bus system, as well as to Broward County Transit (BCT) routes. The Aventura Advantage Blue Route serves the northern area of the city from the Mall east to NE 213th Street. The Green Route serves the central area of Aventura from the Lehman Causeway to NE 207th Street. Finally, the Yellow Route covers the southern part of the city from the Mall to Point East. A map exhibiting Aventura’s routes is shown in Figure 2 on page 29.

Service is provided from 8:45 a.m. to 5:30 p.m. Monday through Saturday. The frequency of service ranges from 60 to 90 minutes. While the service frequency is relatively low, the service is considered a success because it is helping to meet the mobility needs of many of the elderly

residents of the city. Between 300 and 400 passengers per day use the current service. A more attractive technology such as electric vehicles could bring even more attention and ridership to the system.

Vehicle and Infrastructure Requirements

The service is currently run with three minibus vehicles. Aventura's circulator routes enter condominium entryways and stop underneath their porticos; the routes also run alongside paths used for jogging, walking, and bicycling. The operating environment of this service is conducive to the use of electric vehicle technology. Consequently, vehicles that operate more quietly and cleanly would be very appropriate in Aventura.

It is anticipated that three 22-foot electric or hybrid-electric vehicles would be used to run the existing service. One spare might be necessary. Coach USA's facility is located at 11077 NW 36th Avenue, and there is the possibility of retrofitting the facility to accept the charging and storage of electric or hybrid-electric vehicles. Because the facility lies approximately eight miles away from the City of Aventura, it is unlikely that a pure electric service could be dispatched from Coach USA's facility, unless there is a rapid recharger installed near Aventura Mall, where the three routes converge.

Whether pure electric vehicles or hybrid vehicles are chosen would depend on several factors, including the staff and space available for swapping out batteries between charges, the possibility of placing a rapid recharge facility in Aventura, and the opportunities for resource sharing among other communities in North Miami-Dade (described further below). Pure electric service routes are best served when the maintenance facility is located in immediate proximity to the routes. In Aventura's case, this would be best served by a maintenance center near the transfer center at Aventura Mall. If the City has no interest in providing a maintenance facility, then hybrid-electric vehicles could be operated out of Coach USA's current facility.

Opportunities

In keeping with its motto as the "City of Excellence," there is a definite interest in using electric vehicles to provide the circulator services described above. While the City itself does not provide the service with its own personnel, Aventura's representative to the Study Advisory Committee believes that the City would be greatly interested in contracting to use electric

vehicles on its circulator routes, thus positioning Aventura as one of the leaders in the county in using this technology.

The proximity of Aventura to the Cities of North Miami Beach and North Miami, and to a lesser extent to the City of Miami Beach, provides opportunities for the sharing of resources among communities. By sharing a facility, significant operational and capital expenses could be saved by not only the City of Aventura, but also by other cities or communities that are involved. In addition, there is the possibility that a central maintenance facility for electric vehicles will be located in Miami Beach. The main purpose of the facility would be to provide storage and maintenance for Miami Beach's Electrowave vehicles; however, the possibility exists for the provision of maintenance services for other electric and hybrid-electric fleets throughout the area.

Aventura could consider providing a minimal storage facility for as many as six vehicles. Heavy maintenance could be performed at Miami Beach, or arrangements could be made to have a Miami Beach mechanic come to Aventura. In any event, the vehicles would need to have their batteries equalized while in overnight storage. However, the City has initially indicated that it would prefer to avoid the responsibilities of owning and maintaining vehicles and equipment. If Aventura maintains this position, it will need to pursue partnerships with neighboring cities that are also interested in providing electric transit circulator services and might, in turn, be willing to maintain and operate the vehicles in Aventura through an interlocal agreement.

CITY OF NORTH MIAMI BEACH

The City of North Miami Beach promotes itself as being centrally located between Miami and Ft. Lauderdale. The 5.2 square-mile city's economic base consists mainly of health care and retail sectors. The largest employers are Publix, for its warehouse/distribution functions, Parkway Regional Medical Center, Aventura Columbia Medical Center, and FMS Management Systems, each of which have more than 1,000 employees. In addition, Nova Southeastern University has a North Miami Beach Campus located at 1750 NE 167th Street. The city is known for its shopping, as well: the three largest shopping areas are The Mall at 163rd Street (at NE 15th Avenue), The Shoppes at Skylake (NE 18th Avenue and Miami Gardens Drive), and the Intracoastal Mall (163rd Street and the Intracoastal Waterway), and the length of NW/NE 163rd-162nd Street between Golden Glades and Biscayne Boulevard, virtually a continuous strip mall.

Existing Service Characteristics

North Miami Beach contracts with Handi-Van to provide a fare-free minibus shuttle service to help residents traverse the city. The city divides the system into a Blue Route and a Yellow Route; however, the service actually consists of one route alignment with the Blue Route representing travel in one direction and the Yellow Route consisting of travel in the opposite direction. In addition to the three major shopping areas (Intracoastal Mall, 163rd Street Mall, and The Shoppes at Skylake), the North Miami Beach Line also serves a post office, a government services building, the North Miami Beach Library, K-Mart and Publix, and several residential areas, among other destinations. A map depicting the North Miami Beach Line can be seen in Figure 2 on page 29.

Service is provided from 8:30 a.m. to 4:30 p.m. Monday through Friday. Looking at the Blue and Yellow Routes individually, the service frequency ranges from 90 to 120 minutes. However, most passengers switch between the Blue and Yellow Routes (same alignment, different direction) when completing their trips so they do not have to wait as long for the shuttle. By using the system in this way, passengers take advantage of more frequent service.

Vehicle and Infrastructure Requirements

Two 22-passenger minibuses are used to operate the service in North Miami Beach. The current service is appropriate for application of electric vehicle technology given the relatively short length (approximately nine miles in one direction) of the circulator route(s). If electric or hybrid-electric vehicles are used for this service, a conventional-fuel vehicle already owned by the City or Handi-Van could be used as a spare. The vehicles used in the current service come from Handi-Van's facility in the City of North Miami (located at North Miami Avenue and 119th Street NW). While it may be a possibility to retrofit this facility to be able to store and charge electric vehicles, other potential locations for a facility should be explored, particularly since North Miami Beach is so close to other areas in the county considering the use of electric vehicle technology.

Opportunities

The type of technology (pure electric versus hybrid-electric) that could be used will ultimately be determined by several factors, including availability of staff and space for storing and swapping out batteries, and the availability of other existing infrastructure. It should be noted

that the City of North Miami, located just south of North Miami Beach, has four compressed natural gas (CNG) facilities in place. With the CNG infrastructure already in place and relatively nearby, North Miami Beach might want to strongly consider the option of utilizing hybrid-electric vehicles with CNG auxiliary power units (APUs).

The Study Advisory Committee's representative from North Miami Beach expressed interest in this study and in the electric vehicle technology. While the North Miami Beach Line has relatively low ridership at this time, the City believes that, along with the other transit options in the area, the system can grow.

North Miami Beach's location is central to other areas in North Miami-Dade County that are interested in using electric vehicle technology to operate local circulator service. The City is located just south of Aventura, and just north of North Miami. Just to the east are Sunny Isles Beach and Bal Harbour, which both have small circulator services in operation. Therefore, opportunities for the sharing of resources are plentiful. As such, a shared facility, perhaps just for the storage and charging of vehicles, located in North Miami Beach would be a possibility. Also, it must not be forgotten that there is a planned full-service maintenance facility for electric vehicles to be located in Miami Beach. The primary purpose of this facility will be to store and maintain Miami Beach's Electrowave vehicles; however, the possibility exists for the centralized provision of full maintenance services for other electric and hybrid-electric fleets in the area.

CITY OF NORTH MIAMI

The City of North Miami, the fourth-largest city in Miami-Dade County, has been called the "Gateway to South Florida." The city, known for various film and television productions, has undergone major revitalization efforts in its downtown. Downtown North Miami (located in the area of NE 125th Street and 15th Avenue) is becoming a cultural and entertainment center anchored by the 22,000-square-foot Museum of Contemporary Art, and boasts new offices, art galleries, and several restaurants. The city has an active and growing business community with more than 2,500 businesses. The city has a campus of Florida International University (FIU) and is home to Johnson and Wales University, a prestigious culinary and food service university. Finally, the City is part of the Clean Cities Coalition, a group of state legislators, local government representatives, federal and state agencies, and private sector representatives dedicated to reducing the region's reliance on gasoline and diesel fuels and improving air quality.

Potential Service Characteristics

The city has undertaken a feasibility study for a transit circulator service, and is currently reviewing the implementation of such a service. Two major goals were specified for a circulator service: (1) to provide services tailored to the needs of transit-dependent residents, to provide a convenience and courtesy service, to improve quality of life, to provide a sense of community, and to assist with customer travel to businesses; and (2) to attract choice riders to transit to reduce single-occupant vehicle usage, to implement transportation demand management (TDM) initiatives, and to interface with pedestrians, other local circulators, and MDT services. The study recommended the implementation of two citywide public transit circulator routes. The routes will be coordinated to provide a shuttle system that will meet the needs of area residents, employees, and visitors. The West route will mainly serve residents to the west of NE 8th Avenue, serving the West Side Community Center, several parks and schools, the Publix at NE 6th Avenue, and the North Miami CBD. The East route will serve those to the east of NE 8th Avenue, including destinations such as the Museum of Contemporary Art, several parks and schools, Biscayne Boulevard, and the North Miami CBD. The routes will connect conveniently at the North Miami Library. Connections to MDT service are also available. The planned North Miami circulator routes are shown on the map in Figure 2 on page 29.

The shuttles will run from 9:00 a.m. to 7:00 p.m., Monday through Friday. The City will consider using the vehicles to provide weekend and other special services to areas outside North Miami such as Kane Concourse, Bal Harbour, Surfside, or Aventura Mall. Approximate headways will be 45 minutes. North Miami wishes to initiate the service as soon as funding is available. For the first 90 days, the circulators will be fare free; after that time, the City will determine if a fare is needed.

Vehicle and Infrastructure Requirements

For the first year of service, North Miami plans on contracting with a private vendor to provide the vehicles (most likely vans) and operate the service. Within one year of implementation, the City intends to purchase alternative-fuel vehicles, which will be provided to a private vendor who will operate the service. Two vehicles will be needed to provide the service, and the vendor can use vans as spares. North Miami is definitely interested in the application of electric vehicle technology. The city's interest in electric vehicles is consistent with its participation in the Clean Cities Coalition and its support of CNG as an alternative fuel. It would be operationally feasible to utilize electric or hybrid-electric vehicles in the provision of the local

circulators. Given the fact that North Miami has four CNG fueling facilities, North Miami might consider using hybrid-electric vehicle technology with CNG as the fuel for the hybrid's auxiliary power unit (APU). CNG infrastructure tends to be expensive; therefore, the City might want to take even further advantage of the infrastructure that is already in place. In addition, as previously discussed, the hybrid-electric vehicles, while costing more than pure electric vehicles, require fewer batteries to be kept on hand and have a much longer range than pure electric vehicles.

Opportunities

Given the City of North Miami's interest in using electric vehicle technology, there are many opportunities that can be explored. With the existing CNG infrastructure, the City could consider using hybrid-electric vehicles with APUs that operate on CNG. Also, there are several opportunities for the sharing of resources among the communities in North Miami-Dade.

The sections above relating to Aventura and North Miami Beach addressed how the proximity of Aventura, North Miami Beach, North Miami, Sunny Isles Beach, and Bal Harbour to each other provides an opportunity for a shared facility, at least for the storage and charging of vehicles, if not for maintenance as well. This would help to reduce costs for all parties involved and enhance the feasibility of applying the electric vehicle technology to the area.

Again, the planned full maintenance facility in Miami Beach must be mentioned here. The major purpose of this facility will be for storing and maintaining the Electrowave vehicles; however, there is the possibility for the centralized provision of maintenance services for other electric and hybrid-electric fleets in the area. North Miami's geographic location is central to North Miami Beach, Sunny Isles Beach, and Bal Harbour; not too far south of Aventura; and also close to the planned facility in Miami Beach. This uniquely positions the city to serve as a base site for electric or hybrid-electric transit service in each of these communities. Should the City of North Miami find its "champion" to pursue the use of electric vehicle technology in the provision of its planned circulator service, it could become the leader in the north Miami-Dade area and encourage and help coordinate such services in the surrounding communities.

CITY OF SUNNY ISLES BEACH

Incorporated three years ago, the City of Sunny Isles Beach is one of the newest cities in Miami-Dade County. Sunny Isles Beach has a permanent resident population of about 14,500 and, during the winter, the population swells to about 20,000. Many residents live in high-rise condominiums, providing density ideal for transit to serve. The small city is bordered by Golden Beach on the north, Haulover Beach Park on the south, the Intracoastal Waterway on the west, and the Atlantic Ocean on the east. Sunny Isles Beach is experiencing significant growth and development.

Existing Service Characteristics

Sunny Isles Beach operates one simple route that mainly traverses Collins Avenue and N. Bay Road. The service operates within the city limits except for two days each week—Wednesday and Saturday—when the route travels to Aventura to serve the Library and Aventura Mall. The service is available Monday through Saturday from 9:00 a.m. until 4:30 p.m. Sunny Isles Beach is shown on the map in Figure 2 on page 29.

Vehicle and Infrastructure Requirements

The route in Sunny Isles Beach is operated using two conventional-fuel vehicles backed by a spare. Two 18-passenger vehicles and one 23-passenger vehicle are available to provide the service, and the City tries to rotate the three vehicles in service provision. However, the City has vans available that can also be used as spare vehicles.

The length of the circulator route is relatively short, and serves a relatively small geographic area. As such, the City might prefer to use two pure electric 22-passenger minibuses to operate its service or, if it wants the vehicles to be available for fire or hurricane evacuations, or for other purposes, it could use hybrid-electric vehicles. A third electric vehicle could be kept as a spare, or the City could continue to use its vans as spares, thus saving the cost of an additional vehicle.

Sunny Isles Beach could consider partnering with neighboring communities to share a facility for vehicle storage and light maintenance.

Opportunities

The service operating on Sunny Isles Beach is in close proximity to the Intracoastal Mall and the service provided in the City of North Miami Beach. The Sunny Isles Beach service also connects to the Aventura Mall twice per week. As discussed previously, tremendous opportunities exist for the sharing of resources among the communities in North Miami-Dade that are either operating or planning to operate electric transit circulator services (Aventura, North Miami Beach, North Miami, Sunny Isles Beach, and Bal Harbour). In addition, there is the planned maintenance facility in Miami Beach that can serve as a centralized maintenance facility for electric and hybrid-electric vehicle fleets in the area.

The City of Sunny Isles Beach is definitely interested in the possibility of using electric vehicles to operate its circulator service. With the rising cost of gasoline, the City is attracted not only by the possibility of lowered operating costs but also by the image that the vehicles would portray. Quiet and clean electric vehicles would be attractive in a small beach community that is also bordered by a park.

VILLAGE OF BAL HARBOUR

Billing itself as a “tiny, magical enclave on the ocean,” Bal Harbour Village is a small, affluent community bordered by Haulover Park on the north, Biscayne Bay and Bay Harbour Islands to the west, the Town of Surfside to the south, and the Atlantic Ocean on the east. The Village has a population of approximately 3,200 and encompasses an area of only three-tenths of a square mile, a total of 245 acres. The area is known for the Sheraton Bal Harbour Beach Resort and the Bal Harbour Shops, which are located one block west of the ocean at Collins Avenue and 96th Street and contain a unique collection of world-renowned boutiques, shops, and fine restaurants (shops include Neiman Marcus, Saks Fifth Avenue, Cartier, Armani, Chanel, Versace, and Tiffany & Company, among others).

Existing Service Characteristics

A shuttle is operated from Bal Harbour, through Bay Harbour Islands to the Publix on Biscayne Boulevard. The service, known as the Bal Harbour Bus Line, is operated from 9:00 a.m. until 1:00 p.m. Monday, Wednesday, and Friday. Ridership is between 40 and 60 passengers per day. The primary purpose of the service is to provide elderly residents of Bal Harbour with

access to grocery shopping. The Bal Harbour Bus Line is shown on the map in Figure 2 on page 29.

Vehicle and Infrastructure Requirements

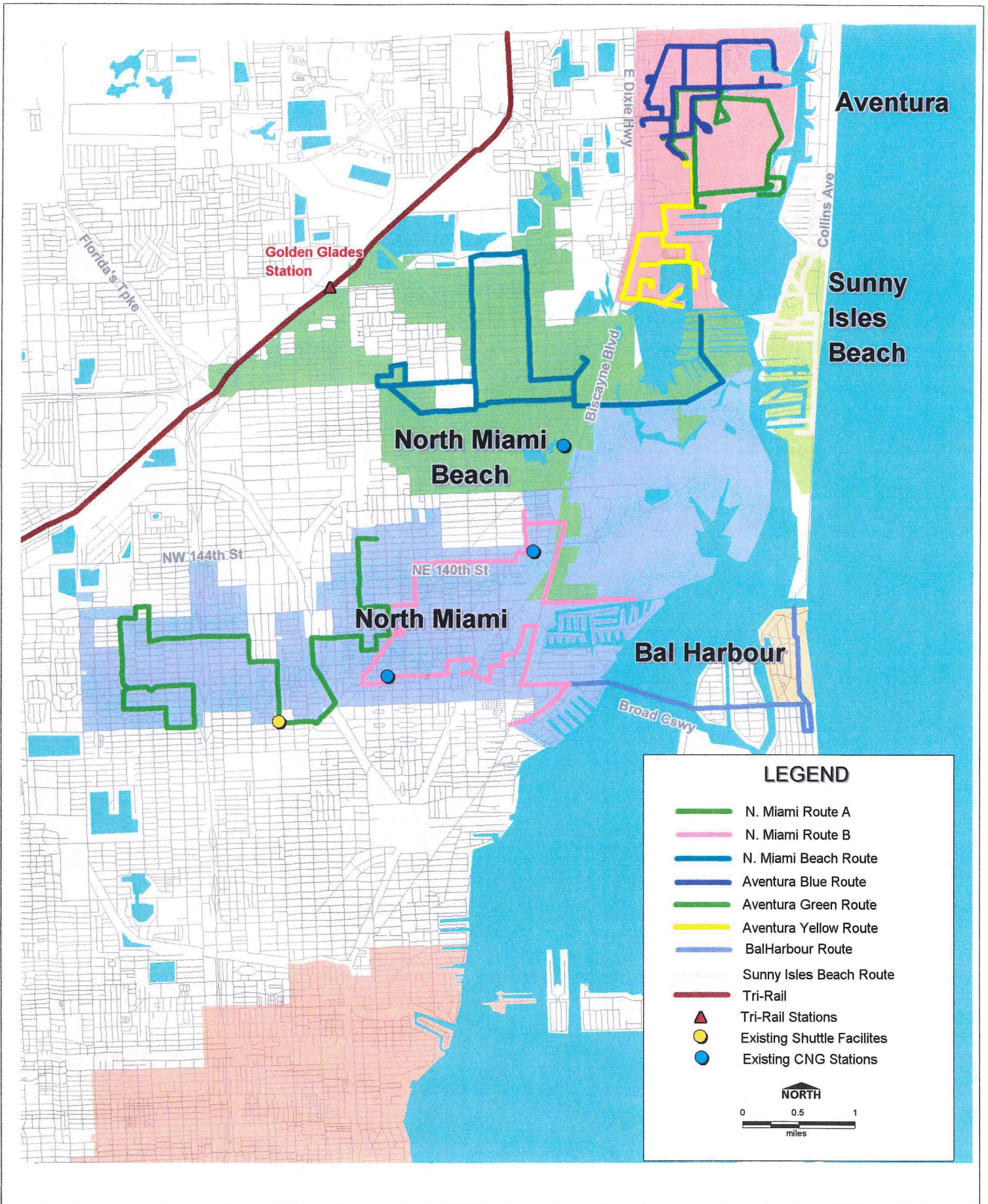
The service is currently operated using 20-passenger minibuses with wheel-chair lifts. Given the small service area and the relatively short route, electric vehicle technology could be applied to this area. Pure electric vehicles would work well, but hybrid-electric vehicles might be used if Bal Harbour would like the vehicles to be available for use in fire or hurricane evacuations or other events. Bal Harbour should consider partnering with neighboring communities to share a facility for vehicle storage and light maintenance.

Opportunities

The service operating on Bal Harbour and Bay Harbour Islands travels to the Publix on Biscayne Boulevard, which is located in the City of North Miami. North Miami is currently studying the implementation of its own circulator system, as mentioned earlier in this section. The opportunities are plentiful for Bal Harbour to combine resources with the other cities in North-Miami Dade that are considering using electric vehicles for circulator services (Aventura, North Miami Beach, North Miami, and Sunny Isles Beach). Furthermore, Bal Harbour is located the closest to the planned maintenance facility in Miami Beach that can ultimately serve as a centralized maintenance facility for electric and hybrid-electric vehicle fleets throughout the area.

Bal Harbour is interested in the possibility of using electric vehicle technology. As with Sunny Isles Beach, the quiet and clean nature of electric vehicles would be well-received in a small beach community that is also bordered by a park.

Figure 2
North Dade Study Areas



TOWN OF MIAMI LAKES

The Town of Miami Lakes is the most recent municipality in the county to incorporate. An election was held on February 13, 2001 to determine the first elected officials of this new municipality. Located in northwestern Miami-Dade County within the "big bend" of the Palmetto Expressway (see the map in Figure 3 on page 39), the town has a population of approximately 20,000 in an area of six square miles. It was originally designed as a master-planned community with a distinct town center and a multitude of land uses. Available housing includes single-family homes (some of which are worth up to \$1,000,000), condominiums, townhomes, and numerous rental apartments. The east-west spine of the city is Miami Lakes Drive, NW 154th Street. There are numerous shopping opportunities along Miami Lakes Drive. There are also business parks with office complexes and light industrial activities on both the east and west ends of this corridor. Ludlam Road (NW 67th Avenue) is the primary north-south route through the town. The town center, quite literally Main Street, contains specialty shops, restaurants, and a hotel, and appeals primarily to visitors. However, Main Street also contains neo-traditional mixed uses, and there will be more retail development (including a book store and additional restaurants) occurring nearby that will make this area more attractive as a destination. The campuses of Florida Memorial College, Miami-Dade Community College, and St. Thomas University are located very near the town.

Miami Lakes is generally regarded as a middle-upper income area. The town has a number of employment opportunities in the activities described above, and representatives of the Graham Company have estimated that the daytime population of the town increases by about 75 percent, approaching 35,000 people. Given the master-planned nature of the town, there are ample opportunities for people to live and work in the community. Representatives of the Miami Lakes Business Association have indicated that they believe that as many as 50 percent of the people who live in Miami Lakes also work in Miami Lakes. They also regard Miami Lakes as a place where many people walk to their destinations. Members of the Miami Lakes Civic Association also noted that there are a number of senior citizens in the town.

There did not appear to be consensus on the level of traffic congestion in the town. It appears that traffic is becoming more of a problem as the area continues to grow, but area representatives do not seem to think conditions are particularly bad, let alone severe.

Potential Service Characteristics

Because of its newly-minted status as a municipality, it is not clear if the soon-to-be-established town council and mayor will be enthusiastic about an electric vehicle circulator service. However, members of the project Advisory Board suggested reviewing the area as a potential location for such services. CUTR staff contacted representatives of the Miami Lakes Business Association, the Miami Lakes Civic Association, and the Graham Company to gain insights on the nature of the area and the possible applicability of electric vehicle circulator service.

Vehicle and Infrastructure Requirements

It is premature to estimate what number of vehicles might be needed when there has been no study to determine demand, when route length and frequency are unknown, and when the newly-elected officials have only recently taken office. However, if Miami Lakes is interested in the same level of service as some other municipalities in the county, it might be reasonably estimated that no more than four vehicles would be necessary to provide a service that would primarily be utilized during peak commute hours and the midday hours.

Opportunities

A master-planned community with a recognized center and complementary land uses offers an advantageous framework and favorable opportunities for a practical internal circulator service. Many representatives of the town noted the circular or spiral nature of the street system, where most roads allow easy access to the center of town. There is a strong east-west spine that connects most shopping and employment centers. The town is regarded as a “walking area” where people are not necessarily dependent on the automobile for all trips, and which makes accessible destinations likely to be served by transit circulator services.

All of the conditions noted above, a sense of centrality, pedestrian-friendly site designs, mixed land uses, etc., are promising and supportive of transit services. The town also extends west of the Palmetto Expressway, and there appears to be some consideration that the areas east and west of the expressway need to be symbolically united. An internal circulator service might help in that regard as well.

However, traffic congestion and parking do not appear to be major problems in the area. The median income is relatively high, and most people have cars and apparently easily drive or walk to their destinations within the town. No studies have been conducted on the feasibility of a

local transit service, and there is no clear indication of what kind of priority such a service would have with a newly elected town council.

Copies of this report should be provided to the new leaders of the town. They can then determine if they would like to pursue a feasibility study for establishing an electric vehicle circulator service in their new community. If they do express interest, they can review the opportunities to partner with Hialeah and the Airport West area for facilities and equipment. They should also consider how they might work with the City of Aventura if that city continues to utilize Coach USA as a contractor. Coach USA's operations center is located within three miles of Miami Lakes.

CITY OF HIALEAH

The City of Hialeah, which recently celebrated its 75th year of incorporation, is the second-largest Miami-Dade city with more than 230,000 residents. Hialeah contains a wide variety of community facilities, businesses, factories, and residences. It is the fifth-largest populated city in Florida, and is one of Miami-Dade County's largest employers. Hialeah is home to the "World's Most Beautiful Park," the Hialeah Park and Race Course, and boasts over 15,000 multi-lingual businesses.

Potential Service Characteristics

A recent study (*City of Hialeah Circulator Study*, Carr Smith Corradino, October 1998) determined that, while MDT routes have adequate coverage in most areas of the city, the headways of mostly one hour are not frequent enough to satisfy the area's needs. Also, major developing areas such as the portion of the city west of the Palmetto Expressway (SR 826) have very little service. Key populations in need of transportation include senior citizens, youth, and people needing access to jobs in the community, and those requiring access to other transit services (MDT's Metrobus/Metrorail and Tri-Rail).

It was recommended that Hialeah implement a demonstration circulator service that coordinates with MDT (Metrobus and Metrorail), Tri-Rail, and local jitney services. A system of two routes was developed that could have one central transfer point or multiple transfer points. This would allow riders to travel in four different directions at a relatively high frequency.

Design goals of the service include: to provide service to under/unserved areas; to target seniors, income-disadvantaged, and youth; to link residential areas of the city with major shopping, health care, recreational, employment, and social service destinations; to run routes on neighborhood streets wherever possible; and to coordinate service with all existing transportation providers, including MDT, Tri-Rail, Conchita Express (a private transit provider), children's transportation services (usually private schoolbus services), social service agencies, etc.

The proposed circulator service was recommended to operate bi-directional service along the entire alignment with 30-minute frequencies. The two proposed routes, which are shown on the map in Figure 3 on page 39, are about 11 miles long, and a one-hour, one-way running time was estimated. Service spans would be 12 hours on weekdays and 8 hours on weekends and holidays. It was proposed that the service have a fare, but one that would be less than MDT's current base fare of \$1.25 (\$0.75, for example). However, in accordance with County ordinances, if fares are charged by the cities, they need to be consistent with MDT's fares.

Vehicle and Infrastructure Requirements

Ten minibuses (21-22 passenger vehicles) would be utilized for the service: eight for service and two spares. Due to the length of the routes, the use of hybrid-electric vehicles (rather than pure electric) would be more appropriate. Hybrid-electric vehicles, while costing more than pure electric vehicles, require fewer batteries to be kept on hand and have a much longer range than pure electric vehicles (as discussed in Chapter 1 of this report). The hybrids can incorporate a diesel, LNG, or LPG auxiliary power unit (APU). Hialeah is currently in negotiations with Coach USA for the provision of its circulator service.

Opportunities

Members of the Study Advisory Committee indicated that the City of Hialeah has a high level of interest in the application of electric vehicle technology, and this notion was confirmed by a representative of the City. If indeed the interest is strong in Hialeah, as well as in Miami Lakes and Airport West (discussed below), then the opportunities for combining resources among them should be explored fully. These areas are located at some distance from the other areas in the eastern portion of the County that are considering using electric or hybrid-electric vehicles, and also some distance from the planned maintenance facility to be built in Miami Beach. Therefore, these areas could possibly share their own facility for the storage and

maintenance of their fleets, and perhaps rely on the facility in Miami Beach for heavy maintenance (or contract to have a mechanic from Miami Beach come to the area).

AIRPORT WEST

The area known as Airport West (AW) surrounds the western half of Miami International Airport and is home to several industrial centers; corporate parks; shopping facilities including Miami International Mall, Mall of the Americas, and the Dolphin Mall; hotels; and other stand-alone major employers. The boundaries of the area are considered to be Okeechobee Road (US 27) on the north, Le Jeune Road on the east, Flagler Street on the south, and the Florida Turnpike on the west. Airport West is characterized by extremely heavy traffic volumes in the peak morning and afternoon rush periods, as well as high midday volumes. One of the most congested areas is near the intersection of the Palmetto Expressway (SR 826) and the Dolphin Expressway (SR 836). While the area has been historically underserved by MDT (due to a lack of funding), two new routes have recently been implemented (Airport Connection and the Doral Connection), with plans for a third (Blue Lagoon Connection). In addition, there are Tri-Rail shuttles that serve the Koger Center (a major office park) and the area south of the airport known as Blue Lagoon that includes some hotels and the Waterford Corporate Center. Tri-Rail shuttles serve the Koger Center at the heart of the Airport West area.

Potential Service Characteristics

As a result of a very recent study undertaken for the Miami-Dade MPO (*Miami Surface Shuttle Services: Feasibility Study for Transit Circulator Services in Downtown Miami, Brickell, Overtown, and Airport West*, CUTR, June 2000), two AW shuttle routes were proposed. These routes are initially planned to be midday shuttles, since MDT now has new service that can help better serve the commute trips that connect the area to Metrorail and other Metrobus routes, and Tri-Rail also has a commuter-oriented shuttle service in the area. As interest and funding allow, the service span, frequency, and service coverage of the shuttles can be expanded.

One proposed route is the International Mall Shuttle, which would provide service to the International Mall for employees in Airport West that are located along NW 84th Avenue, NW 25th Street, NW 87th Avenue, NW 36th Street, and NW 12th Street. Restaurant destinations along the alignment would also be served. The other proposed route is the Blue Lagoon Shuttle, which would run from the Miami Airport Hilton west to the Mall of the Americas. This shuttle

route would also serve the Hotel Sofitel, Waterford Corporate Center, and the Radisson Mart Plaza Hotel. These two shuttle routes are shown on the map in Figure 3 on page 39.

Initially, the service span would cover the midday, between 11:00 a.m. and 2:00 p.m. The purpose of the midday service would be to provide frequent service at 15-minute headways for those who take transit to work and need transportation for lunch or other errands. If potential users who now drive to work have an attractive and reliable service to help them traverse the area during the day without relying on their cars, then some might be encouraged to use MDT and Tri-Rail transit options available for the commute trip. Even if commuters do not switch modes for the work trip, using midday shuttles will help alleviate the noontime congestion plaguing the area.

Vehicle and Infrastructure Requirements

For 15-minute service, the International Mall Shuttle would require four vehicles, and the Blue Lagoon Shuttle would require three vehicles, including spares. Both shuttle routes are expected to be implemented using small transit vehicles such as 22-passenger minibuses.

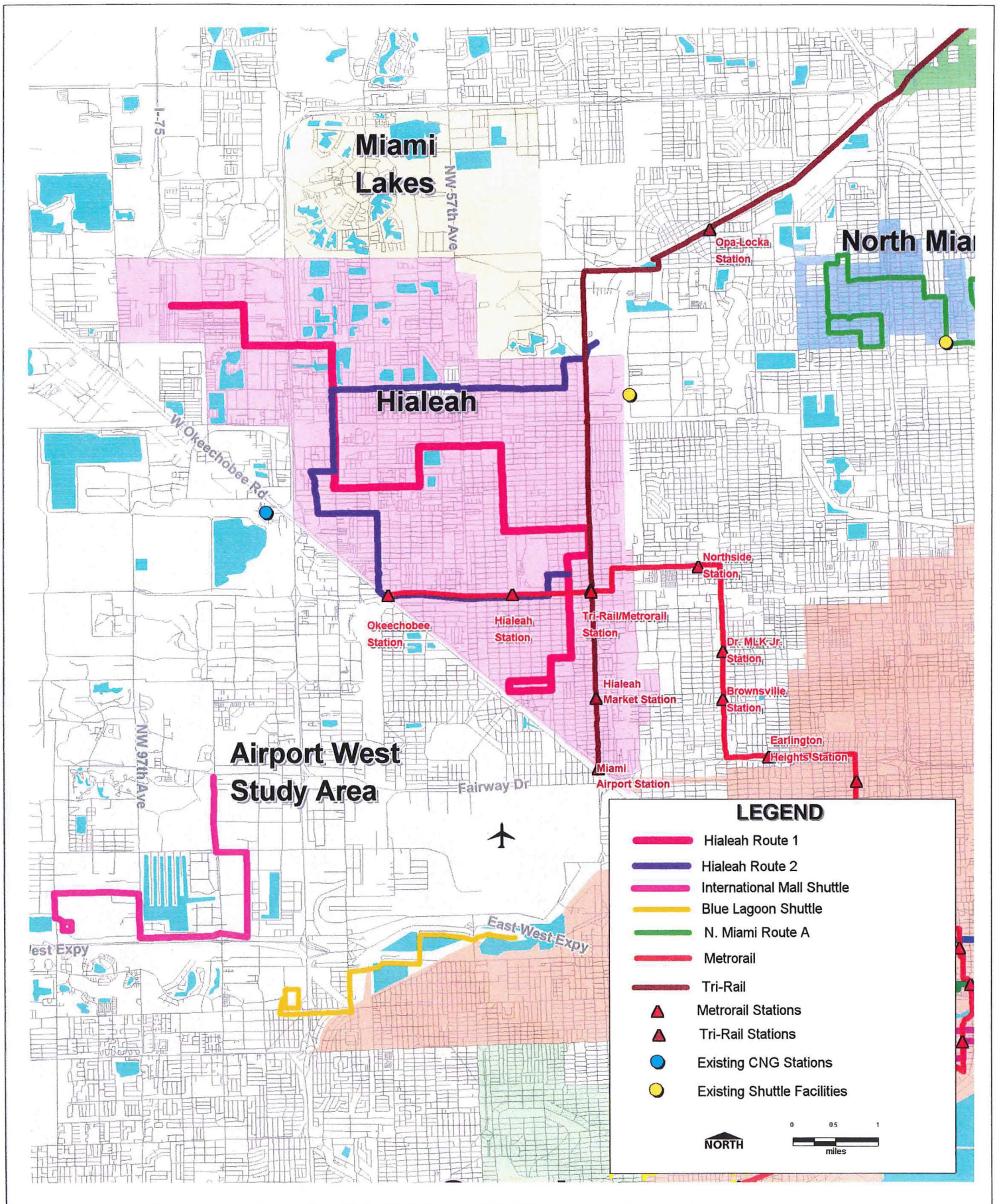
The use of alternative-fuel vehicles, such as electric or hybrid-electric vehicles, is the focus of this study; they were included in the previous CUTR study as one bus technology considered. Airport West is interested in getting some services on the streets of the congested areas, no matter what the vehicle technology. It is true, however, that potential users would like to see a clean, attractive, convenient, and reliable service. If the use of electric or hybrid-electric vehicles can enhance the attractiveness to potential riders, and if the funding can be secured, then the technology should be considered for this area.

Opportunities

If there is indeed a firm interest in Airport West for using the electric vehicle technology, then, as with the other areas examined in this feasibility study, they should review the opportunities available for the sharing of resources. While there might be the possibility of using a facility at 650 NW 8th Street in Downtown Miami (a facility discussed below, whose location is recommended for the shuttle services planned for Downtown Miami, Brickell, and Overtown), Airport West should preferentially consider partnering with Hialeah and/or Miami Lakes if the interest in those areas for applying the electric vehicle technology also exists. Since Airport

West lies in unincorporated Miami-Dade County and there is no municipal body to maintain or operate the service, MDT's Coral Way facility might also be considered.

Figure 3
Miami Lakes-Hialeah-Airport West Study Areas



OVERTOWN

Overtown is the historic largely African-American community located directly north of and adjacent to Downtown Miami. The community is primarily residential, with some neighborhood businesses and other commercial/industrial uses located in its more northeastern portions.

Prior to 1960, Overtown was a relatively stable and vibrant community of almost 40,000 residents. While the community was economically-challenged, there was a great sense of neighborhood due to the location of some higher-income residents, neighborhood schools, and hundreds of locally-owned businesses. After 1960, a number of forces including school desegregation, increased housing opportunities for higher-income minority residents in other areas, speculative apartment construction, and disinvestment negatively impacted the community and caused a reduction in community cohesion. The most devastating blow to the community's flourishing sense of identity occurred when hundreds of residences and businesses were purchased and destroyed to accommodate the construction of Interstate 95 in the late 1950s and early 1960s. Later, construction of Interstate 395, and even the elevated Metrorail further exacerbated physical divisions within Overtown. These transportation projects removed a large part of the economic base of Overtown, and created physical barriers that divided what was once a singular community into four different parts.

Today, Overtown is a shell of what it once was. The population of the area has shrunk from 33,000 people in 1950 to about 8,000 today. Overtown is experiencing the most extreme hardship of any community in Miami-Dade County. 1990 U.S. Census data indicated that only 34 percent of Overtown's working age residents were employed and over half of all families in the community were shown to have incomes below poverty levels. There is substantial underinvestment in this area, an area that literally abuts other major centers of economic growth such as the Civic Center to the northwest, and new development in the Miami CBD and the Omni area to the east and south.

Potential Service Characteristics

The Miami Surface Shuttle Services Circulator Feasibility Study, completed by CUTR in June 2000, recommended shuttle service that would travel through Overtown primarily on an east-west basis. One route was recommended that would travel along 10th/11th Streets and 8th Street to connect with other transit modes and provide service past historic buildings,

redevelopment areas, parks, human services, schools, shopping, jobs, and high-density residential developments.

The objectives of the service are to provide residents with increased access to multiple work, human service, and shopping destinations; encourage non-residents to visit the historic attractions in Overtown; support redevelopment efforts; and be consistent with bicycle/pedestrian/greenway plans and improvements that are intended to connect the Miami River to Biscayne Bay through Overtown. The routing was aligned to meet these objectives while avoiding duplication of existing MDT services while still connecting with as many transit modes as feasible.

The planned route is shown on a map in Figure 4 on page 49. The recommended service would operate from 6:30 a.m. to 6:30 p.m. Monday through Saturday with 20-minute frequencies.

Vehicle and Infrastructure Requirements

The proposed circulator service for Overtown would require one small vehicle, such as a minibus, to provide the 20-minute service. Two minibuses would be required to provide 15-minute service that would also allow an extension of service to the Civic Center. If needed, a spare vehicle for the Downtown Miami services could be shared with Overtown. It would be operationally feasible to use an electric or hybrid-electric minibus to operate this service. There is a facility located at 650 NW 8th Street in Downtown Miami that once served as the storage and maintenance site for the electric streetcars that served Miami until the 1950s. This building could be converted to a facility to house and maintain electric or hybrid-electric vehicles for all of greater Downtown Miami.

Opportunities

With the nearby areas of Downtown Miami and Brickell also seriously interested in applying electric vehicle technology to their proposed shuttle services, there is a great opportunity for Overtown to also become involved. There is also the possibility of cooperative involvement with the Airport West circulators, though not as attractive as those for other downtown area circulators.

DOWNTOWN MIAMI

While most downtowns have seen retail functions depart for the suburbs, Downtown Miami's Central Business District still hosts numerous major retailers, including general department stores Burdine's, Ross, and Marshall's, and major specialty big box retailers Sports Authority and Office Depot, as well as outlets for several mall and chain retailers, and multiple independent and local chain clothing, shoe, and electronics retailers. A jewelry district, one of the largest in Florida, thrives in the CBD. A number of urban malls also occurs throughout the CBD, where small retailers and restaurants of all types, sizes, and sophistication proliferate. The bayside marine-themed specialty mall, and tourist and local visitor attraction center, Bayside, lies on the midtown waterfront surrounding a marina, directly north of and adjacent to Bayfront Park, Miami's main waterfront park, used throughout the year for festivals, concerts, and other community and regional activities. A number of hotels occur throughout the CBD, two large and notable churches continue to operate there, and there appears to be the beginnings of a return to downtown residential dwellings. In the approximately 9 by 7 block area of the CBD, employment numbers around 47,000, located in the many Miami office buildings and Downtown towers so characteristic of major metropolitan CBDs. While I-95 on the west, and Biscayne Boulevard paralleling the Bayfront on the east, are major thoroughfares that run north-south and frame the CBD, the Flagler Street/South 1st Street parallel pair of one-way streets is the most important east-west corridor; this critical corridor is the main east-west activity axis and development spine of the CBD.

Along the Flagler Street Corridor in Downtown Miami, and largely on Flagler Street itself, are a number of historic buildings, including the Gusman Theater. At the west end of the corridor is the Miami River, while the east end of the corridor terminates at Bayfront Park. What gives the Flagler Street Corridor a somewhat different character than most downtowns in Florida is the level of retail activity it has maintained and continues to enjoy. The virtual majority of retail activity in the Miami CBD occurs along the Flagler Street Corridor, either on Flagler Street itself, or within one block of Flagler on the parallel streets.

Traffic engineering levels of service (LOS) on the streets of the corridor are generally good (B or C), although cars pulling in and out of street parking spaces and trucks making deliveries can cause aggravation to traffic. Flagler Street is generally alive with pedestrians during daylight hours; however, the Downtown Development Authority (DDA) believes the corridor has fallen short of its potential as an all-day, year-round, street-oriented marketplace and exciting

pedestrian promenade (some storefronts are shuttered and, after 5:00 p.m., the area is far less patronized).

Potential Service Characteristics

The DDA is very excited about the prospects for renewed private investment in the downtown, and has developed plans for improving the Flagler Street Corridor. One component of the successful implementation of these plans is the establishment of a shuttle service that would take the place of the larger MDT buses that currently traverse Flagler Street.

The previously-mentioned study, *Miami Surface Shuttle Services: Feasibility Study for Transit Circulator Services in Downtown Miami, Brickell, Overtown, and Airport West* (CUTR, June 2000), described how, once improvements to Flagler Street are completed (mid-2001), a shuttle service will be able to travel on Flagler in both directions, making the service easy to use and understand for potential riders. Also, the service would be frequent enough that riders would not need a schedule to use it (service every three to five minutes). The shuttle should serve as much of the length of Flagler Street as is appropriate given the current levels of development, and it should connect with other transportation modes wherever possible. It is envisioned that the shuttle service would initially run from 6:30 a.m. to 6:30 p.m. Monday through Saturday. The recommended route alignment is shown on the map in Figure 4 on page 49.

Vehicle and Infrastructure Requirements

It is also the objective of the DDA that the services be provided using small vehicles that would better fit in with the activity in the corridor. Since larger, diesel-powered buses are not preferred, electric or hybrid-electric minibuses would be an attractive option for the shuttle service. Depending on the ultimate frequency of these services and route length, between 4 and 12 vehicles (including spares) will be needed.

The DDA is definitely interested in how the electric vehicle technology could be applied to the Flagler Street Corridor. The clean, quiet, and non-intrusive nature of electric and hybrid-electric vehicles would be an ideal match for the operating environment of Flagler Street (with its high level of pedestrian activity). While pure electric vehicles would be operationally feasible, hybrids might be considered depending on whether the vehicles would be used for evacuations or other events where an extended range would be needed, or whether the vehicles would be also be used (perhaps later in the evenings and on Sundays) for shuttle services in other areas.

Opportunities

The proximity of the services proposed for the Flagler Street Corridor to those recommended for Overtown and Brickell provide an obvious opportunity for resource sharing. A possible location for a facility that could be used for all the vehicles in these areas would be at 650 NW 8th Street in Downtown Miami. These areas are also close enough to the planned maintenance facility to be located in Miami Beach to take advantage of the centralized heavy-duty maintenance opportunity.

There are also other opportunities, however. Coconut Grove and the City of Coral Gables (discussed later in this chapter) are currently undergoing circulator studies and are very interested in the electric vehicle technology. Coconut Grove would want frequent late night and weekend service. It would then be possible for some vehicles used in the Downtown area during the day to be used later in the evening and on weekends to provide the extra service to Coconut Grove. As the Coconut Grove and Coral Gables studies are completed, these prospects should be further explored.

BRICKELL

The Brickell area lies south of the Flagler Street Corridor, on the south side of the Miami River. In general, the area is considered to be bound by the Miami River on the north, SW 15th Road on the south, Biscayne Bay on the east, and I-95 and SW 3rd Avenue on the west, and to include Brickell Key. Brickell is a mixed-use, high-density area that provides a setting for the development of an urban community where residents can live, work, eat, shop, and relax, all within close distances. Some have referred to the concept of the "Brickell Village," given its potential to become a true, nearly self-supporting urban neighborhood. The types of densities and mixed uses in Brickell clearly lend themselves to not only supporting mass transit services, but actively encouraging them.

The Brickell area has the potential to be one of the most exciting close-in, downtown urban neighborhoods in Florida. Over 15,000 people live in the area, and more than 5,000 new residents are expected during the next three years. It has proven to be an attractive location for prime high-rise office developments since the 1980s, contributing to one of the largest financial and banking districts in the world. A considerable amount of new high-rise condominium residential development has either been built or is being built north of 15th Road,

from Brickell Key to SW 3rd Avenue. More than 8,000 housing units currently exist, while an additional 3,000 are already currently planned. Retail activities are also increasing along SW 7th and 8th Streets with restaurants and cafes, a new Publix, and a new Walgreen's.

Potential Service Characteristics

According to the recent Feasibility Study for Transit Circulator Services, the Brickell community can initially be served with a clockwise loop that primarily connects the eastern portions of Brickell, where massive existing residential, commercial, and hotel development is currently being augmented by vigorous new construction, with the Metrorail/Metrobus/Metromover Brickell Station. This loop would also provide an internal circulator service for local shopping and leisure trips, and for lunch trips throughout the area. The recommended shuttle route is designed to complement, not compete with, existing MDT service. The proposed Brickell service is displayed on the map in Figure 4 on page 49.

It is recommended that service be provided from 6:30 a.m. to 6:30 p.m. Monday through Saturday with 15-minute service. In the long run, the Brickell community should consider if it would prefer to maintain what is essentially a local circulator within the Brickell area, but with a bit more coverage and a 10-minute frequency.

Vehicle and Infrastructure Requirements

To provide 15-minute service, one minibus would be required; to provide 10-minute service, two minibuses would be required. If needed, a spare vehicle for the Downtown Miami services could be used as a spare in Brickell. There is a high level of interest in using electric or hybrid-electric vehicles to operate this service.

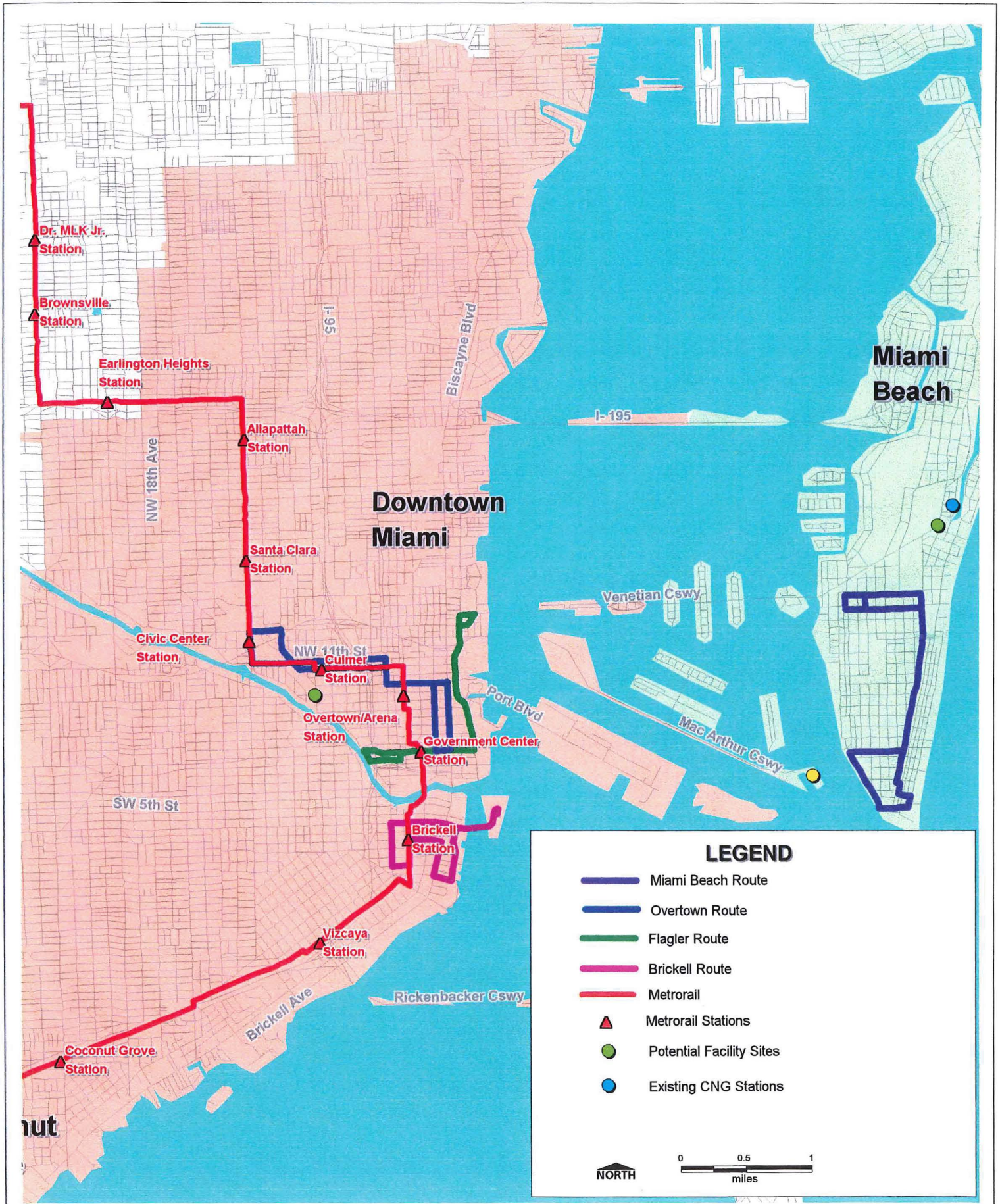
Electric vehicle technology would complement the operating characteristics of this proposed route. The quiet, non-intrusive attributes of the technology would fit in well with the idea of a "Brickell Village." Ultimately, which technology (pure electric versus hybrids) is selected would depend on whether any other uses would be required of the vehicles (evacuations, other events requiring an extended range, storing vehicles for off-peak uses in other areas, etc.). Pure electric minibuses would be operationally feasible on the proposed Brickell service; however, as mentioned previously, whether the vehicles would be also be used for possible off-peak or Sunday shuttle services in other areas must be considered.

Opportunities

The proximity of the services proposed for Brickell to those recommended for Overtown and Downtown Miami provides a clear possibility for the sharing or combining of resources. A possible location for a facility that could be used for all the vehicles in these areas would be at the former transit barn on NW 8th Street in Downtown Miami. These areas are also near enough to the proposed maintenance facility to be constructed in Miami Beach to take advantage of the opportunity to have centralized maintenance.

Additional opportunities exist with Coconut Grove and the City of Coral Gables (discussed later in this chapter), which are both currently studying the feasibility of circulators in their respective areas. Both areas are highly interested in using electric or hybrid-electric vehicles. Coconut Grove wants frequent late night and weekend service; as such, it could be possible for some vehicles used in the Brickell area during the day to be used later in the evening and on weekends in Coconut Grove. As the Coconut Grove and Coral Gables studies are completed, these possibilities should be seriously examined further.

Figure 4
Downtown Miami Study Area



CITY OF CORAL GABLES

The historic City of Coral Gables, "The City Beautiful," is home to 150 multinational corporations, 21 consulates and trade offices, several fine art galleries, and live theater. Miracle Mile, one of the original literal "shopping centers" in South Florida, is actually Coral Way, SW 22nd Street, between Douglas Road and Le Jeune Road, and is lined with wall-to-wall stores, shops, and boutiques. Coral Gables is also noted as a fine dining capital of South Florida, with a large range of continental, Latin, ethnic, and domestic restaurants, bistros, and cafes. The city has a population of approximately 43,000 in 14 square miles. There is 5.5 million square feet of office space city-wide, with more than an additional 500,000 square feet proposed or underway. The city also has 1,400 hotel rooms, half of which have luxury or first-class status. Coral Gables is shown on the map in Figure 5 on page 59.

Potential Service Characteristics

A community travel study was completed in 1997 and was summarized in *Summary of Major Findings and Conclusions of a Community Travel Study Assessing the Factors Contributing to Traffic Congestion in the Coral Gables Central Business District*, Behavioral Science Research, Coral Gables. Fundamental observations and major findings are presented below:

- Approximately 80 percent of survey respondents indicated that finding parking in the CBD was "difficult" or "somewhat difficult."
- Arrival and departure of CBD office workers appears to be distributed so as not to be a major cause of traffic congestion.
- About 60 percent of downtown Coral Gables office workers visit the Gables CBD for personal shopping and meals at least once per week. Nearly 60 percent of those use their cars for such visits and 75 percent of those use on-street metered parking.
- A trolley/shuttle system that would link the CBD with the closest Metrorail stations "elicits a relatively impressive degree of interest in likely usage." While only 1 percent of the 5,500 CBD office employees currently use Metrorail for the work commute, nearly 20 percent would be "very likely" to use it if there were reliable and convenient shuttle services between the CBD and the stations. Another 25 percent would be "somewhat likely" to use Metrorail under these conditions.

- A trolley/shuttle system would reduce the number of employees using on- or off-street metered spaces deemed “inappropriate usage” of the spaces by city staff and merchants seeking to make it easier for other “income-generating” visitors to find parking.
- A trolley/shuttle system that traversed just the CBD routed between office buildings, retail, and remote parking areas, elicited the interest of two-thirds of CBD office employees. This is an important finding, because those who might take Metrorail and a shuttle to get to work would probably like to have a system available to take them to shopping/lunch destinations in the CBD that might be too far to walk. Indeed, even those who drive to work may find a lunchtime alternative travel mode attractive, as they would not need to find parking at their destinations and upon returning to work.
- There is little awareness of MDT bus service in the area, and there are overall “negative impressions” of Metrobus. More than 71 percent of the CBD workers are “not at all familiar” with Metrobus schedules in the Gables CBD. The three major reasons CBD workers do not use public transit are:
 - 1- Bus stops are too far from points of origin/destination (23%)
 - 2- Car needed during the workday (17%)
 - 3- Buses come too infrequently (11%)
- The study shows “ample evidence” supporting an intra-CBD trolley/shuttle service. This assumes that the service would be “making stops at office buildings and major shopping sites in the CBD, on a timely basis, dependent upon demand, in and around the Coral Gables Business District.”
- The study estimates that as many as 1,000 new riders would use Metrorail each way, and that it would reduce, by up to that many, the number of cars entering and departing the CBD each day during a.m. and p.m. peaks, as well as reduce the lunchtime competition for on-street metered parking between noon and 2:00 p.m. each day. While the initial estimates from this study of the numbers of riders might be optimistic, it is anticipated that the current study being completed for Coral Gables will result in more accurate potential ridership estimates.

The City of Coral Gables has recently begun a circulator study for the area. While no results are available at this time, the type of service that might be considered can be presented here. A circulator system in the Coral Gables CBD would likely serve Metrorail, offices, and shopping sites. Service could be provided with high frequency from 6:30 a.m. to 6:30 p.m. Monday through Friday.

Vehicle and Infrastructure Requirements

Any service recommended for Coral Gables might require between two and four vehicles, including a spare, depending on the frequency of service and the length and configuration of the route(s). There is a high level of interest in the use of electric or hybrid-electric vehicles. The operating environment apparent in the Coral Gables CBD, which includes the pedestrian-oriented Miracle Mile, would certainly be conducive to the use of electric vehicle technology.

Opportunities

While, as discussed earlier in this chapter, there exist possibilities for resource sharing with Brickell and Downtown Miami, the more obvious partnering opportunity might be with Coconut Grove, which is undergoing its own circulator study at the present time. As the map in Figure 5 (on page 59) shows, the Coral Gables CBD can be connected easily with Coconut Grove, interestingly enough, at the Douglas Road Metrorail Station, which both Coral Gables and Coconut Grove would like to serve with their individual circulators. As their studies are completed, opportunities for shared vehicles and a shared facility should most definitely be explored. It is also important to remember that a centralized maintenance facility on Miami Beach will likely be available for use by other electric and hybrid-electric fleets in the area.

COCONUT GROVE

The community of Coconut Grove lies just south of Downtown Miami, and contains an eclectic mix of restaurants, shops, parks, cultural activities, residences, and residents. The major shopping areas are located in the village center at the junction of Cocowalk, which houses an AMC movie theater, 38 shops, and restaurants, and the Streets of Mayfair, which holds 228,000 square feet of shopping and dining within 2.5 city blocks. Coconut Grove is also a residential area, with sections of very affluent housing as well as a section (West Grove) with a low-income, minority population. Coconut Grove is shown on the map in Figure 5 on page 59.

The commercial area suffers from a shortage of parking that results in significant traffic congestion, air and noise pollution from vehicles, and conflicts with pedestrians. The area is also known for its ample nightlife, which is evident not only on weekends but also during the week.

Potential Service Characteristics

A circulator study sponsored by the Miami Parking Authority is currently underway to recommend solutions to the congestion and parking problems that exist in the commercial area of Coconut Grove. In addition, circulator service is desired in the West Grove area, to provide increased access to MDT, primarily Metrorail at the Douglas Road station close to bus service across US 1 from the West Grove, employment, and other services, etc.

It is very likely that people would utilize an attractive type of service that not only provides internal circulation but has convenient connections to Metrorail and shopping/leisure destinations, and has access to connections to Downtown Miami/Brickell. Coconut Grove is looking to implement a convenient local circulator service for residents, employees, and visitors to Coconut Grove. Remote parking areas served by a shuttle on the edges of the communities could allow visitors to, in effect, drive to Coconut Grove but leave their cars outside of the commercial district.

Service could be provided from 6:30 a.m. until at least 8:00 p.m. Monday through Wednesday, with service until midnight or later Thursday through Saturday. Sunday service will also be required, but with a shorter service span, such as 9:00 a.m. to 6:00 p.m. Actual hours of operation will be determined based on the results of the study. Service frequency should be high, particularly in the commercial district.

Vehicle and Infrastructure Requirements

Since the circulator study for Coconut Grove is ongoing, it is premature to determine here the number of vehicles that would be needed to serve the area; the final number will be based on the service ultimately recommended in the study. However, given the size of the desired service area and the type of service Coconut Grove would like to see implemented, it is likely that two to four vehicles would be required for the envisioned service, including a spare. The possibility also exists to use vehicles from shuttle services in Downtown Miami and Brickell to provide additional service on nights and weekends.

Coconut Grove is definitely interested in using electric or hybrid-electric vehicles to operate the circulator service. The quiet, and non-intrusive nature of the electric vehicle technology would be ideal for the commercial area, which consists of many restaurants with outdoor seating and

is oriented to the pedestrian. Due to the service area size, pure electric vehicles could work well if a storage and charging facility was located near the routes.

Opportunities

Opportunities certainly exist for partnering with neighboring Coral Gables, which is currently conducting a circulator study of its own. One of the main issues Coral Gables is studying is how to provide service to its CBD and how to better connect its offices and shopping with Metrorail. Both areas have a desire to serve the Douglas Road Metrorail Station. As the individual studies for Coconut Grove and Coral Gables are completed, the opportunities for sharing vehicles and/or sharing a facility should be explored.

Because Coconut Grove lies within the City of Miami, another possibility for partnering exists with the Downtown Miami and Brickell areas, which are nearby. As mentioned previously, vehicles from shuttle services in Downtown Miami and Brickell might be able to be used to provide additional service in Coconut Grove later at night and weekends. Again, there will be the maintenance facility on Miami Beach that will likely be available for use by other electric and hybrid-electric fleets in the area.

CITY OF SOUTH MIAMI

The City of South Miami is located immediately southwest of Coral Gables, along US 1 about eight miles southwest of the Miami CBD. It is a small community consisting of just 2.4 square miles, and a population of 10,404 (1990 U.S. Census).

South Miami is known for having a people-friendly, people-scaled business district centered at Red Road and Sunset Drive, and possibly best known for the Shops at Sunset Place, which contains 69 shops within 502,000 square feet of space in an attractive outdoor setting. Sunset Place, which mixes shopping, entertainment, and dining, is anchored by such names as GameWorks, IMAX, Virgin Records, Barnes & Noble, and an AMC 24-theater movie complex. South Miami is shown in Figure 5 on page 59.

Existing Service Characteristics

The City of South Miami had previously operated a fixed-route rubber-tire trolley, but found that the ridership did not support fixed-route services. Currently, through a partnership of the City of South Miami and the South Miami Community Redevelopment Agency, a shuttle service known as the “Green Lightning” offers varied and flexible transportation services to meet the transportation needs of the community. The Lightning provides service for the elderly, the South Miami Senior Center, local schools, recreational activities such as the after-school program Prevention through Academic and Recreational Excellence (PARE), and special events.

The Lightning also acts as a flexible downtown shuttle service that aims to meet the transportation needs of the City and Redevelopment Area’s residents, businesses, and visitors. The “Hometown” downtown area in South Miami is very active with pedestrians patronizing the Shops at Sunset Place, especially on weekends. The Lightning is a park-and-ride shuttle on Friday and Saturday nights, transporting those who park at the South Miami Metrorail parking garage or at “easy to find” spots on SW 73rd Street to the door of their “Hometown” destination. Friday night hours are from 6:00 p.m. until midnight, and Saturday hours are from 3:00 p.m. until midnight.

Vehicle and Infrastructure Requirements

While South Miami currently uses minibuses to provide its demand-responsive Green Lightning service, the number of vehicles required to operate a fixed-route circulator service cannot be determined without further study. Activity centers served, routes, and schedules will all affect vehicle and infrastructure requirements for services. However, it is anticipated, based on the size of the possible service area, that approximately two vehicles would be needed to provide a circulator service.

Opportunities

The City of South Miami has expressed significant interest in exploring the use of electric vehicle technology to operate circulator service. The possibility of partnering with the neighboring City of Coral Gables to share resources, which is conducting its own circulator study and is interested in using electric transit vehicles, should be explored.

The Shops at Sunset Place in the "Hometown" area of South Miami is an activity center providing shopping, entertainment, and dining. The area is pedestrian-oriented and would be a possible location for the use of the quiet and clean electric vehicle technology.

"DOWNTOWN" KENDALL

The unincorporated suburban community of Kendall wishes, as the consensus of a 1999 planning charrette, to create an attractive, recognizable center around the Dadeland Mall area. The Downtown Kendall area not only contains Dadeland Mall, but also several other shopping areas, a major grocery store—Publix, two office centers—Datran Office Park, which also includes the Dadeland Marriott and a new hotel, and Dadeland Office Towers, which includes AvMed, among others, a retail mall and attached six-story parking garage, Dadeland Station, and some low-rise condominiums and rental residential areas in the northern section. The two southernmost Metrorail stations, Dadeland North and Dadeland South, are located in this area, as is the South Dade Busway, which connects with Dadeland South.

"Downtown" Kendall has a Master Plan that was adopted by the Miami-Dade County Commission in December 1999. The Downtown Kendall Master Plan recommends the development of an attractive, secure, and shaded pedestrian-oriented environment with a sidewalk network connecting bus stops and Metrorail stations to the proposed residential, retail, and office areas. In addition, there is a proposed Downtown Kendall Circulator system; a study is ongoing that is looking at improvements to existing bus services and the implementation of transit circulator loops.

Potential Service Characteristics

The current Downtown Kendall Circulator Study recommends the staged implementation of four dedicated transit loops in the area. These potential loops are shown on the map in Figure 5 on page 59. Loop 1 travels west along Kendall Drive from a planned transit center near SW 85th Street and SW 72nd Avenue and south to the Dadeland South Station. Loop 2 travels west along Kendall Drive from the transit center, south to the Dadeland South Station, then north past Kendall Drive and east on SW 85th Street. Loop 3 runs west from the Dadeland North Station in a loop south of Snapper Creek, in the area of the Mall. Finally, Loop 4 runs from the Dadeland North Station north of Snapper Creek to serve residential areas.

Frequent service (10 minutes or less so that riders do not need a schedule) during the peak and off-peak periods is recommended. Also, the study recommends a strong system identity, including an attractive, integrated, and clearly-identifiable design for bus stops, routes, and vehicles. The study also suggests the implementation of a parking management program to encourage area employees to utilize transit and to encourage those who visit the area to park only once, and then use the circulators to travel within the Downtown Kendall area.

As mentioned previously, the circulator loops will be implemented incrementally as development of the Downtown Kendall area progresses. Within the next 24 months, only Loop 1 is recommended for implementation.

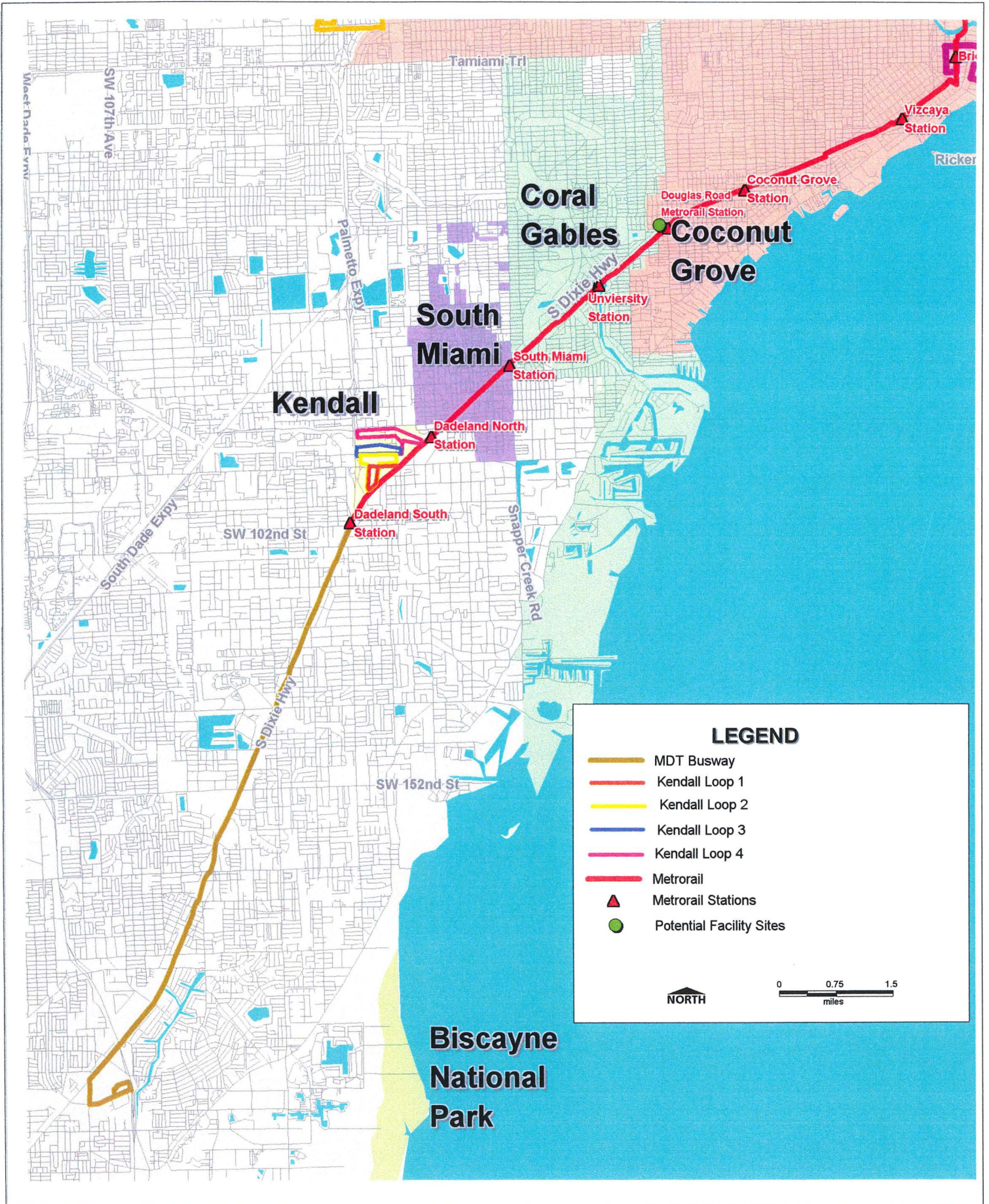
Vehicle and Infrastructure Requirements

The Downtown Kendall Circulator Study recommends that three smaller buses (minibuses) be used to operate Loop 1. The study does not indicate whether the use of any alternative-fuel vehicles should be considered, and the expense summaries show only the capital cost of typical diesel minibuses. However, given the small service area of Downtown Kendall and the relatively short length of the recommended circulator loops, the electric vehicle technology would apply to this area.

Opportunities

Only one of the four proposed circulator loops is recommended to begin operating within two years. The other three likely would not start operating for at least two years, as the Downtown Kendall Master Plan is implemented. The other area examined for this feasibility study that is nearest to Downtown Kendall is South Miami, which currently has a demand-responsive service and park-and-ride shuttle for the Shops at Sunset Place. It might be that, as the recommendations of the Downtown Kendall Master Plan and the Downtown Kendall Circulator Study come to fruition, opportunities for making use of electric vehicle technology and for sharing resources with other areas might increase over the next few years.

Figure 5
Coral Gables-Coconut Grove-South Miami Study Areas



CITY OF HOMESTEAD/FLORIDA CITY

According to its website, the City of Homestead combines “rustic charm” with big-city opportunities. Homestead and Florida City are located at a crossroad of tropical South Florida: to the north is the intense urbanization of the City of Miami; to the south is the tropical island ambience of the Florida Keys and the Atlantic Ocean; Biscayne Bay lies to the east; and ten miles to the west are the wilds of Everglades National Park. The area boasts family-oriented attractions, small-scale business centers such as the Park of Commerce and Redland Industrial Park, and its economy is advancing each year. Homestead is also one of the youngest areas in Miami-Dade County with a median age of less than 30 years.

Since the devastation of Hurricane Andrew in 1992, Homestead has been slowly rebuilding its economy through a variety of projects and strategies intended to create jobs and encourage prosperity for its residents. As a result, the City of Homestead is gradually transforming into a more successful community.

A proposed Urban Transit Village is part of Homestead’s comprehensive efforts to combat unemployment, spur economic development, and create a cohesive recreation environment. The Urban Transit Village is a downtown development project which includes a bicycle museum and hub, bicycle path, parking facility, gateway entrances, and connections to the South Dade Greenway Bicycle Network (a fully funded project connecting eight bikeways within Miami-Dade County). The Urban Transit Village project has been defined as a compact development centered around a transit station, which will provide enhanced mobility, environmental quality, pedestrian friendliness, alternative living and working environments, neighborhood revitalization, public safety and public celebration. The project, to be located partially on a section of land adjacent to the Busway extension, will connect commercial and residential boundaries by creating an urban park. The existence of large undeveloped parcels adjacent to the Krome Avenue corridor and business district, and the impending expansion of the Busway, make the area a prime location for transit-oriented development.

The area around Homestead’s historic downtown business community has also been designated as a Florida Main Street. In 1993, a group of local shop owners formed the Homestead Main Street Organization, with a mission to preserve the historical environment of the downtown area. The Main Street Organization focuses on attracting people and business owners to the downtown area. Now, downtown, which boasts a large antique trade, has become increasingly popular and is a growing arts and entertainment area.

Potential Service Characteristics

With construction of the South Dade Busway extension to Homestead to begin in 2002 and the development of the Urban Transit Village, there will be the potential for the implementation of additional transit service in the area, such as circulators. The Urban Transit Village project will focus on the intermodal connections between the Busway extension, the Deep South Miami-Dade region, Homestead's redevelopment area, including Miami-Dade Community College and the local historic businesses and hotels, and via the Busway and connections to it further north, access to Miami International Airport and Downtown Miami. The City of Homestead envisions that the Urban Transit Village can serve as a national model for transit-oriented development.

Vehicle and Infrastructure Requirements

At this time, it is premature to estimate the number of vehicles that might be needed to provide any circulator service. With the extension of MDT's Busway in the near future and with the progression of the Urban Transit Village project, more detailed service characteristics and requirements can be devised at a later time.

Opportunities

With the South Dade Busway extension and the Urban Transit Village project, there are many exciting possibilities for transit services in Homestead and Florida City. The Urban Transit Village is expected to promote economic development, support job creation, retain green space, and provide transportation elements required for sustainability. Additionally, the Urban Transit Village will be located within the boundaries of a recently-designated federal Empowerment Zone. This designation facilitates millions of dollars being invested in the area through various means: businesses located in the Empowerment Zone receive grant opportunities, significant tax incentives, and facilitated lending opportunities.

The area is definitely interested in exploring the opportunities for using electric or hybrid-electric vehicles to provide transit circulator services. Further study is needed in this area to determine the extent to which opportunities are available.

BISCAYNE NATIONAL PARK

Located near Miami, Key Biscayne, and Homestead, the “turquoise waters, emerald islands, and fish-bejeweled reefs” of the preserve make Biscayne National Park a perfect place for wildlife-watching, snorkeling, diving, boating, and fishing, among other activities. The Park, with nearly 173,000 acres, encompasses the longest stretch of mangrove forest on the east coast of Florida, more than 40 of the northernmost Florida Keys, and a living coral reef, among other natural resources. The Park’s archaeological sites, historic buildings, and shipwrecks illustrate a rich history of Native American use, pirates, Spanish exploration, early settlements, plantations, hurricanes, and maritime trade. In 1999, 442,585 recreational visits were recorded at the Park.

Biscayne National Park is currently involved in the first stages of a General Management Plan, which will create a new vision for the park’s future. The final plan will provide guidance for future park management, the protection of resources, visitor activities, allowable levels of use, and facility development. Several public meetings/workshops are being held to elicit public input on the plan.

Potential Service Characteristics

A representative from Biscayne National Park expressed interest in the development of shuttle services. There is a desire to connect to MDT’s services, such as the Busway, to allow transportation for employees as well as visitors. The Park would like to see an increase in the number of minority visitors, and it believes that providing transit access will help in that regard. More detailed service characteristics have not been developed.

Vehicle and Infrastructure Requirements

It is not surprising that Biscayne National Park would be extremely interested in using electric vehicle technology to operate any type of shuttle service in the area. Electric vehicles are non-polluting, quiet, and non-intrusive, and therefore would fit in perfectly with the environment of a national park. Similar transportation services are being provided in other national parks throughout the country. Specific vehicle requirements are not yet known.

Opportunities

The Park is located too far south to share resources with other areas. However, there might be other funds available through the National Park Service to help pay for a circulator service. Since the interest in electric vehicle technology is evident, further study is recommended in this area to explore the possibilities of service.

SUMMARY OF STUDY AREA OPPORTUNITIES

This chapter has outlined the existing or potential service characteristics for each of the study areas, the vehicle requirements (if known), and each area's interest in the technology. With the many municipalities and other community areas in Miami-Dade County either currently providing or considering provision of transit circulator services, and with the high level of interest evident among these areas to further explore the use of electric or hybrid-electric vehicles, opportunities abound for the sharing or combining of resources to allow for the most effective and efficient application of this technology.

Most of the areas studied for this report are interested in providing a service that is tailored especially for their individual local area. These communities want to see additional benefits accrue to their residents, employees, and visitors that would result from increased mobility. Many areas are also interested in increasing residents' access to employment, education, and other services; improved connectivity to MDT's Metrobus, Metrorail, and Metromover, as well as the South Dade Busway is also desired. Areas such as Hialeah and Airport West also want increased access to Tri-Rail stations. Other places, such as Overtown, Coral Gables, and Coconut Grove, have historic attractions or other enticements such as shopping and dining, and wish to attract additional visitors to their areas, but to avoid entangling congestion that problematically accompanies the economic, social, and cultural positives of increased tourist and visitor arrivals.

In planning these types of circulator services, the study areas have recognized the outstanding success of the Electrowave service on Miami Beach, and want something similar. The electric vehicles operating on Miami Beach are small, non-intrusive, non-polluting, quiet, clean, and attractive. Each of these aspects appeals to the areas that are operating, planning, or considering circulator services. For example, areas that are pedestrian-oriented, such as Downtown Miami, Brickell, and Coconut Grove, would prefer an electrically-powered vehicle that

will not disturb the area with air and especially noise pollution. Beach communities and Biscayne National Park, for example, are attracted to the non-polluting qualities of the vehicles that can provide a needed service while helping to preserve the pristine nature of the areas. Other areas see the operation of electric vehicles as a symbol of community leadership, in that the area is taking steps to take advantage of the latest in vehicle propulsion technology. All of the areas also realize that people, many of them non-traditional transit riders, are intrigued by the electric vehicles and might want to ride them, perhaps more than they would want to ride a conventional transit bus.

As was discussed in the previous chapter of this study, electric and hybrid-electric vehicle technology is expensive, as is the infrastructure required to operate and maintain it. If they really want to utilize this technology, communities will need to find the most effective and efficient ways to do so. A recurring theme in this chapter is that there are plenty of opportunities available for various cities and areas to share resources, by sharing vehicles, sharing facilities, or sharing both, to help reduce costs for everyone involved. The proximity of many of the areas to each other enhances the feasibility of partnering. In addition, there will be a maintenance facility on Miami Beach initially for the Electrowave vehicles that likely will be able to provide heavy maintenance services for other fleets in the area. Clearly, however, the extent to which resources actually are shared will depend upon the true desire of each of the areas to take the steps to implement this technology. It might also take an unusual degree of intergovernmental cooperation and coordination. The next chapter, Chapter 3, discusses funding sources.

CHAPTER 3: FUNDING SOURCES

The real key to determining if the services described in this report are feasible is whether or not funding can be secured to pay for their operating and capital expenses. In some cases such as Aventura, the city is already committed to providing the operating expenses of an existing transit circulator service being provided with traditional diesel minibuses. Aventura is most interested in identifying capital funds that could be used to purchase electric or hybrid-electric vehicles and the infrastructure to support electric vehicle operation, although that city would intend to contract for the service through a private provider. However, most of the other areas noted in this report would be hoping to find funds for both operating and capital expenses associated with a *new* local circulator transit service. Operating a single local circulator transit vehicle costs approximately \$40 to \$45 per hour, inclusive of operators wages, maintenance, fuel, insurance, etc. If, for instance, a local area wished to operate a single vehicle on a local circulator route from 7:00 a.m. to 7:00 p.m. six days per week, the annual operating and maintenance costs would be approximately \$172,000. The current cost to purchase a 22-foot electric minibus ranges from approximately \$210,000 to \$250,000, depending on whether the vehicle is a pure electric or a hybrid-electric vehicle. To further demonstrate potential costs, the circulator services in the three areas of greater downtown Miami (Flagler Street, Brickell, and Overtown) that are described in Chapter 2 are estimated to range in cost from approximately \$914,000 to \$2,636,000 per year, depending on the routes selected, the service span, and the frequency of service provided. Capital expenses could be as high as \$4,165,000 for a fleet of 17 electric-hybrid vehicles and another \$600,000 to purchase and/or build a new maintenance facility. Hence, the availability of funds will have a dramatic effect on the extent of services that are provided.

There are many *potential* sources of funds that could help to pay for the operating and capital expenses of electric vehicle circulator services. A local government must go through a competitive process to obtain funds from virtually all of the sources described in this section of the report. There are long lists of transportation improvements that already lay claim to many of the established sources available for funding transportation projects in Miami-Dade County over the next five years. Federal dollars for transit capital investment have increased by approximately eight percent a year for the past three years, but locally, MDT's backlog of capital replacement and rehabilitation requirements for both bus and rail could easily absorb all federal transit grants that might be available for capital purposes.

In spite of these discouraging conditions, there are a variety of sources of funds and techniques that could conceivably provide the funds necessary to pay for new local circulator services and electric vehicles and facilities. It will require genuine, pro-active support and cooperation from a variety of both public and private partners to make this happen. It will also take local champions to provide "grass tops" leadership and oversight similar to the efforts that resulted in the Electrowave service in Miami Beach. The next section of the report will describe the sources of funding that exist and might be available to pay for operating and/or capital expenses associated with new local electric circulator services.

FLORIDA DEPARTMENT OF TRANSPORTATION (FDOT) FUNDING PROGRAMS

1. The Transportation Outreach Program

The Florida Legislature created the Transportation Outreach Program (TOP) with the passage of Senate Bill 862 in FY 2000. This program replaced the Fast Track Economic Growth Transportation Initiative that was in place for only one year. The "TOPs" program is dedicated to funding transportation projects of a high priority based on the principles of:

- Preserving the existing transportation infrastructure;
- Enhancing Florida's economic growth and competitiveness; and
- Improving travel choices to ensure mobility.

A minimum of \$60 million will be available, annually, to fund projects under this program. A seven-member Transportation Outreach Program Advisory Council makes annual recommendations to the Legislature on prioritization and selection of economic growth projects. The Advisory Council is composed of three representatives chosen by the Governor, and two each by the President of the Senate and the Speaker of the House of Representatives. In the first year of the program (FY 2001), the Advisory Council has recommended projects totaling \$115,313,183 to the Legislature, an amount that exceeds the minimum availability by almost a two-to-one ratio. The Legislature will make its final decisions in the Spring of 2001.

Transportation Outreach Program projects may be proposed by any local government, regional organization, economic development board, public or private partnership, metropolitan planning organization, state agency, or other entity engaged in economic development activities.

Eligible projects include those for planning, design, acquiring right-of-way for, or constructing the following: major highway improvements, feeder roads which link to major highways, bridges of state or regional significance, transportation improvements for trade and economic development corridors, access projects for freight and passengers, and hurricane evacuation routes. Other eligible projects include major "public transportation" projects that encompass seaport and airport projects, rail projects that facilitate the movement of passengers and cargo, Spaceport Florida Authority projects, and bicycle and pedestrian facilities that add to or enhance a statewide system of public trails. Of particular interest to this report, public transportation transit projects which improve mobility on interstate highways, or which improve regional or localized travel are also eligible.

Projects funded under this program should provide for increased mobility on the state's transportation system. Projects that have local or private matching funds may be given priority over other projects. Projects must also be production-ready within five years and be consistent with local comprehensive plans.

From the description of the program provided above, it is clear that this program has a heavy predisposition to favor projects that will help the economy of a region. A simple transit circulator service within a municipality might not fair well against projects that provide greater intermodal connections or provide greater opportunity for commerce. However, there are a few study areas noted within this report that could make a case for providing clear regional economic benefits as well as mobility benefits for local residents. For instance, a circulator service between the Busway in Homestead/Florida City and the National Parks could be advanced as a service that could help eco-tourism in south Miami-Dade County. A comprehensive proposal for electric circulator services in greater downtown Miami could be promoted as a vital element of the redevelopment of Flagler Street, one that will boost the general economic competitive status of the central business district, and as a project that will also provide job opportunities for low income residents in Overtown.

The projects that have been recommended for funding by the TOPs Advisory Council in the first year of the program range in cost from \$63,000 to \$27 million. Hence, even relatively small projects might be funded, and local areas should not hesitate to apply for such funding, particularly if they can secure partners and supporters, and they believe a good case can be made that their project will enhance economic development. It has not yet been determined what the schedule for proposal submission will be for FY 2002. Local areas interested in developing applications for these funds should consider having their proposals ready by July

2002. Those areas interested in proposing such projects should contact the District Six Planning and Public Transportation Director's office at 305-377-5900. Two of the seven members of the TOPs Advisory Council are residents of Miami-Dade County (Elizabeth Reyes-Diaz and Carlos L. Valdes).

2. Public Transit Service Development Program

The Public Transit Service Development Program was enacted by the Florida Legislature to provide *initial* funding for *special* projects. The program is selectively applied to determine whether a *new or innovative* technique or measure can be used to improve or expand public transit. Service Development Projects specifically include projects involving the use of new technologies, services, routes, or service frequencies; the purchase of special transportation services; and other such techniques for increasing service to the riding public as are applicable to specific localities and transit user groups. Projects involving the application of new technologies or methods for improving existing conventional operations, maintenance, and marketing in public transit systems can be funded through the program. Funding of Service Development Projects are subject to specified times of duration, but are supported for no more than three years. If deemed successful by their own measures, Service Development Projects will need to be continued by the public transit provider without Public Transit Service Development Program funds at the conclusion of the FDOT support period.

Each district FDOT office develops and submits a program of eligible Service Development projects to the Central Office by the first working day of July each year, for implementation beginning July 1 of the following fiscal year. Projects are developed in consultation with eligible recipients, and the need for such projects is justified in the recipient's Transit Development Plan (TDP). For example, a project to initiate a new marketing campaign must be generally supported in the recipient's TDP with a statement of need for improved marketing efforts, as well as an objective to provide these efforts. It is important to note that municipalities wishing to start a new transit service separate from the county are also eligible for Service Development funds from FDOT. Their Service Development grant application must be supported by their own Transit Development Plan that describes the project and the likely benefit to public transit in the area.

As delineated in *Section 341.051, Florida Statutes*, the Department is authorized to fund Service Development Projects that will improve system efficiencies, ridership, or revenues. The following are eligible functional areas along with specified time durations for Service Development Projects: projects that improve system operations, having a duration of no more

than three years; projects that improve system maintenance procedures, having a duration of no more than three years; projects that improve marketing and consumer information programs, having a duration of no more than two years; and projects that improve technology involved in overall operations, having a duration of no more than two years.

The Department provides up to one-half of the net project cost, but usually no more than the amount of funding committed by the local project sponsor. Any proposed state participation of more than 50 percent of the net project cost is for projects of statewide significance. The FDOT Central Office in Tallahassee makes the final determination of whether a project qualifies for more than 50 percent state participation. District offices are notified of the determination before the appropriation request is forwarded to the Legislature. The requirement to provide 50 percent of the costs of a project might be daunting to many of the local study areas in this report. However, for those areas with the local municipal determination and the financial capability to handle 50 percent of the project's cost, this program offers great support for new circulator services.

This state program is the most likely source of funding of operating or capital costs associated with any of the services described in this report. The City of Hialeah is using funds from this program to help pay for its soon-to-be-offered local circulator services. Local municipalities wishing to provide transit services in their areas are eligible recipients for these funds, in spite of the fact that they are not locally designated recipients of federal transit funds. Requests for such funds need to reach FDOT District offices by early May 2001 in order to be considered for funding starting in July 2002. Areas in Miami-Dade County that are interested in applying for grants from this program should contact the District Six Public Transportation Office 305-377-5906. FDOT budgets approximately \$2,000,000 statewide per year for this program. These funds are distributed throughout the seven districts of the department; approximately \$450,000 might be available in District VI on an annual basis. Again, there is severe competition for this program's funds, not the least of which comes from MDT which has many projects it would like to try on a pilot basis. Local leaders might consider approaching the FDOT Central Office staff in Tallahassee to recommend increasing funding for this program on a statewide basis to help support new local circulator services.

3. Transit Corridor Program

The FDOT Central Office annually reviews all existing projects that are currently approved and operating as of its annual review. The Department then allocates to each district sufficient funds to cover these ongoing projects. First priority for funding under this program is for

existing projects meeting their adopted goals and objectives. Any remaining funds are allocated to each of the districts by formula, based on each districts' percentage of the total state urbanized population. It is generally recommended that new corridor funding requests be submitted to the district FDOT office at least 12 months prior to the desired year of funding.

The districts may program up to 100 percent of the cost for transit corridor projects, as provided by statute, involving the activities indicated below, either by grants to a public entity or by a Department contract for services for part of or all services necessary to plan and execute a transit corridor project including, but not limited to:

- Development of Transit Corridor Plans;
- Design and construction or installation oversight of project facilities and improvements;
- Providing guidance and administrative support to the project's Technical Advisory Group during planning and implementation of the project;
- Development of marketing and public relations activities;
- Capital acquisition and investments based on study findings and as agreed to by the project Technical Advisory Group, including but not limited to:
 1. Rolling stock such as buses, vans, light rail vehicles and other high occupancy vehicles.
 2. Purchase of land for installation of project facilities and right-of-way for transportation corridor improvements.
 3. Construction and installation of facilities, such as park-and-ride lots, shelters and stations.
 4. Transportation corridor improvements such as turn lanes, traffic controls, and exclusive lanes or facilities for high occupancy vehicles.
- Operational costs including but not limited to:
 1. Pre-service preparations
 2. Service operating deficits
 3. Marketing and public relations
 4. Project administration
 5. Security and traffic control
 6. Equipment and project lease, including appraisals
 7. Commuter transportation services
 8. Carpool and vanpool activities
 9. Other Transportation Demand Management strategies targeting employers along the corridor or legitimate costs deemed appropriate by the District.

Each corridor project must have clearly defined goals and objectives. Milestones have to be established by which progress toward the goals and objectives can be measured. Decision points should be established where continuation of certain elements of the project—or indeed the entire project—can be acted upon. The goals, objectives, milestones, and decision points must be defined by the grantee, be consistent with the Local Government Comprehensive Plan(s), Strategic Regional Policy Plan, Metropolitan Planning Organization Long Range Transportation Plan and the Florida Transportation Plan, and approved by the district office initiating the project. After the initial two-year period, projects consistently meeting milestones can be reauthorized by being added to the Department's work program.

This program is particularly pertinent to the downtown Miami Flagler shuttle options described in this report. Both Biscayne Boulevard and Flagler Street are considered state roads, and the shuttle services described in any of the three options for Flagler circulators are eligible for funding under the Corridor Program. It might also be applicable to new circulator services in Coral Gables and Coconut Grove if services might help relieve traffic congestion on South Dixie Highway by attracting more people to use transit instead of their car to commute to those areas. This funding program requires more rigorous planning and accountability in terms of measures of success. However, the major advantage of this program is that *it can fund virtually 100 percent of operating and capital costs for an unlimited number of years as long as the project's goals are being met*. Once again, applications for these funds should be submitted a year in advance of planned implementation. This would mean an application for these funds should be made by May 2001 for implementation in July 2002. In spite of the high applicability of this funding program to a few of the service areas noted in this report, it should be realized that FDOT's District Six office is not accepting new applications for funding under this program this year. Existing transit projects on Flagler Street and the Busway currently absorb the dollars that are available under this program. Any new dollars that come available in future years would only be for projects targeted at transit improvements in corridors identified in the "Transition Study" conducted in 1993. This would limit the opportunities to projects along Biscayne Boulevard, Flagler Street, and South Dixie Highway.

4. County Incentive Grant Program

This Florida DOT program provides grants to counties to improve a transportation facility which is located on the State Highway System or which relieves traffic congestion on the State Highway System. The FDOT must consider, but is not limited to, the following criteria for evaluation of projects for County Incentive Grant program assistance:

- The extent to which the project will encourage, enhance, or create economic benefits;
- The likelihood that assistance would enable the project to proceed at an earlier date than the project could otherwise proceed;
- The extent to which assistance would foster innovative public-private partnerships and attract private debt or equity investment;
- The extent to which the project uses new technologies, including intelligent transportation systems, which enhance the efficiency of the facility;
- The extent to which the project helps to maintain or protect the environment; and
- The extent to which the project includes transportation benefits for improving intermodalism and safety.

FDOT will participate financially at different levels, depending on the nature of the project. For projects on the Florida Intrastate Highway System, the department shall provide 60 percent of the project costs. For projects on the State Highway System, the department shall provide 50 percent of the project costs. For local projects that demonstrate an ability to relieve traffic congestion on the State Highway System, the department shall provide 35 percent of the project costs.

Grants from this program source may only be used to pay for capital costs associated with a transportation project, but they can and have been used for *transit* capital expenses. Five transit projects received funding through this program in FY 2000, with the funds being used for such purposes as transit transfer hubs, shelters, and the cost of purchasing property for transit improvements. Approximately \$13.5 million will be available in District VI in FY 2003, although it is uncertain how much money might be available after that time. A municipality may apply to the county for consideration by the county for funding under this program. The county must evaluate all municipal applications. If a municipality's proposed project is rejected by the county for funding or if the county's proposed project adversely affects a municipality within the county, the municipality may request mediation to resolve any concerns of the municipality and the county. This is a program that is controlled by the FDOT District offices, and the FDOT District staff makes the decisions on which projects are funded.

Although this program appears to be designed for projects that are typically regarded as county or state responsibilities, it is possible that any of the study areas reviewed in this report could approach Miami-Dade County and discuss the possibility of an interlocal agreement whereby the local share for the project would be provided by the municipality, or in partnership with the

county or other entities. In addition, representatives of both the Miami-Dade MPO and FDOT District VI have indicated that the TOPs program offers the best opportunity for state funding of the purchase of new electric vehicles. Last year, *local areas in District VI failed to take advantage of almost \$7 million in state funds that could have been used to match local funds. These funds are still available on a carryover basis to local applicants with eligible projects and matching funds.*

5. Urban Transit Capital Program

This FDOT program provides an additional resource for capital projects. Priority for funding is given to projects which: (1) support the strategies outlined in Transit 2020, A Strategic Plan for Florida, (2) demonstrate that the state funds will be used to leverage other local funds, private funds or federal funds, and (3) can be initiated and completed in a timely fashion. Urban Transit Capital funds are allocated to the FDOT districts by formula. District VI is projected to have between \$750,000 and \$3,000,000 per year available between FY 2003 and FY 2006. Up to one-half of the non-federal share of capital costs may be awarded for eligible projects. Eligible costs include expenses limited to:

- Rolling stock such as buses, vans, light rail vehicles, and other high occupancy vehicles;
- Purchase of land for installation of project facilities and right of way for transit corridor improvements;
- Acquiring or constructing mass transportation facilities, maintenance facilities, terminals, park and ride lots, or passenger waiting areas; and
- Computer hardware or software for planning, scheduling, customer service or communications.

Toll revenue credits may not be used as match. Local funds or private funds may be used as match.

Eligible recipients are public agencies eligible to receive FDOT Transit Block Grants, Public Transit Service Development, or Transit Corridor funds. These funds are not restricted to specific transportation corridors as is the case with the Transit Corridor program. Local municipalities wishing to start local circulator services that promote the goals of the 2020 Strategic Plan are eligible for these state funds. The District Six office is likely to favor applications that demonstrate a clear promise of carrying significant numbers of passengers.

Project requests must be submitted to the District Office by November 1st annually. The District office will review submissions and make award decisions by December 1st annually. Project proposals must include a description of the project and its budget, a discussion on how the project will leverage non-department funds and how the project supports the strategies in the Transit Strategic Plan. The project should also be included in the local Transit Development Plan.

FEDERAL TRANSPORTATION FUNDING PROGRAMS

Flexible funding programs first authorized by the Intermodal Surface Transportation and Efficiency Act have been maintained in the Transportation Equity Act for the 21st Century (TEA-21). These sources may be used for either transit or highway projects. The following flexible funding programs may be used for transit projects: the Surface Transportation Program (STP) and the Congestion Mitigation and Air Quality Improvement (CMAQ) programs. Both the STP and CMAQ programs are discussed below.

Flexible funds, such as STP funds, can be transferred from the Federal Highway Administration (FHWA) to the Federal Transit Administration (FTA) for project approval. Flexible funds that are programmed for transit-specific projects must result from both the local and state planning and programming processes, and must be contained in an approved State Transportation Improvement Program (STIP). In Florida, the STIP is the composite of individual jurisdiction's TIPs. Therefore, local approval of transit projects considered for flex-funding is required by MPOs and FDOT Districts even before statewide consideration is contemplated. Once transferred, these funds are treated as FTA formula funds and may be used for any *non-operating* purpose eligible under the FTA program. (Note: CMAQ may be used for operating assistance within the parameters set for that program.)

1. Surface Transportation Program (STP)

TEA-21 authorizes \$33.3 billion nationally for STP over the life of the Act, which ends in September of 2003. STP funds are distributed among the states based on each state's lane-miles of federal-aid highways, total vehicle miles traveled on those highways, and estimated contributions to the Highway Account of the Highway Trust Fund. Once the funds are distributed to the states, sub-allocations are developed for each local area. STP funds may be used for any transit *capital* project including bus terminals and facilities, and rolling stock. A

state/local match of 20 percent is required for STP funds. However, toll revenue credits may be used as a soft match for this program.

Public agencies that are interested in pursuing STP funds for use on transit capital projects must work with their local metropolitan planning organizations and district FDOT offices to obtain access to those funds. For example, the transit agency in Volusia County, VOTRAN, was able to obtain a formal resolution by the Volusia County MPO to annually set aside 20 percent of the county's STP apportionment for VOTRAN. However, in Miami-Dade, transportation needs far exceed resources required to fund them. Virtually all of the STP funds available to Miami-Dade County are programmed to specific transportation projects over the next five years. While it might seem like a long way off, municipalities that are interested in obtaining these funds for new electric vehicles should plan on getting their proposed projects into the queue of projects that starts six years from now. Miami-Dade Transit might consider doing this as well to provide funding to purchase electric vehicles that can then be leased to local municipalities.

2. Congestion Mitigation and Air Quality Program (CMAQ)

The CMAQ program was reauthorized in the recently enacted TEA-21. The primary purpose of the CMAQ program is to fund transportation projects and programs in non-attainment and maintenance areas that reduce transportation-related emissions. Over \$8.1 billion is authorized over the six-year program (1998-2003), with annual authorization amounts increasing each year during this period. All projects and programs eligible for funding must come from a conforming transportation improvement program that is consistent with the National Environmental Policy Act (NEPA) requirements.

Eligible projects include capital funding to establish new or expanded transportation projects and programs and operating assistance, under limited circumstances. Operating assistance under the CMAQ program is limited to three years, in most cases. The establishment or implementation of Transportation Control Measures (TCMs) generally satisfy program criteria and include programs for improved public transit. CMAQ can fund up to 100 percent of the project costs for eligible activities. This would be an ideal program to fund the purchase of new electric minibuses due to their low levels of emissions. Broward County utilized this program to purchase four hybrid-electric minibuses for the city of Coconut Creek.

The Miami-Dade airshed has improved over the past five years, and the south Florida area is now regarded as an "attainment area" in terms of air quality. Consequently, south Florida will no longer be eligible for CMAQ funding in the near future. However, if the Miami area air

quality degrades and the region once again becomes eligible for CMAQ funds, this program would be particularly appropriate to help pay the costs associated with the purchase of electric vehicles that measurably reduce the amount of ozone, carbon monoxide, and particulate matter pollution. It should be noted that all known amounts of CMAQ funding available to Miami-Dade County (obtained when the county was not in an “attainment” status) for the remaining years of TEA-21 are already programmed for other projects.

3. Federal Transit Administration Urbanized Area Formula Transit Grants

The Federal Transit Administration provides funding to transit agencies throughout the nation through two primary programs. The first is the Urbanized Area Formula Transit Grant Program, commonly known by its authorizing legislation as “Section 5307”, that provides funding to urbanized areas of over 200,000 population to support capital expenses. As the title of the program implies, local transit authorities are entitled to these funds (assuming they meet all federal guidelines and requirements), and receive their share of these funds on a formula basis that takes into account the area’s population, population density, and the amount of service miles provided. Miami-Dade Transit is the sole recipient of these funds in the county, although they can share parts of these funds with other local transit providers through an interlocal agreement such as has happened in Miami Beach, Aventura, and North Miami Beach. The total dollars shared with municipalities through this program is relatively minimal (less than 10 percent of the cities’ costs of providing the local services).

4. Federal Transit Administration Major Capital Grant Program

Commonly known by its authorizing legislation as “Section 5309”, this program provides capital assistance for new rail and other fixed guideway systems, modernization of rail and other fixed guideway systems, and for new and replacement buses and facilities. There are approximately \$535 million available nationwide to help purchase buses and bus facilities. Funds from this source are available on a competitive basis and are not distributed by formula. The “competition” for these funds is primarily *political*, rather than being based on skills in grantsmanship. All of the funds for buses and bus facilities from this source are “earmarked” by Congress, with little input from the FTA staff. Once Congress has made its decisions on what areas will receive the funds, FTA prefers to work with only one designated recipient in any urban area. In Miami-Dade, the locally designated recipient is MDT. However, that agency could act as a pass-through on behalf of a local city, if there exists an interlocal agreement between the city and the county that allows the buses purchased by the county to be used in a locality for a particular program. This is what happened with the Electrowave service in Miami Beach.

For Fiscal Year 2002, the Federal Transit Administration's proposed budget includes \$50 million in this program for a "Clean Fuels Formula Program" to purchase or lease alternative fueled buses and their facilities. Municipalities within Miami-Dade County that are interested in obtaining electric vehicles through this program would be wise to consult with both MDT officials and their local Congressional representative(s) to see if the county's grant application could include provisions for acquiring electric minibuses.

5. Transportation Enhancement Program

The Transportation Enhancement Program (TEP) is a federal program administered by FDOT and local Metropolitan Planning Organizations. The FDOT Environmental Management Office provides TEP guidance and direction. FDOT district offices review projects for eligibility and feasibility, but the Miami-Dade MPO makes final decisions on which projects are selected for funding.

Funding for transportation enhancement projects is provided by FHWA through TEA-21. This funding is intended for projects or features that transcend what has been customarily provided with transportation improvements. This program is for projects that are related to the transportation system, but are beyond what is required through normal mitigation or routinely provided transportation improvements. TEP is not a grant program; rather project sponsors undertake projects, and eligible costs are reimbursed.

The following 12 activities are eligible for funding under the Transportation Enhancement Program:

- Provision of facilities for pedestrians and bicycles;
- Provision of safety and educational activities for pedestrians and bicyclists;
- Acquisition of scenic easements and scenic or historic sites;
- Scenic or historic highway programs (including the provision of tourist and welcome center facilities;
- Landscaping and other scenic beautification;
- Historic preservation;
- Rehabilitation and operation of historic transportation buildings, structures, or facilities (including historic railroad facilities and canals);

- Preservation of abandoned railway corridors (including the conversion and use thereof for pedestrian or bicycle trails);
- Control and removal of outdoor advertising;
- Archaeological planning and research;
- Environmental mitigation to address water pollution due to highway runoff or reduce vehicle-caused wildlife mortality while maintaining habitat connectivity; and
- Establishment of transportation museums.

TEP funds can be used for planning, project development and environmental studies, design work, right-of-way acquisition, construction operations, and construction engineering and inspection services. Applications for enhancement funds are taken in February/March of each year by the Miami-Dade MPO. Approximately \$3 million will be available in FYs 2002 through 2004. Transportation Enhancement Funds are provided in an 80 percent/20 percent ratio of federal to state/local contributions. If a proposed project were regarded as having statewide significance, no local match would be required. The FDOT provides "soft match" money from toll revenue credits in such instances. The MPO could consider increasing the priority of a project under this program if a local sponsor indicated they would pay for a percentage of the project with their own funds versus having the project paid for entirely with federal funds. It should be noted that most of the funds available through this program are already programmed to multiple projects. However, there are annual opportunities to modify the priorities, and there might be projects that were approved in prior years that could not be implemented, thereby freeing up those dollars for allocation to new projects.

While searching for possible locations for a maintenance and storage facility for local circulator services in downtown Miami, CUTR project managers were advised of the building and grounds at 650 NW 8th Street in Overtown. This site contains a 30,000 square foot building that is currently underutilized as a Commercial Driver's License testing site. The interior of the building is barely being used at the present time, and would require significant rehabilitation. However, part of the reason it is such an interesting option is that it is the building that once housed the electric trolleys that operated in downtown Miami in the 1930s and 40s. Would it not be exciting and appropriate, especially when considering a new electric vehicle shuttle service, to utilize the building that housed previous electric public transportation services to accommodate the new generation of electric vehicles? The old expression "what goes around, comes around" comes to mind. And what goes around and comes around as much as local circulator shuttles? One major advantage of this facility is its location. It is located only two blocks away from

proposed Overtown routes, as little as six blocks away from the Flagler route, and 12 blocks north of the Brickell route. This proximity to Overtown, Flagler, and Brickell would keep open the option of utilizing all-electric vehicles in those areas. This facility is also located near enough to Coconut Grove and Coral Gables to serve as a reasonable maintenance and operating center for hybrid-electric vehicles that would serve those areas. Another advantage is that the proximity of the site almost eliminates the deadhead mileage associated with providing transit service, at least for downtown Miami, thereby reducing operating costs by the almost eight percent that deadheading contributes to transit operating expenses. The site is located in Overtown, which could provide some opportunities for jobs and further investment in the area. In fact, the site might also be of interest to Advanced Vehicle Systems (the manufacturer of the electric vehicles utilized by Miami Beach) as a service center, if a similar service center is not established in Miami Beach. Given Overtown's status as an Economic Empowerment Zone, there are incentives available to encourage investment in the area, and given the building's previous use and history, it might also be possible to receive funds to rehabilitate and operate the building through the Transportation Enhancement Program as well.

OTHER FEDERAL FUNDING PROGRAMS THAT SUPPORT TRANSPORTATION PROJECTS

1. Transportation and Community and System Preservation Pilot Program

The Transportation and Community and System Preservation Pilot (TCSP) program is a comprehensive initiative of research and grants to investigate the relationships between transportation and community and system preservation, and private sector-based initiatives. The TCSP is a FHWA program being jointly developed with the Federal Transit Administration, the Federal Rail Administration, the Office of the Secretary, and the Research and Special Programs/Volpe Center within the US Department of Transportation, and the US Environmental Protection Agency.

The TCSP provides funding for grants and research to investigate and address the relationship between transportation and community and system preservation. The States, local governments, metropolitan planning organizations (MPOs), tribal governments, and other local and regional public agencies are eligible for discretionary grants to plan and implement transportation strategies which improve the efficiency of the transportation system, reduce environmental impacts of transportation, reduce the need for costly future public infrastructure investments, ensure efficient access to jobs, services and centers of trade, and examine

development patterns and identify strategies to encourage private sector development patterns which achieve these goals.

The services identified for the Downtown Miami area are consistent with the goals of this program. The proposed shuttle services would help eliminate the need for further extensions of the Metromover system in both Brickell and Overtown. Electric vehicles could help reduce the air quality environmental impacts of transportation in the downtown area. The service would help get people to jobs in the booming parts of Downtown -- the Miami CBD and Brickell -- and encourage continued development within these areas with concentrated transit services. The proposed services would also encourage growth patterns to meet program goals in the Omni, Park West, and Overtown areas of the Downtown as these areas develop.

This program might also be particularly appropriate in the Homestead/Florida City area where there are proposals to establish a transit service that would connect citizens from that area with recreational and employment opportunities within the national parks in the most environmentally friendly way possible. Given the redevelopment that is occurring in those cities and the extension of the Busway further south, there might also be an opportunity to contribute to transit oriented developments that effectively tie into the Busway.

A total of \$120 million is authorized for this program for FYs 1999-2003. Grant applications for TCSP grants are due to the appropriate FHWA Division Office in January of each year (FY 2002 applications were due by January 31, 2001). Grant projects are awarded in October of each year. Competition for these funds is vigorous and severe, and of the \$35 million made available in FY 2000, less than 30 percent was competitively available, as \$25 million was earmarked by Congress. Even more tellingly, only six tenths of one percent—35 of 530 submitted applications—were funded last year, receiving anywhere from \$100,000 to \$1,000,000. However, a strong case can be made for at least a couple of the areas described in this report. In addition, South Florida is represented on the House Appropriations Committee, and it is possible that a Congressional earmark might be secured through a local congressional representative.

2. Access to Jobs and Reverse Commute Grant Program

In 1996, Congress passed the Personal Responsibility and Work Opportunity Reconciliation Act that radically changed the way welfare programs would be administered throughout the country. Welfare recipients may now only be eligible for benefits for a total of five years, with no more than two consecutive years of benefits received at one time. This legislation requires

most people currently receiving welfare benefits to prepare to find work. As a way of helping welfare recipients make the transition to work, the Federal Transit Administration created the Access to Jobs and Reverse Commute Grant Program, "Welfare to Work," to help welfare recipients and low-income individuals access employment opportunities. Funds from this program are available to pay for a wide range of transportation services that link those needing jobs with areas that have jobs. Throughout the country this has often meant providing transportation from the inner city where many welfare recipients reside to the outer suburban areas where the new jobs are being created. However, there is no reason that a transportation service can't be approved for grant funding if it connects inner city residents with other employment opportunities, even if jobs are located in the central city.

Miami-Dade County has been earmarked by Congress to receive \$1.1 million from this program to help establish the kinds of transportation services described above. The \$1.1 million is matched by an equal amount of funds from other sources, for a total grant program of \$2.2 million that will primarily be used to pay the operating expenses of new bus routes to be provided by MDT. These funds are also going to be used for providing operating expenses associated with a new local circulator route in Brickell. It is possible that this same program could be used in future years to continue to pay for services in Brickell, or for new services in Overtown or the Homestead/Florida City areas.

3. Community Development Block Grant (CDBG) Funds

This federally funded nationwide program administered by the Department of Housing and Urban Development (HUD) provides \$4.8 billion on a formula basis to support a wide variety of community and economic development activities, with priorities determined at the local level. This program is specifically designed to assist areas of low and moderate income. While this program is not focused on transportation, communities can use CDBG funds for the construction of transportation facilities, or for vehicle acquisition and operating expenses for community transportation services. Funds from this source could be used to pay for either capital or operating expenses of shuttle services in the Overtown area and in the Homestead/Florida City area. There is a great deal of local input into how these federal funds are used, and any thoughts of using CDBG funds for the purpose of purchasing buses, bus facilities, or shuttle services would need the support of these communities which have many other pressing needs and redevelopment aspirations, and long lists of actions to be funded in the pipeline.

LOCAL SOURCES OF FUNDING

1. Local General Revenues

It is tempting for any local municipality to simply say that public transportation is the responsibility of the county, in part because the County Code of Ordinances grants Miami-Dade County the jurisdiction for virtually all transportation services in the county. However, any city with the desire to do so can utilize funds from its own general revenue accounts to help pay for a local community-oriented transit circulator service. Because the county code grants the county jurisdiction over transportation services, a city must enter an interlocal agreement with the county to receive permission to provide local circulator services. The City of Aventura was anxious to start a local service and did not want to wait for the almost two years anticipated to get grant funds to pay for such service. Consequently, the City Commission entered an interlocal agreement with the county and authorized the expenditure of over \$250,000 per year from its own general funds to pay for the local circulator service that has now been in place for more than a year. In Miami Beach, that city has committed over \$600,000 per year to help pay for the operating costs of the Electrowave service. In Broward County, seven cities each utilize their own municipal general funds to help pay for the operating expenses of their local circulator services.

2. Local Option Gas Tax Revenues

All cities receive portions of local option gas taxes levied by Miami-Dade County. Proceeds already being collected are basically completely committed to roadway and traffic engineering improvements. However, it is possible for a city to indicate that any *new* revenues from this source that exceed existing amounts would be dedicated to helping to pay for the operation expenses of a local transit circulator service.

In Broward County, the County Commission passed an additional one-cent local option gas tax in FY 2000. It was passed to encourage more local participation in transit improvements, including new circulator services, new transit-supportive infrastructure (e.g., bus shelters, bus bays, or kiosks), or other improvements at existing transit terminals. Each city in the county is entitled to a portion of the penny gas tax proceeds, as long as they use it for any of these purposes. The funding associated with this provision represents 26 percent of the penny tax proceeds, or about \$1,690,000 per year. These dollars are distributed by formula based on each city's population. In addition to this funding, there is another 26 percent of the same one-cent gas tax that is available to all cities on a competitive grant basis. The funds available

through this additional 26 percent of the penny gas tax can only be used for community bus service and not for the broader uses noted above. Seven cities in Broward County have taken advantage of the competitive grants and are now in the process of receiving between \$100,000 and \$400,000 annually that they apply toward the cost of providing local transit circulator services in their respective communities.

Miami-Dade County has an opportunity to do something similar. The County has a statutory authority to levy an additional two cents of local option gas tax. Miami-Dade County was levying the entire statutory-permitted six cents maximum local option gas tax until 1996. During that year, the County Commission rescinded two cents of the six cents being levied. The County Commission, by supermajority vote and the support of the County Mayor, could again levy one or two additional pennies of local option gas tax. Each penny levied would generate approximately \$9 million per year. Proceeds from the tax could be used for any transportation purpose, and probably would be largely allocated to the backlog of road projects needed, but at least a portion could be used to fund the capital and/or operating expenses of local transit circulator services. This would clearly be the most expedient way to pay for much of the operating expenses associated with circulator services. However, it is politically risky to do so, and transit-oriented general sales tax initiatives have thrice failed by increasingly large margins at the polls over the past decade. Still, representatives of the Miami-Dade League of Cities, particularly those in the study areas noted in this report, might wish to review what has occurred in Broward County and determine if they would like to pursue such a proposal with the Miami-Dade County Commission and Mayor.

3. Other County Funds

Broward County also utilizes some of its own County general revenues to help pay the costs of municipal circulator service. Cities in Broward County that do not compete for the funds from the local option gas tax are reimbursed at a rate of \$20 per hour for each hour of service provided by municipal transit circulators. This represents approximately half the cost of providing service at the local level.

Miami-Dade County is also considering endorsing a \$1.5 billion bond issue for unmet capital needs throughout the county. A referendum might be placed on the ballot as soon as mid-2001. The new (February 2001) County Manager and the Mayor will fine-tune the list of projects that will be proposed for funding. It would be possible to include funding for electric vehicle maintenance centers and a fleet of minibus electric vehicles as part of this plan. Those

municipalities that are interested in this opportunity need to act quickly and attempt to get their electric vehicle and infrastructure projects included in the proposed list of projects.

4. Special Taxing District Funding

Chapter 18 of the Code of Miami-Dade County provides the county with the authority to establish Special Taxing Districts to help finance the provision of a wide range of public improvements and services. Special Taxing Districts are usually associated with public infrastructure capital improvements such as street lighting or sidewalks. However, they can also be used to fund public transit improvements or services. Special taxing districts may embrace not only an unincorporated area in the county, but also all or part of one or more municipalities in the county; provided however, that no such district shall be comprised solely of a municipality or embrace all or a part of a municipality without the approval of the governing body of such municipality. Special taxing districts for public transportation improvements may embrace the transporting of people by conveyances, or systems of conveyances, traveling on land or water, local or regional in nature, and available for use by the public, or a project undertaken by a public agency to provide public transit to its constituency, and may include but shall not be limited to the acquisition, design, construction, reconstruction, or improvement of a governmentally owned or operated transit system or ancillary facilities and improvements related thereto.

It is the intent of the county code to provide for the construction and the financing of public improvements and of providing services in areas in the county where such improvements and services could not conveniently be made available otherwise; that the cost of such improvements and services be borne on an equitable basis by those who receive the benefits thereof; and that property receiving special benefits be assessed in proportion to, but not in excess of, such special benefits. Indeed, this is how the local capital match for the Metromover system was secured. The special assessments for the areas of downtown Miami associated with the inner loop of the Metromover system have just been terminated within the past year. The special assessments for Brickell and the northeast sections of downtown associated with the Omni and Brickell loops of the Metromover will continue in effect until the year 2004.

While the county has the authority to establish special districts, it obviously would only want to do so on the condition that there is support for such a district within the proposed district. No issuance of bonds to pay for capital improvements can be accomplished without the consent of a majority of the property owners in the district.

Before a special taxing district of this nature can be established, a report must be completed that documents the benefits that will be realized as a result of the improvements or services. The report that was completed for the special assessment district established for the Metromover concluded that the estimated benefits of the project would be \$256 million due to higher prestige, additional floor space made possible by better access and higher demand, less parking required, premium rents, higher occupancy, increased sales, and increased property values.

The establishment of a special taxing district could generate revenues that might possibly pay for all or a part of the operating and capital costs associated with local circulator services in Downtown Miami, Coconut Grove, and Coral Gables. All of these areas are characterized by concentrated business and high pedestrian activity. The benefits these retail areas might realize from an electric circulator service might provide sufficient support from local property owners to vote a new tax on themselves.

5. Savings from Truncated MDT Bus Routes

A substantial portion of the operating costs associated with new local circulator service in the Flagler/Biscayne corridor could be paid for through the savings realized by truncating a number of MDT bus routes at the Omni and the Central Bus Terminals. The savings realized from discontinuing certain MDT bus routes through downtown Miami could be utilized to pay for the costs of operating an electric shuttle service along Flagler Street and Biscayne Boulevard. This is a controversial option that has been discussed by the County Commission before and rejected. This option was proposed a few years ago as a way of saving as much as \$2.7 million in operating expenses a year in conjunction with implementing the Omni loop of the Downtown People Mover. Passengers would be required to transfer from the two transit transfer facilities in order to complete any trips to the downtown. In the past, the only option available to passengers was to use the Metromover, requiring a change in elevation, a wait for the Metromover car, and longer travel time to complete their trip on a vehicle with virtually no seats.

If new electric shuttle services were established between the downtown bus terminal and the Omni bus terminal, passengers would have the option of taking the Metromover to complete their trip through downtown, or the shuttle services that would operate on a very frequent basis (once every two to three minutes). The savings to be realized from truncating bus routes are described in more detail in the MPO report entitled "*Miami Surface Shuttle Services: Feasibility Study for Transit Circulator Services in Downtown Miami, Brickell, Overtown, and Airport West*"

(CUTR, June 2000). A similar service is offered in downtown Denver, and passengers do not mind the need to change vehicles because the frequency of service makes such transfers relatively convenient. A similar set of circumstances exists in Coconut Grove where MDT currently provides regular fixed-route service that travels from the Metrorail stations through Coconut Grove. The portions of those MDT routes that serve Coconut Grove could be discontinued, and the savings realized from discontinuing the MDT services could be applied toward the cost of providing minibus electric circulator services.

This option would only work if MDT is willing to cooperate, and if MDT and only MDT is the operator of the service. Union employees could rightfully grieve if their jobs are eliminated due to this project. MDT would be skeptical of these options because they might believe there is little to gain for them. However, being part of a major improvement in the downtown is a major public relations accomplishment, just as the Electrowave has become a popular service on Miami Beach. If the real mission of a transit agency is to improve the community of which they are a part, they should give serious consideration to these options to help pay for such services if the community enthusiastically supports them. The savings they contribute would cost them nothing, and those dollars contributed to the project could, perhaps even more beneficially, serve as the match for any number of other state and federal sources of funds.

6. Revenues from Parking Authorities

In other cities where downtown circulator services are provided, a good portion of the funds to pay for their operation comes from parking revenues. These services are designed to serve as feeders to and from parking facilities located on the immediate periphery of their downtowns. The Electrowave service in Miami Beach is clearly designed to encourage people to use central parking garages rather than cruise for on-street parking. Extensions of the Electrowave might also serve in this role. Coconut Grove also experiences severe parking shortages and extremely congested traffic during the prime entertainment evenings, and any new transit circulator services will surely be designed to influence where people park and how they access the venues within the central business district of the Grove. This same relationship between parking and circulator services might come into play to a lesser extent in Downtown Miami and is being scrutinized in the current "trolley" feasibility study in Coral Gables. If the local circulator services are ultimately designed with the intent to serve as an "intercept parking connection" that makes parking facilities more attractive and increases their revenues, it is not unrealistic to hope that the local parking agencies could contribute toward the cost of operating such shuttle services. Again, these funds could be used as a match to leverage funds from other sources.

7. Impact Fees or Mitigation Fees in Lieu of Impact Fees

Miami-Dade County extracts general transportation impact fees from new developments, but does not utilize these fees for transit purposes. Broward County and Hillsboro County both levy impact fees on new development that may be used to purchase capital equipment or facilities for transit service. There needs to be a rational relationship between where the developments occur and where the capital items are utilized. Miami-Dade County could institute an ordinance similar to the ones in the counties noted above. Clearly, there are some major developments that have been proposed for development in Downtown Miami and Brickell that will be adding impacts to the local transportation system. Although the levels of service of most roads in downtown Miami are relatively good, the City should want to keep it that way. The County might have the opportunity to assess impact fees on these new developments that could be used to help pay for some of the capital costs associated with the proposed shuttle services. There might be other study areas described in this report that will also see substantial growth that will impact the transportation system, and could be tapped to fund transit services to ameliorate the transportation impacts of the growth.

In Miami Beach, the city is hoping to establish a steady source of revenue for operating its Electrowave through a mitigation fee in lieu of impact fees. It appears that state law provides that impact fees can only be levied by a county. A mitigation fee is an instrument that local municipalities can assess that might help accomplish the same purpose.

8. Revenues from the Circulator Services

Transit services generally recover only partial percentages of their costs through the farebox; local circulator services can be expected to recover even smaller percentages. Since the trips taken on circulator services are relatively short, most providers believe the fares should be minimal or free. In addition, low fares, or no fares, also help encourage ridership. Fares for local circulator services in Miami-Dade County must be consistent with fares charged by MDT. The most similar fare that MDT charges is \$0.25 for the Metromover, which provides services very similar to local circulator minibuses. Therefore, all local circulator services currently being provided in the county charge either \$0.25 or allow passengers to board for free. While free fares certainly encourage the greatest level of ridership, it can potentially lead to undesirable riders. In Miami Beach, passengers were allowed to ride for free for the first year of the service, but a fare of \$0.25 was imposed afterward. While ridership decreased by over 30 percent, the service generated over \$250,000 per year in revenues. Each study area will need to determine if it wants to institute a fare or not. It is possible that the collection of a fare will be more headaches than it is worth when revenue collection and accounting activities and costs

are taken into consideration. However, the farebox should be recognized as a potential source of income to help pay for the circulator services.

Another possible source of revenue that circulator services might generate is through the sale of advertising space on the outside and/or inside of the minibuses. This might take the form of ads on placards that promote consumer products or services. Some regard this as unsightly, but it could generate thousands of dollars a month in revenue for the service. Another approach is to sell space to sponsors of the service with their names prominently placed on the vehicle in ways that don't appear quite so commercial. The agency that operates the service should focus on working with local businesses to sponsor the service as a way of generating revenue, and as a way of promoting partnerships with such businesses who will do other things to help promote the new service. Since their names would be associated with the vehicles, they would have a vested interest in helping the service to succeed.

9. Assistance from Other Partners

Florida Power & Light Company is the major electric utility in South Florida, and has a clear interest in the development of electric vehicle technology. Florida Power & Light (FPL) might help in designing maintenance facilities, and possibly contribute toward the cost of charging units. FPL staff will undoubtedly offer technical assistance to any study area in the development of specifications of electric vehicles and the infrastructure to support them.

If the routes help promote other public programs, there might be the chance that these programs could provide funding for facilities such as bus stops or shelters, or help promote the new shuttle services. For instance, the routes in downtown Miami could promote the fact they go past many of Miami's historic sites and buildings. The routes could also complement the work going on with the Miami River Commission's efforts to establish a continuous greenway along the river, and connecting the river to the bay through Overtown. It is possible that these other programs will identify non-transportation sources of funds to help pay for enhancements such as bus shelters. Non-profit foundations might provide similar assistance if they see the synergy between the circulator services and the other public programs. Clearly, there would be more support from enthusiastic citizens if the circulator services enhance access to the other public programs. More prominent assistance might come from the United States Interior Department for service that would connect Homestead/Florida City with the Everglades and Biscayne National Parks. All prospective applicants should realize that there might be non-traditional, non-transportation partners that can be expected to help a new circulator service succeed due to the fact that the service will benefit them in one way or another.

10. Private Contributions

In a previous project performed by CUTR for the MPO, CUTR project managers asked property owners in Brickell and Airport West if they would be willing to contribute toward the costs of providing local shuttle services. The response was somewhat muted in Airport West, but the representatives in Brickell were much more open to the idea. The manager of the Brickell Key Master Association expressed a willingness to tack a fee onto each unit on the island to generate funds to help pay for the service. It is possible other residential complexes in Brickell, as well as the major new hotels, would be willing to do something similar. This type of revenue generation occurs in Broward County in the major condominium complexes known as Century Village. A fee of approximately \$4 per unit per month is paid by each residential unit to help pay for the extensive circulator services that are provided on an otherwise fare-free basis to all residents. This allows unlimited access to such services by the residents of the condos. Although many of the residents still drive and do not use the bus services, they understand the benefits for their neighbors and support the monthly payments.

Something similar might be developed in the Brickell area in particular. This area has a significant number of residential units and hotels, and a significant amount of wealth. This type of revenue generation would not require a special assessment to be established. It could be done through the voluntary actions of the residents and businesses of the area. Although such a funding mechanism might be easier to establish, it is also more prone to uncertainty given its voluntary nature. If certain parties should “drop out” of their voluntary agreement to pay, the source of revenue for operating the service would diminish, and the communal sense of fairness and equity would be destroyed. However, it should still be kept as an option, particularly for services that benefit Brickell Key. This development’s nature as an island causes the service to be a little more expensive to provide (requiring route deviations from the primary service area). In addition, Brickell Key was not subject to the special assessments for the Metromover capital funding project. Mostly, however, Brickell Key is an enthusiastic supporter of better transit services, and already has a market for such services that will only grow larger as the island continues to develop. They would probably be willing to contribute to the costs of new shuttle services that help reduce traffic on their causeway, and helps their residents and employees gain access to areas of interest without adding to the traffic congestion in the Brickell area.

There might be opportunities for private contributions toward the cost of circulator services in other study areas as well. Miami Lakes has industrial parks that might stand to benefit from a circulator service in terms of better access for their employees and customers. These businesses could be asked to help pay for the services, sponsor promotions for the service, pay

for advertising on the vehicles, and could also provide facilities for minibus operators when they need to take a brief break. Perhaps the Aventura Mall would be willing to contribute toward the cost of constructing a storage and battery charging area for electric vehicles that converge at the mall.

In short, no opportunities to gain private partners should be dismissed. It is surprising how often private entities will find it in their best interest to contribute to a mobility service.

OTHER SOURCES OF FUNDING FOR ELECTRIC CIRCULATOR SERVICES

While the most likely sources of funds for paying for the operating and capital expenses associated with local electric circulator services have been described above, there are other potential sources of funding from the federal and state governments. The United States Department of Energy (U.S. DOE) and the Florida Department of Community Affairs are involved in promoting alternative fuel programs. These programs deal with all types of fuels, including such alternatives as compressed natural gas, biodiesel, liquefied natural gas, propane, and hydrogen among others, as well as electric propulsion.

The Clean Cities program was initiated by the U.S. DOE in the early 1990s. It began in south Florida in 1993 with the creation of the Florida Gold Coast Clean Cities Coalition by Executive Order of the Governor and a subsequent Clean Cities designation by the U.S. DOE. The Florida Gold Coast Clean Cities Coalition is a public/private advisory board composed of state legislators, local government representatives, federal and state agencies, and private sector representatives dedicated to reducing the region's reliance on gasoline and diesel fuels and improving air quality. The role of the Coalition is to provide a fuel-neutral policy direction to maximize the use of vehicles operating on clean alternative fuels throughout the five county area. This area is composed of Monroe, Miami-Dade, Broward, Palm Beach, and Martin Counties. South Florida Regional Planning Council (SFRPC) staff provides support to the Coalition through a contract with the Florida Department of Community Affairs.

The mission of the Coalition is:

"To reduce our dependence on imported oil and improve the environment by creating a sustainable alternative fuel market through the support and promotion of clean fuels."

The goals of the Coalition are as follows:

- To increase the acquisition and use of alternative fuel vehicles;
- To develop alternative fuel infrastructure;
- To contribute to economic development through the support of alternative fuel industry;
- To promote the benefits of using alternative fuel vehicles; and
- To gain legislative support and funding for alternative fuel vehicle programs.

Since its inception, the coalition has increased the number of alternative fuel vehicles being used in the five-county region by 16 percent every year. They have also increased the number of alternative refueling facilities, increased their number of stakeholders by 50 percent, and sponsored the first statewide alternative fuel conference in February 1999.

Members of the Coalition from Miami-Dade County include the City of North Miami Beach, Judy Evans of the Miami Beach TMA, Doug Yoder of the Miami-Dade County Department of Environmental Resources Management, and Mark Glaiber of Miami-Dade County government.

There are now as many as 1,700 alternative-fueled vehicles in South Florida (including vehicles in eight police fleets). The majority of these vehicles have been converted to run on compressed natural gas (CNG) or propane. However, while the Coalition is fuel-neutral in terms of the use of alternative (other than gasoline and diesel) fuels, with the presence of EV Ready Broward, there is increasing interest in electric and electric-hybrid vehicles.

The Clean Cities Coalition (CCC) is committed to trying to find funding for alternative fuel projects. They also help with writing grant proposals and initiating demonstration projects. Grants are available from a few sources on a periodic basis. Units of local government including, but not limited to, cities, towns, counties, school boards, airport authorities, transit agencies, and designated 501(c)(3) organizations are eligible to submit proposals for various grants managed by the Coalition. In order to receive assistance in these matters, the proposing agency must become a member of the Coalition, easily done through the adoption of a "Memorandum of Understanding" that serves as a non-binding agreement to the principles of the National Clean Cities Program.

There have been a number of programs that proposers in south Florida pursued in the recent past. One was the Gold Coast Clean Cities Alternative Fuel Mini-Grant Program. A total of \$60,000 was available on a first-come, first-served basis. Grantees could receive up to \$25,000, matched on a dollar-for-dollar basis. Funds may be used for alternative fuel projects that make a positive contribution to the environment, the health, welfare, and quality of life in the applicant's community, or in reducing reliance on petroleum. The highest priority was given to proposals dealing with mass transit projects.

Another program managed by the Coalition is an alternative fuel vehicle rebate program. During the year 2000, \$31,250 in funding was provided to local fleets for the purchase of alternative fuel vehicles (AFVs). Nine local fleets received 25 rebates, which included seven rebates for dedicated AFVs and 18 for bi-fuel AFVs. By fuel type, the AFVs included 22 compressed natural gas vehicles (7 dedicated/15 bi-fuel) and three bi-fuel propane vehicles. Dedicated AFVs were eligible for a \$2,000 rebate per vehicle and bi-fuel AFVs were eligible for a \$1,000 rebate per vehicle. Funding for this program was from a U.S. DOE grant with matching funds from the SFRPC. The rebate program will continue for the next three years. However, future rebates will only be available to dedicated AFVs using compressed natural gas, propane or electricity for fuel. Rebates will be \$2,000 per vehicle and will be applied for through automobile dealerships. This program as currently structured would not apply to electric vehicle minibus purchases.

The Coalition also manages another program that is primarily funded by the U.S. DOE and EPA dealing with "Brownfields." These are areas that have been subject to any number of environmental degradations and are now eligible for federal funds to enhance improvements, which can include infrastructure and services. The SFRPC has a list of the eligible sites that could serve as electric vehicle servicing sites. There is also a "Small Bus Loan" program that encourages private companies to secure inexpensive financing to buy alternative fuel vehicles, and then get tax credits to help further reduce their costs.

Each county in the state is responsible for a source of funds that represents reconciliations for environmental violations. Representatives of any study areas noted in this report may wish to contact Miami-Dade's Department of Environmental Resources Management to determine if such funding could be made available for transportation-related improvements.

CHAPTER 4: ELECTRIC VEHICLE EXPERIENCES

This chapter briefly summarizes the experiences that four other areas have had with their electric transit services. The four areas are: Santa Barbara Metropolitan Transit District, Chattanooga Area Regional Transportation Authority, the Miami Beach Transportation Management Association, and Broward County. At the end of the chapter, a thorough compilation of lessons learned in the implementation, operation, and maintenance of electric vehicle circulators is presented.

SANTA BARBARA METROPOLITAN TRANSIT DISTRICT

The City of Santa Barbara, California, with its 25 miles of Pacific coastline, is known for its rich history, distinctive Spanish colonial architecture, and a relaxed southern California lifestyle. The city also has a thriving arts community, myriad shopping and dining, and its well-known wine country. Santa Barbara, located between the Santa Ynez Mountains and the Pacific Ocean, is just 92 miles north of Los Angeles and 332 miles south of San Francisco. The City has been involved with a number of redevelopment efforts over the past several years, with recent projects including public art, sidewalk redesign in the CBD, renovation of a railroad station to be used as an intermodal transportation facility, and the construction of park-and-ride lots. The Santa Barbara Metropolitan Transit District operates 26 bus routes and the Downtown-Waterfront Shuttle.

The Santa Barbara Metropolitan Transit District was the first major transit agency to implement the operation of battery-powered electric buses on a fixed route. In a "leap of faith," Santa Barbara introduced its first electric vehicle in January 1991 on the year-old Downtown-Waterfront Shuttle serving Santa Barbara's commercial district and waterfront. Santa Barbara's first electric shuttle bus was manufactured by Bus Manufacturing, USA, Inc., and the manufacturing of additional vehicles was subcontracted to Specialty Vehicle Manufacturing Corporation. In 1993, Santa Barbara operated eight 22-foot electric buses on the Downtown-Waterfront Shuttle.

By the second year of operation, ridership on the Downtown-Waterfront Shuttle increased 800 percent to nearly one million annual passengers. The increase was attributed to the use of the

new, attractive electric vehicle technology. Santa Barbara experienced a great deal of satisfaction with the electric shuttles and began to receive many requests to expand the service.

Today, Santa Barbara operates 18 electric vehicles throughout its system ranging in size from 22-foot shuttles to one 35-foot vehicle. Rapid recharge equipment is used to make its all-day service feasible. There are plans to deploy 40 more electric shuttles on various typical transit routes in the system by utilizing rapid recharge technology.

In Santa Barbara, the South Coast Transit Plan is a proposal for improved transit services that will be essential to keeping area traffic and vehicle emissions at acceptable levels. One component of this plan is The Electric Avenue, which represents a collaborative effort between the Metropolitan Transit District and the City of Santa Barbara to address traffic concerns in the downtown corridor.

The Electric Avenue consists of attractive, “packaged” transit service using electric shuttles that is very frequent, convenient, reliable, clean, and comfortable. The Electric Avenue service concept could be applied to other areas and neighborhoods.

The City truly appreciates the “pedestrian scale” of the small, quiet, odorless, low-floor electric shuttles on its streets. In Santa Barbara, it has been recognized that electric transit vehicles provide a significant boost to ridership, mainly by attracting the non-traditional “choice” customer.

CHATTANOOGA AREA REGIONAL TRANSPORTATION AUTHORITY

In 1969, Chattanooga was named as the city with the worst particulate air pollution in the U.S. The city then made a sound commitment to improving air quality and the overall quality of life in the area. The efforts paid off when, in just a few years, Chattanooga became one of the cleanest cities in the U.S. This strong commitment to environmental issues and quality of life continued. In 1984, a project called Vision 2000 was established to set goals for Chattanooga’s future. One of the goals was the revitalization of the city’s downtown.

As in Santa Barbara, Chattanooga’s experience with electric buses began with the revitalization efforts in the downtown corridor. Chattanooga’s major downtown corridor is more than two miles long and very narrow, in some places as small as four blocks. These characteristics make

the corridor too lengthy to walk in its entirety, but also make it difficult to fit large numbers of automobiles; however, a corridor of this configuration is ideal for transit to serve. Accordingly, the city decided to explore the idea of a downtown circulator system.

This circulator would not be ordinary. Chattanooga wanted a system that would become a permanent piece of the city's landscape. In addition to being easy to use, dependable, frequent, and linked to other transportation options, the city wanted the ride *itself* to be a desirable experience. The service had to be an attraction in and by itself; however, the service also needed to be effective in transporting employees and visitors to the downtown area and in attracting development. After learning about the electric vehicle operation in Santa Barbara, the Chattanooga Area Regional Transportation Authority (CARTA) decided that electric shuttles would fit the role of a unique, innovative, visually attractive, and environmentally-friendly vehicle.

Unfortunately, CARTA discovered that no one was manufacturing the type of electric vehicle that the city required. As a result, a company called Advanced Vehicle Systems, Inc. (AVS) was founded locally with the express purpose of producing electric shuttle vehicles for CARTA as well as for transit operators nationally and internationally.

In 1992, the first electric shuttle began operating on the downtown corridor. In 1993, six vehicles were operating (two from Specialty Vehicle Manufacturing Corporation and four from AVS). The fare-free shuttle with five-minute frequencies immediately became successful. CARTA learned first-hand just how electric shuttles can attract riders: reports of riders allowing diesel vehicles to pass in order to ride on an electric shuttle were common.

CARTA also worked to form the Electric Transit Vehicle Institute (ETVI), a non-profit organization that educates and promotes the use of electric transit vehicles. CARTA and ETVI, along with AVS and the Tennessee Valley Authority (TVA), represent a "living laboratory" for electric vehicle technology. As part of the living laboratory, Chattanooga Transit acts as a test site for AVS vehicles. By placing new vehicles directly into revenue service, needed improvements can quickly be identified and efforts begun to address them.

Today, CARTA, which has had the full support of the Chattanooga municipal government, has a fleet of 23 electric shuttles, and the success of its popular Downtown Shuttle continues to grow. CARTA also planned for a system of parking garages that now provides revenue not only for the operation of the shuttle but also the capital cost of acquiring additional vehicles. CARTA's

commitment to electric vehicles is strong; in about 10 years, they hope to have the entire Chattanooga transit fleet consist of electric and hybrid-electric vehicles.

MIAMI BEACH ELECTROWAVE

It is not unknown to spend up to an hour finding a place to park in popular South Beach. In addition, Miami-Dade Transit's conventional large diesel buses are not particularly suited to the urban development pattern of South Beach, which includes intense pedestrian activity and multiple roadways with stretches of many restaurants with outdoor sidewalk seating. Looking for a solution to these problems, the Miami Beach Transportation Management Association (TMA) began investigating the use of alternative-fuel vehicles, particularly electric vehicles, that would fit in nicely on the streets of Miami Beach with their small size and clean, quiet operation.

Along with Florida Power & Light (FPL), the TMA and other local leaders traveled to Chattanooga to meet with AVS and learn more about the manufacturing and operating process involved with electric vehicle technology. In 1998, seven AVS 22-foot electric shuttles began operating along a five-mile, two-way circulator route through Miami Beach's Art Deco District 20 hours per day, seven days per week. Despite having to appease initially apprehensive city commissioners, and transit-doubters in general, success for the system was realized immediately.

More than a million passengers rode the Electrowave shuttles during the first 35 weeks of operation, far surpassing all estimates. The extreme level of success was not anticipated, and the shuttles were (and still are) occasionally overcrowded and sometimes need to pass people waiting at the stops. Today, 11 vehicles are in operation, and a new route began service in December 2000. The Miami Beach TMA has ordered new hybrid-electric shuttles from AVS, and there are plans for a new maintenance facility.

Because the application of the technology has been so popular in Miami Beach, it has served as a continuing and valuable test case for AVS, the TMA, the electric vehicle industry, and for Miami-Dade County which, through this feasibility study, is examining the potential use of electric vehicles to operate on circulators elsewhere in the county. Now, because of Miami Beach's experience, there is information available concerning how factors such as high humidity, salt air from the ocean, exceptionally high road temperatures, and an extremely demanding operating schedule affect the electric shuttles.

According to the TMA, the success of the Electrowave is a testament to community involvement. Miami Beach got what it wanted: small, attractive, clean, quiet shuttle vehicles that generate high ridership and project a positive image of the community.

EV READY BROWARD

EV Ready Broward (EVRB) is a community-based public-private volunteer organization committed to the introduction of electric transportation in Broward County. The Board of Directors of EVRB is a mix of private business and government that brings together respected and visible community members (including a County Commissioner, County Administrator, a City Manager, as well as representatives of regional planning agencies, Florida Power & Light, and other corporations) with extensive knowledge, skill, talent, and resources. Started in 1996, EVRB was one of the eleven communities nationwide identified as a market launch site for electric transportation. This initiative was orchestrated by the U.S. Department of Energy, private sector partners, and others to encourage the implementation of zero emission transportation.

Since its inception, EVRB has worked to create a community partnership for electric transportation in its roles as a convener of interested parties and a provider of a forum for building capacity and consensus on many of the issues related to clean fuel vehicles and community transportation. EVRB's community partners are actively:

- Creating public confidence in electric transportation;
- Facilitating charging infrastructure development and implementation;
- Promoting necessary changes to existing building and related codes;
- Advocating for incentives—both monetary and non-monetary—from state and local governments that encourage the widespread use of electric transportation;
- Educating the community at large, and through special projects with the Broward County Schools, about the need for, and benefits of, electric transportation;
- Impacting the environment by introducing clean fuel transportation that minimizes adverse effects on our air quality; and

- Encouraging the development of new businesses related to electric transportation and fostering the networking of existing business to bring about profitable collaborations.

EVRB has provided leadership in advocating for government and private sector support and has been actively involved in issues related to public policy. EVRB was the impetus behind the Clean Fuel Florida Act that successfully passed during the 1999 Florida Legislative session and mandated the implementation of the Clean Fuel Florida Advisory Board. EVRB has been a leader in forging relationships to promote public awareness and support of responsible transportation choices. It has asked the Florida League of Cities to adopt as part of its legislative package the following concept statement:

"As Florida cities continue to experience significant growth in population, the issues of air quality, mobility of people and goods and other transportation-related challenges become increasing priorities and areas of concern. The Florida League of Cities encourages the support of modes of neighborhood transportation that utilize alternative fuels to help address these concerns and provide win-win solutions for its citizens."

In Broward County, there have been genuine champions who took an active interest in electric vehicle technology such as the Director of the County's Planning and Environmental Protection Department, the City Manager of Coconut Creek, and a County Commissioner. FPL noted this interest and provided substantial support to this community interest. EVRB receives financial support from FPL, FDOT, Broward County, and the South Florida Regional Planning Council. In-kind support is made available by Board members and others representing the private sector, city governments, and the Gold Coast Clean Cities program.

EVRB also has a great partner with Broward County Transit that had years earlier decided to promote local municipal transit circulator services through interlocal agreements between the county and various cities. Although there are a number of other applications for electric vehicles including car rental shuttle buses at the Ft. Lauderdale Airport, shuttle buses between the airport and Port Everglades, and even a hybrid-electric water-ferry service, one of the very best opportunities to promote and initiate electric vehicle service is through the county's program to enhance community shuttle service in as many cities as possible. In the year 2000, Broward County took the bold step of passing an additional one-cent gas sales tax, with 52 percent of the revenue given to cities that are in turn required to spend the money on public transit improvements. Half of the proceeds from that source that goes to the cities (\$1.7 million) is distributed through a formula based on population, while the other half is distributed on a competitive basis. This provides a solid base of funds for municipalities to initiate local

circulator services in their neighborhoods. In addition to these operating funds, the county also utilizes its capital funding from federal and state grants to purchase minibuses, and then leases them to the cities for \$10 per year.

These community shuttles benefit Broward County Transit in many ways. First, it allows the county to modify and improve its regional routes by taking its large buses out of local streets and keep them on major arterials. The municipal shuttles are more appropriate for local service on smaller streets, and the routes are designed to help cities serve the mobility needs of their local residents more effectively. The municipal services often are designed to take residents to local shopping centers or community services, and the institutions within the city can help promote the availability of the service very effectively. Having electric vehicles makes these types of services even more attractive. They are clean, less disruptive, and environmentally sound. The cities of Coconut Creek and Ft. Lauderdale are expecting to receive their hybrid-electric minibuses in April 2001. Broward County will be purchasing the vehicles as noted above. Coconut Creek is hoping to become the regional "gurus" in electric vehicle technology, and wants to be in a position to assist other communities with dealing with the technical aspects of establishing facilities and other infrastructure supportive of electric vehicles, as well as offer guidance on maintaining and operating the vehicles.

EVRB would like to expand its goals to help promote electric vehicle transit in all of South Florida. It has started a "Community Transportation Initiative" that they hope will ultimately develop into a regional program. The long-range vision is to begin with the implementation of community transportation supported by electric shuttle bus services, followed by the conversion of primary route carriers to alternative fuels buses. As the Initiative unfolds, applications of other forms of electric and alternative fuel transportation such as off-road vehicles and marine vehicles will be strongly considered for inclusion.

In achieving the goals of EVRB, its members are creating a community model that can be readily introduced and replicated elsewhere in Florida. EVRB's website is located at <http://www.sfrpc.com/evready.htm>.

LESSONS LEARNED

There are a number of common experiences among the various areas that have implemented electric vehicle services that offer helpful lessons to other areas that are considering this type of

service. In particular, the Miami Beach TMA has its own lessons to offer that will be of specific interest to the areas in Miami-Dade County that are exploring this technology, especially because the operating environments within the county are so similar.

- ***Match the technology with operating characteristics*** – One of the most important lessons is to ensure that the electric vehicle technology will meet the operational requirements of the planned or existing circulator service. The propulsion system must provide the power and range that is needed. In addition, the location of storage/maintenance facilities is important: they should be on or near the routes.
- ***Implement high quality service*** – As is true for any transit service, in terms of service on the routes, frequency is key. Linear routes with bi-directional service tend to be more successful than looped routes, since they are more direct and easier for the rider to understand. However, it should be noted that “high quality service” might be defined somewhat differently in different areas. A system is providing high quality service if it is meeting the needs of those it serves and is deemed successful within its community.
- ***Meet Americans with Disabilities Act (ADA) requirements*** – While the electric shuttles operating in Miami Beach comply with ADA for manual wheelchairs, they cannot accommodate electric wheelchairs. Manufacturers must find a way to meet this need.
- ***Assign a dedicated staff*** – Areas using this technology, especially Miami Beach, have found that it is important to have an operations and maintenance staff whose sole priority is the electric shuttle system.
- ***Provide comprehensive training*** – Both mechanics/technicians and shuttle vehicle operators need full training on electric vehicles and electric propulsion technologies. There are many nuances they need to appreciate. For example, the range of the electric shuttles is highly sensitive to the operating techniques of the drivers. Slow rates of acceleration and controlled deceleration makes the best use of regenerative braking systems and can increase the range of the vehicles. In addition, Miami Beach has found that continual refresher training (every 35 or 45 days) is helpful.
- ***Do pre-acceptance testing*** – Run the vehicle as it would be run in service and measure its performance against baseline measures before final acceptance of the vehicles. This not only helps determine if the equipment is built to specifications, but also can help direct the training used for the operators and technicians.
- ***Involve the experts*** – There are many organizations, such as the Southern Coalition for Advanced Transportation (SCAT) and ETVI that are more than willing to help with the start-up of an electric transit vehicle circulator system. Make sure that the vehicle

manufacturer is committed to standing behind the product and is willing to provide considerable on-site training. Ensure, too, that the manufacturer knows the characteristics of the service that will be operated. Miami Beach has been very pleased with AVS, who has sent mechanics and engineers to help with problems and has shipped parts overnight. In addition, AVS developed a training program for mechanics. Also, work with the local electric utility company. FPL was very helpful to the Miami Beach TMA in developing technical specifications and writing funding applications.

- **Select technology carefully** – There are many decisions that will need to be made, such as whether to choose pure electric vehicles or hybrid-electrics. If hybrids are chosen, the fuel for the APU must also be selected (diesel, CNG, etc.). Batteries must be selected very carefully: check with areas that have experience and choose the batteries with the best track record.
- **Know inventory needs** – Be aware of what parts will be needed on site and which parts can be quickly secured from the manufacturer. This will be helpful in deciding what will be needed in the inventory, in determining storage space requirements at the facility, and in estimating inventory costs.
- **Expect some "bugs"** – There will likely be some problems with the new technology, so expect them. It is still a new industry, and each vehicle is individually assembled by hand. In spite of advances in the industry, there are always at least some problems with new vehicles. Anticipate that, and realize that it will get better. Make sure that the number of spare vehicles is sufficient.
- **Understand infrastructure requirements** – Very specific infrastructure is needed to operate and maintain electric vehicles. Any area wishing to implement electric shuttles should fully understand these requirements (which were detailed in Chapter 1 of this report). Also, work with the local utility, who can help specify exact needs for a system. Become familiar with the peak and off-peak times and rates for electricity.
- **Install infrastructure first** – Have the facility, infrastructure, systems, and trained mechanics in place before the vehicles arrive. When the first electric shuttles arrived in Miami Beach, there was nowhere to store them, and a temporary shelter had to be built.
- **Understand that electric vehicles attract non-traditional transit riders** – People who would never think to ride a conventional city transit bus are very open to using electric vehicles. "Choice" riders will be attracted to the small, quiet, clean, and nice-looking shuttles. With quality, easy-to-understand service and customer-friendly operators, the trip in itself becomes a convenient, unique, and fashionable experience.
- **Fully leverage the public relations value** – Transit operators should be sure to take full advantage of the high public relations value electric shuttles invariably generate.

The technology is non-intrusive and extremely popular for all the right reasons: the vehicles are environmentally-friendly, quiet and clean, futuristic and fun to ride, attract ridership, cost less to operate (although capital costs are higher), and encourage development in the areas around the route network. Because of these benefits, there tends to be support for the technology from local leaders. Those who sponsor or otherwise support an electric transit circulator system are seen as "leaders," "pioneers," and "innovators," as well as champions.

- ***There must be a "champion" for the system*** – Whether it is an elected official, a transit general manager, or another community leader or decision-maker, there must be someone prominent in the community who really wants to use the technology and wants to make it work. Support for this type of system must come from the top ("grass tops" as opposed to "grass roots"). A leader with sufficient organizational clout or political skills can help ensure that the details associated with a new electric circulator system will be addressed.

CHAPTER 5: FINDINGS AND RECOMMENDATIONS

This report has provided details on available electric transit vehicle technology, successful applications of that technology in different areas of the country, funding that is potentially available to pay for local electric circulator services, and areas in Miami-Dade County where such service might be suitable. This chapter will assess how feasible it is to expect more electric transit circulator services in Miami-Dade County, and where they would be most applicable. Recommendations are also offered to help the process of implementing these services.

In terms of technology, the electric vehicle manufacturers have progressed enough to provide a reasonably reliable vehicle to utilize in local circulator services. Where electric transit circulator services have already been established—in places like Santa Barbara, Chattanooga, and Miami Beach—local sponsors of the service report resounding success in terms of ridership and public acceptance. Electric transit vehicles offer a multitude of benefits to a community: they are clean, quiet, fuel-efficient, relatively easy and cost-efficient to maintain, and they generate priceless positive publicity for transit.

Given this track record, it is reasonable to ask: why aren't more areas doing the same thing? Answering this question will help determine the feasibility of providing more local electric transit circulator services in Miami-Dade County. In spite of the various advantages of electric vehicles noted above, there are a number of both technical and economic downsides associated with electric bus operations.

Up to the present time, electric vehicle manufacturers have only been able to offer the pure electric minibus to communities interested in providing this type of service. Pure electric vehicles have limited range and require several hours to recharge batteries. These operating characteristics have limited their application to relatively short transit routes and to require strategically placed battery-swapping facilities located along or near the route as well, unless rapid recharging is used. It is expected that hybrid-electric minibuses will minimize the problems associated with limited range and the time it takes to charge and change batteries. While a number of transit agencies have ordered fleets of series hybrid-electric minibuses, none of them have been in service long enough to develop a track record of their performance. It is hoped that these hybrid minibuses will ultimately be found to be reliable in the very near future.

The most significant disadvantage of electric minibuses is their capital cost. In Florida, the FDOT has developed a vehicle procurement program that allows transit providers to purchase a variety of transit vehicles at prices that were determined through a statewide bidding process that helped reduce the per-unit cost of these vehicles due to the volume that would be purchased throughout the state. Light duty “cutaway body on chassis” minibuses that seat up to 18 passengers in transit-coach design and are engineered to last for at least five years can be purchased for \$55,000. Medium duty 26-foot minibuses that seat up to 29 people and are designed to last for 10 years can be purchased for approximately \$110,000. In contrast, electric minibuses that seat up to 25 passengers cost approximately \$215,000, while hybrid-electric minibuses cost approximately \$245,000. Hence, electric minibuses cost anywhere from twice, to almost five times, as much as conventional minibuses. In addition, the conventional minibuses do not require any special maintenance or operation facilities, or special expertise beyond typical transit maintenance skills.

Given the substantial differential in capital costs, a local area must have an exceptional reason to purchase electric minibuses. South Florida has been designated as an “Attainment Area” for air quality. Therefore, the argument to purchase electric buses solely to improve air quality in the region is not as compelling as it might be in a place like Atlanta that suffers high levels of air pollution. In addition, and perhaps more pragmatically importantly, Miami-Dade Transit itself already has enormous capital needs including the need to replace an aging bus fleet, add new buses to the fleet to satisfy requests for new service, rehabilitate its rail fleet and facilities, and add new technology throughout its system. Their imposing needs more than absorb any known available capital funding over the next five years. MDT officials would be hard-pressed to utilize the federal capital grants to which they have access to go outside the agency and participate in purchasing electric minibuses on behalf of local municipalities, unless there were outstanding reasons to do so.

Many of the local communities in the study areas covered in this report are relatively wealthy areas and might have the financial capacity to afford electric minibuses either through their own resources or in conjunction with possible grants from FDOT. If they decide they can afford to inaugurate a transit circulator, and then to utilize EVs or HEVs as vehicles, and to move forward, they should feel free to do so and enjoy all the benefits that electric vehicles have to offer. However, they must be ready to answer to their local taxpayers and feel comfortable in explaining why they are paying for vehicles that cost between two and five times the cost of conventional minibuses. If they cannot demonstrate a comparatively high level of demand and ridership on their services, or otherwise establish that the benefits of the electric vehicles as

described in this report equal or outweigh the costs, it is doubtful they would feel comfortable purchasing electric minibuses for local circulator routes. Unfortunately, a number of the study areas described in this report, while sincerely interested in using electric minibuses for their local shuttles, are unlikely to generate significant ridership. Electric vehicles can help generate interest in utilizing transit circulator service, but there must already be a potential market of riders to attract.

Miami Beach provides a case study of where electric vehicles are most feasible and appropriate. That city worked closely with stakeholders in the community and determined that electric vehicles, in spite of their higher capital cost, made sense in their setting. Electric minibuses made sense because the city was trying to encourage more automobile drivers to utilize centralized parking rather than cruise in search of scarce on-street parking, driving behavior which was contributing to traffic congestion that was in turn eroding the livability, sustainability, and very attractiveness of South Beach. City officials believed that a transit service that was particularly attractive was necessary on fashionable Miami Beach to change automobile drivers' behavior. In addition, Miami Beach is an area with a tremendous number of pedestrians, street-level retail shops, and curbside cafes that would benefit from a quiet and clean transit fleet. The vehicles would be operating in a frequent stop-and-go environment that would maximize the benefits of reduced emissions and improved fuel economy that electric vehicles offer. Finally, the electric vehicles would be an attraction in themselves that would be in keeping with this world-famous location. The City of Miami Beach provided approximately half the capital costs for their initial fleet of seven electric minibuses. The Florida DOT, convinced of the potential effectiveness of the new service, and impressed with the city's willingness to participate financially, paid for the remaining half. No federal or county funds were involved.

There have been a number of similar conditions in the cities where electric minibus service has been most successful. Santa Barbara's experience was very comparable to the experience in Miami Beach; similar conditions of tourism, street-level retail and pedestrian activity, and a pristine environment in a busy downtown area contributed to the demand for the electric vehicle service. Ridership increased 800 percent on their Downtown-Waterfront Shuttle after instituting electric minibuses. In Chattanooga, the electric minibuses were an integral part of a complete redevelopment of the downtown area, and also served as a means of transporting people from remote parking to areas of interest in the downtown. In all three of these cities, the electric minibuses were part of a larger environment of high pedestrian activity, downtown redevelopment, limited parking, and tourist activity.

WHERE ELECTRIC MINIBUSES MAKE THE MOST SENSE IN MIAMI-DADE COUNTY

Given the high capital costs of electric minibuses and the scarcity of funds to pay for them, it is unlikely that it will be feasible to establish electric vehicle transit circulator service in all of the study areas included in this report, at least in the near future. However, the following criteria can be utilized to determine where using electric vehicles would make the most sense:

- ***Electric minibuses should be utilized in densely developed areas and/or areas of high pedestrian activity.*** These areas are likely to provide a greater market for ridership that will help justify the extra capital expense associated with these vehicles. They are also areas that will enjoy the maximum benefits from low-emission or emission-free vehicles. In addition, the minibuses will be seen by the greatest number of people, thereby maximizing the public relations benefit of this transit investment.
- ***Electric minibuses are appropriate in areas that are being redeveloped.*** The attractive nature of the vehicles contributes to the efforts to renew interest and investment in these areas. Electric vehicles tend to attract non-traditional passengers who will look forward to riding an electric minibus, although they might never seriously consider riding on a conventional bus. They are particularly effective in areas that have, or anticipate having, a considerable amount of pedestrian activity. Their clean and quiet operation adds to a pleasant environment that is more pedestrian friendly.
- ***Electric minibuses are most appropriately utilized on routes that anticipate a great deal of stop-and-go operations due to significant boarding and alighting of passengers.*** Electric vehicles are much more fuel-efficient and emissions-efficient than conventional buses in operational settings that require frequent acceleration and deceleration.
- ***Electric minibuses are appropriate as a way of attracting people to use remote parking facilities.*** There a number of places in Miami-Dade County, particularly in downtown areas and entertainment districts, where electric minibuses could be used to encourage remote parking in order to reduce traffic that circles repeatedly in efforts to find on-street parking.
- ***Electric minibuses make sense when they connect with other regional transit services.*** Services such as Tri-Rail or MDT Metrorail and Metromover stations, or prominent Metrobus fixed bus routes and/or transfer points can be regarded as gateways, and where appropriate, circulators can augment regional services by extending their reach and providing much more direct access to local activities and destinations. If circulator services provide convenient intermodal connections, they

could encourage more use of such regional transit services and help reduce traffic congestion on the regional road network.

- ***Electric minibuses make more sense where synergistic sharing of resources, major facilities, and interlocal service agreements may be expected.*** A number of cities that have an interest in utilizing electric vehicles and are located near each other can realize savings in support infrastructure and maintenance expenses by sharing a maintenance center. They could also realize savings in operations costs by integrating routes between cities when it makes sense for passengers.
- ***Electric minibuses are far more likely to be used where local municipalities are willing to provide increased matching money to help pay for vehicles and service.***

Using the criteria described above, the study areas that have been reviewed in this report might reasonably fall into three categories in terms of their feasibility in implementing electric transit circulator services. Quite simply, these three categories are:

- ***More Likely***
- ***Somewhat Likely***
- ***Least Likely***

Areas that could be considered *more likely* candidates for implementing electric transit circulator services in the near future include:

- Aventura
- Downtown Miami (including Brickell, Flagler Street, and Overtown)
- Coconut Grove
- Coral Gables
- Everglades/Biscayne National Park

These areas have either high density, pedestrian activities, or relatively high visibility as well as traffic congestion and connections with the regional transit system, or some combination of these characteristics. All of them also have plans for circulator service, or are already providing circulator services. While there are different markets for circulator service ridership in each area, these are the areas that would benefit the most from the fuel efficiency and emission advantages offered by electric vehicles. And while Everglades and Biscayne National Parks are just beginning their planning, they clearly want the most environmentally acceptable transportation alternative possible, and they can restrict parking to create an immediate market

for transit circulators. They will have access to other sources of funds, and might secure support from congressional members in the south Florida area as well as from state agencies that are interested in promoting eco-tourism in the area.

Areas that could be considered *somewhat likely* candidates for implementing electric transit circulator services in the near future include:

- North Miami Beach
- North Miami
- Homestead/Florida City
- Hialeah
- South Miami
- "Downtown" Kendall

With the exception of Hialeah and North Miami Beach, these areas have not currently provide transit circulator services; North Miami and Kendall have, however, completed circulator studies, and South Miami operated a rubber-tired "trolley" in the past. These areas do not currently have either the densities or pedestrian environments normally associated with well-utilized electric circulators; and services would not be characterized by frequent stop-and-go movements. Consequently, the fuel and emission benefits of electric vehicles would not be as prominent. However, most of these areas provide connections to regional transit services, many of them are planning for redevelopment in key corridors, and all connect, or plan to connect, community activity centers. Electric vehicles would be appropriate in these areas if they are truly desired and if funds are available; they simply might not be as beneficial in these communities as they would be in the areas noted in the previous category.

Areas that, at this time, appear to be the *least likely* candidates include:

- Sunny Isles Beach
- Bal Harbour
- Surfside
- Miami Lakes
- Airport West

These areas are less likely to generate the ridership that should be expected when making a substantial investment in electric vehicles. None of these areas currently have the combination

of density, pedestrian activity, or redevelopment that is normally associated with electric circulator services. Again, if funds were available, there is no reason electric vehicles should not be used in these areas if they are in fact desired. In addition, if the communities of Aventura, North Miami, and North Miami Beach all made a concerted effort to coordinate and move forward with electric circulator services, it would make greater sense for Sunny Isles Beach and Bal Harbour to get involved in a northeast-county circulator service resource-sharing consortium.

It should be noted that any of the communities that have been referred to as “somewhat likely” or “least likely” might leapfrog areas that referred to as “more likely” if they identify local funding and generate enough interest and energy to create the partnerships necessary to support an electric vehicle circulator service. It should also be noted that there might be more demand for electric vehicle technology in the near future that will help achieve the benefits of greater mass production and lower unit costs for all communities that are interested in purchasing electric vehicles. It is generally predicted that hybrid-electric technology will be the propulsion system of choice in the transit industry within the next five years. An experiment in New York City with a fleet of parallel, charge-sustaining hybrid-electric buses is going very well, and most experts expect that the experience gained will accelerate the commercial viability of hybrid-electric heavy-duty buses. The factor that will truly confirm the commercial viability of hybrid-electric buses will be the utilization of such propulsion systems by the trucking industry. Once such a large market is established for this propulsion system, the per-unit costs are expected to drop, thereby reducing the costs of electric and hybrid-electric minibuses. Consequently, communities that do not have the highest levels of ridership potential should not be ruled out of consideration for electric or hybrid-electric circulator services in the near future.

CONCLUDING THOUGHTS ON FEASIBILITY

As has been mentioned many times in this report, the primary difficulty for any of the areas wishing to establish electric transit vehicle circulator services will be securing capital funding to pay for the vehicles. In spite of this considerable obstacle, a few areas in South Florida have succeeded in implementing electric vehicle transit services. In Miami Beach, state and local funds were used to pay for their first fleet of seven electric vehicles, while federal transit funds were earmarked for Miami Beach for their next four vehicles. In Coconut Creek, CMAQ funds were used to pay for four hybrid-electric vehicles. In Fort Lauderdale, FDOT will provide the funds to pay for two hybrid-electric vehicles as part of a transit corridor program for Broward

Boulevard. In Broward County, a number of cities have approached the County to seek capital funds from the County's federal transit grants to pay for new electric and hybrid-electric minibuses. Due to the high capital costs of these vehicles, Broward County has indicated a willingness to utilize their federal grants to purchase electric minibuses. However, the county will only agree to do this if the city can demonstrate that their service will carry at least 15 passengers per hour, which represents approximately one-half the county's transit system average.

In Miami-Dade County, local areas will need to be both creative—in terms of identifying partners and complementary programs—and willing to contribute toward the costs of these vehicles if they expect to move forward with an electric vehicle transit circulator service. They might also want to discuss their plans with their local Congressional representative to see if they can gain enough interest and support to obtain "earmark status" in the distribution of federal transit capital funds. However, they should only do this after conferring with officials of Miami-Dade Transit.

RECOMMENDATIONS

The "Lessons Learned" section in Chapter 4 of this report provided highlights that should be useful for any community that is interested in implementing an electric vehicle circulator service. This section will provide some concluding summarized recommendations for those communities:

- 1. *A thorough plan detailing the need for, and nature of, a local circulator service needs to be developed.*** This plan will help a local area determine if electric vehicle technology is truly appropriate. It will also serve as the foundation for generating support for funding both the operating and capital costs associated with the proposed service. In addition, a plan is required if the local area expects to apply for and receive state grants. If there is community consensus on a good plan that makes sense, it is more likely that local and state officials and private business interests will help support the project.
- 2. *A well-placed champion or champions must be found if the project is to succeed.*** Research conducted for this study has found that one of the primary determinants of the feasibility of electric transit vehicle circulator services is how determined a local area is to see it happen. Someone with stature and energy within the community must want to see this service established. "Grass tops" support from a strong champion or multiple leaders in the community will be vital to the ultimate

success of the program. Ideally the champions will be in high-level positions such as city or county commissioners or mayors, or city or county managers. It would also be very helpful for a department head with responsibility for the service to be part of the leadership effort.

3. ***The community must assign a project leader.*** While this advice would apply to virtually any new public project, the implementation of electric vehicle circulator services requires considerable oversight and effort that should not be underestimated. The champions noted above must make the implementation of new electric vehicle circulator service a major priority for the project leader. This project leader must identify and apply for every grant opportunity that is available. The project leader will also be held accountable to form partnerships with Florida Power & Light, businesses in the area, and other associations to help the service succeed. The project leader must display a combination of patience, determination, creativity, and passion for developing this new service.
4. ***The project leader should take advantage of a number of technical resources that are available.*** There are a variety of sources to provide technical assistance in terms of designing support facilities and preparing specifications for the purchase of vehicles, such as Florida Power & Light and the Electric Transit Vehicle Institute in Chattanooga. The community should also join the Clean Cities Coalition that is staffed by the South Florida Regional Planning Council. By joining this coalition, which requires no dues, the community will be eligible for grants that the coalition is responsible for distributing and receive information on technology and funding on a regular basis. They will also be part of a network of similarly interested communities.
5. ***Those areas that are interested in providing electric vehicle services should review how Broward County developed its community-based, public-private volunteer organization known as EV Ready Broward.*** That organization has “branched out” and is now looking to foster its “Community Transportation Initiative” throughout South Florida. Representative of the study areas covered in this report should contact that organization and see how they could contribute and benefit from joining it. This expanded association might develop a strategy to help Miami-Dade County pass a local option gas tax that could help pay for the operating costs of municipal circulator services, similar to the Broward County experience. A larger “Community Transportation Initiative” could also have more clout in Tallahassee and Washington when applying for grants or seeking amendments to state transportation funding programs.
6. ***Local communities that adjoin each other and are interested in implementing electric vehicle circulator service should partner with each other.*** This report has shown that there a number of neighboring communities that have expressed initial interest in utilizing electric vehicles to provide local circulator services, some of which are already being provided with diesel minibuses. There could be clear advantages in

cost savings if these communities worked together and shared storage and maintenance facilities. There might also be capital and operational cost savings depending on the nature of the routes and the times of day they are to be utilized.

This report has tried to identify the areas in Miami-Dade County that appear to be good and reasonable areas to establish electric transit vehicle circulator services. The report makes clear that electric vehicle technology is still developing and improving, but it is advanced enough for more local communities to be confident in its reliability. This technology is more expensive than conventional fueled vehicles and funding is not abundant. However, there are a variety of sources available, or that could be available, and a well-planned service proposal could generate support from a multitude of sources. When determining feasibility of additional electric transit vehicle circulator services in the county, one might well conclude that, while they will not be easy to establish, if there is truly a will, then there will be a way to do it.

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