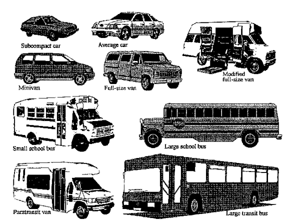
## CHAPTER IX

# Capital Needs

Before transit services can be provided, a myriad of capital items are required. The capital items required for public transit service include vehicles, office and facilities, passenger amenities, administrative computer programs, bicycle/pedestrian facilities, and advanced public transportation system technologies.

## VEHICLES




CATS' current vehicle fleet includes two buses and two mini-vans. The two buses are 2000 Fords which are able to carry 14 passengers at a time, whereas the two mini-vans used are a 2002 Chrysler Town and Country and a 2002 Dodge Grand Caravan. The buses have an average vehicle-life of approximately five years or 150,000 miles (according to the Federal Transit Administration Guidelines). The vehicles will require replacement in the upcoming years. In addition, depending upon the service alternatives chosen, additional vehicles may be required. The following text presents information regarding alternative fuel vehicles which are used across the United States. This information may apply to Cedar City and Iron County in the future.

### Alternative Fuels

To reduce pollution from mobile sources, the national Clean Air Act Amendments of 1990 encouraged the use of clean fuels such as methanol, ethanol, and natural gas derivatives including compressed natural gas, liquefied natural gas, and liquefied petroleum gas. In order to develop a working concept of the different alternative fuels, their advantages and disadvantages, and their potential application for CATS, the following review of the relatively common alternative fuels has been prepared.

## Methanol

Most of the methanol used commercially within the United States is manufactured from natural gas, making it economical to utilize. The tailpipe emissions of methanol are generally considered to be about half as reactive as an equal mass of emissions from gasoline or diesel fuel, promoting its use to reduce urban ozone in urban areas (such as Los Angeles). By volume, methanol has slightly more than half the energy content of diesel fuel and slightly more than half the energy content of gasoline. Due to the above characteristics, a methanol engine will consume slightly over twice the volume of fuel per mile of service, as compared to a diesel engine.

In the past few years, the transit authorities in Los Angeles and Seattle have retired their methanol programs due to the fuel's highly corrosive properties. After spending $102 million on methanol buses since the year 1989, the Los Angeles County transit officials declared their methanol anti-pollution program a failure because the buses are prone to costly mechanical repairs. Officials of the Seattle Metro transit agency eliminated their methanol demonstration program after a trial period of five years. Test results of the program indicated that severe engine malfunctions were experienced on the buses at 60,000 and 70,000 miles, largely attributed to the corrosive nature of the fuel.

## Ethanol

While not being as corrosive as methanol, the major use of ethanol is currently limited as an octane additive and oxygenate for gasoline. According to the *Information Update* (Detroit Diesel Corporation, February 1992), the cost of ethanol is almost twice as much as that of methanol, making its use limited as a motor vehicle fuel. Aside from the fuel's economic drawbacks, ethanol has many benefits. Ethanol produces lower carbon monoxide emission rates than gasoline, has a higher energy density than methanol, and has a lower toxicity than either methanol or gasoline.

## Compressed Natural Gas

The strength of compressed natural gas (CNG) as an alternative fuel for transit buses is that it is generally less expensive per unit of energy than gasoline or diesel fuels. CNG fuel also has the potential to reduce the oxides of nitrogen emissions, reactive organic hydrocarbons, particulate matter concentrations, and carbon monoxide concentrations by as much as 90 percent (per the Transportation Research Board, Transit Cooperative Research Program, 1993). The advantages of a CNG bus include no visible pollution and a quieter operation. Over the last several years, CNG has become the alternative fuel of choice in the US transit systems.

Historically, the weakness of CNG fuel is its difficult storage requirements. CNG is typically stored in high pressure cylinders under maximum pressures. The high weight, volume, and cost of the storage tanks have been a barrier to its commercialization as an alternative fuel. The recent development of lighter aluminum tanks, however, has reduced this disadvantage to some degree.

The main problem with CNG is primarily associated with the moisture in the compressed fuel freezing during the fueling process, since the approximate time to fill a bus may be three hours. Other problems that have been encountered nationally include the quality of local CNG supplies, limited testing of altitude effects on CNG, and limited CNG testing in extreme temperatures.

CATS would face additional costs for vehicles and facilities to operate an entire CNG fleet. CNG vehicles typically cost $30,000 to $35,000 more than diesel-powered equivalent buses. In addition, a CNG refueling facility with an adequate capacity to fuel a substantial portion of the fleet would cost between $600,000 and $1,000,000. Additional costs would be incurred to construct a maintenance facility with the required safety features and to provide emergency response equipment and training.

## Liquefied Natural Gas


*LNG Storage Tank*

Liquefied natural gas (LNG) has only recently received attention as an alternative fuel. The potential advantages of the fuel lie in its economic considerations since the fuel processing costs are much less than that of the other gaseous fuels. LNG also has a greater potential to reduce the oxides of nitrogen emissions and the hydrocarbon emissions when compared to diesel and gasoline fuels. Currently, the biggest obstacles facing LNG are the lack of availability and its storage and handling facility requirements. In 2001, approximately 25 percent of all new buses on order were either CNG or LNG powered.

## Liquefied Petroleum Gas

The advantages and disadvantages of liquefied petroleum gas (LPG) are similar to those of natural gas. The advantage of LPG is that gasoline engines can be easily converted due to its high heating and high octane characteristics. LPG is also well established in its transit fleet applications. According to the *Alternative Transportation Fuel in the United States* (R.F. Webb Corporation, June 1989), approximately 350,000 LPG transit vehicles were in operation in the United States. In 1995, the Department of Transportation estimated over 750,000 LPG transit vehicles would be in operation by the year 2000.

The main disadvantage of LPG is the lower engine performance of transit vehicles using the fuel. According to the above citation, the conversion of an engine from gasoline to LPG will usually cause a 10 to 15 percent power loss.

## Diesel Fuel

Diesel fueled engines have traditionally dominated the transit vehicle marketplace due to diesel's fuel efficiency and durability. From an air quality perspective, diesel engines have very low tailpipe emissions of carbon monoxide and other organic gases. The concern from an air quality perspective, however, has been the diesel emission rates of the oxides of nitrogen emissions (Nox) and particulate matter. Due to increasing environmental pressure to reduce the above emissions, the Environmental Protection Agency and American Public Transit Association have developed stringent Nox and particulate matter regulations. The Clean Air Act Amendments (CAAA) permit the use of clean diesel in urban buses provided that the clean diesel engines meet the particulate matter standards imposed by the CAAA.

In partial response to the 1990 CAAA's recommendations for cleaner burning fuels and the continued development of the previously mentioned alternative fuels, the traditional diesel fuel engine has made great strides toward developing cleaner burning particulate traps and improved catalytic converter technology. Diesel engine manufacturers have been successful in lowering the Nox and particulate tailpipe emissions by employing the above-mentioned techniques while still maintaining diesel fuel's economy.

Barring conversion to alternative fuels, a number of steps can be taken to substantially reduce the air quality impacts of diesel-fueled transit buses. Various transit systems have been successful in reducing the particulate emissions through the application of "clean-diesel" technology. The utilization of a low sulphur fuel has proven to reduce the average annual particulate emissions of a transit coach from 935 pounds to 260-300 pounds, roughly a 70 percent reduction. In addition, installation of an electronically-controlled fuel injection system and specially-designed transmission has dropped emission levels by 120 pounds of particulate matter annually, for a total emissions reduction of 87 percent.

This technology could be appropriate for CATS. Cedar City and Iron County may be open to the idea of alternative fuels, if funding allows. Without funding assistance, CATS could still have a greater impact on local air quality through the purchase of new diesel equipment with "clean-diesel" standards.

## Bicycle Racks on Buses

The concept of bicycle racks on public buses has gained widespread acceptance and popularity over recent years, particularly in smaller transit systems. Bicycle racks are utilized as an inducement to increase transit ridership as well as to encourage non-motorized forms of transportation.

A reasonable cost for a two-position, front-mounted bicycle rack is between $600 and $800 per vehicle. This cost could be reduced if a local bicycling store could be recruited to provide the rack at a reduced cost.

The Los Angeles County Metropolitan Transportation Authority, for example, uses stainless steel racks that hold two bicycles each. The Central Contra Costa Transit Authority of Concord, California is currently providing front-mounted bicycle racks on their entire fleet. MET Transit in Billings, Montana has installed bicycle racks with a very positive response from the community.

The most common type of bicycle rack is placed on the front of the vehicle (so the driver can watch the loading and unloading) and has space for two or four bikes. These racks are available on a "first-come/first-served" basis and are provided with a notice indicating that the passenger is liable for all damages. Passengers must be able to load and unload their bicycles on their own. Bicycles fitted with child seats are typically prohibited from utilizing the racks as the seat could block the bus's turn signals.

The initiation of bicycle racks on transit buses could be a good opportunity for a promotional campaign for the environmentally-friendly citizens of Cedar City and Iron County. The only drawback of bicycle racks is the additional time necessary for loading and unloading the bikes. Operational problems associated with use of the bicycle racks can be minimized through the development and distribution of a pamphlet regarding the correct use of the rack.

## PASSENGER AMENITIES

The "street furniture" (shelters, benches, lighting, etc.) provided by the transit system is a key determinant of the system's attractiveness to both passengers and community residents. In addition, the "street furniture" increases the physical presence of the transit system within the community. Bus benches and shelters can play a large role in improving the overall image of a transit system and in improving the convenience of transit as a travel mode. More importantly, shelters are vital to those waiting for buses in harsh weather conditions.

Adequate shelters and benches are particularly important in attracting ridership among the non-transit-dependent population—those that have cars available as an alternative to the bus for their trips. Preference should be given to locations with a high proportion of elderly or disabled passengers and areas with a likelihood of a high number of daily boardings. Lighting and safety issues are equally important along major highways. This could range from overhead street lighting to a low-power light to illuminate the passenger waiting area.

The cost of modern glass and steel shelters ranges from approximately $1,000 to $8,000. The maintenance and repair of vandalism to bus benches and shelters is a very minor cost. Modern benches and shelters are very durable and resistant to vandalism. Many transit agencies have even had benches provided by advertising firms at no cost to the transit agency.

## VEHICLE MAINTENANCE FACILITY

To conduct proper preventative maintenance procedures, adequate facilities are required. These facilities need to accommodate adequate parts storage, meet safety requirements, and provide the necessary equipment, facilities, and room for maintenance activities. Functional areas should be located in an efficient and safe proximity to each other. The facility should accommodate multipurpose activities, rather than a facility with many areas for specialized activities (which is often a rule at larger agencies).

A fully functional transit facility will provide the following amenities.

- Administrative employee office space.
- Drivers and mechanics room, which would serve as both a locker area and lunchroom.
- Radio/dispatching area, with space for the AVL/real-time dispatching equipment and personnel.
- Multipurpose room, which would be used as a training and meeting room.
- Bulk storage space.

- Separate parts storage space (including tires).
- Transit vehicle parking.
- Employee and visitor vehicle parking.
- Bus service island, with a service lane including a bus washing facility.

## ADMINISTRATIVE CAPITAL NEEDS

CATS will need to continue to have sufficient space for administration and scheduling/dispatch duties. Other administrative capital needs include updating and/or purchasing computer hardware and software as needed.

***Scheduling and dispatching software*** for the transit service is another technological move for CATS. The software has a price range from $2,000 to over $50,000, depending upon the type of system. Each company prices the software differently—by trips per day, number of workstations, or number of vehicles. An adequate cost for CATS would be approximately $10,000 for the software and should be funded in part by the federal government (for 80 percent) if funds are available.

## BICYCLE / PEDESTRIAN FACILITIES

At one end or both ends of their transit trips, virtually all transit passengers also travel on foot or on bicycle. A key element of a successful transit system, therefore, is a convenient system of sidewalks and bikeways accessing the transit stops. CATS should work with the local jurisdictions to review the construction plans and scheduling priorities for pedestrian and bicycle improvements so that these plans coordinate with the transit passengers' needs.

## ADVANCED PUBLIC TRANSPORTATION SYSTEM TECHNOLOGIES

A key consideration in long-term planning is the impact of improvements in technology that can benefit transit services. In recent years, technological research and development programs have been incorporated into the Intelligent Transportation System (ITS) concept. The application elements of ITS for public transportation are known as Advanced Public Transportation Systems (APTS). CATS should look for future technologies beyond the time frame of this study.

APTS basically have to do with the application of many high-tech developments to the transportation realm. Most of the APTS developments have come from the military and financial arenas. One such military development is the use of Global Positioning Satellites (GPS) to determine the exact location of an object through triangulation, radio frequencies, and computers. The same concepts used to track nuclear warheads, submarines, and spy on other countries can be employed for other purposes, notably to improve our transportation systems. Likewise, from the financial arena, the same principles used in credit/debit cards and building security systems can be applied to the transportation field. These technologies can be utilized to monitor the people using the transit service by noting where they board, noting where they alight, debiting their fares from bank accounts, or charging their fares to the appropriate human service agency.

Several key conditions have evolved to make APTS applications more attractive. Technology has progressed to the point that the applications are finding their way into the general market. The cutting edge applications of yesterday are now relatively commonplace. Currently, APTS applications are being used across the United States and are realistic options for CATS.

Advanced traveler information systems are intended to forewarn the public of delays on the transportation network. These may take the form of sign boards on the highway which advise travelers of congestion ahead, or they may be in the form of a traffic report accessed on television or over the phone.

Automated vehicle location (AVL) systems employ one of several means of determining the location of a vehicle. By monitoring the historical locations and demands of the vehicles, transit planners can better refine schedules and networks to optimize the workload of vehicles. Logical links to the AVL systems are real-time ride-matching and on-demand dispatching through sophisticated matching and scheduling programs. These systems function by examining where vehicles are, where the vehicles are heading, and how full the vehicles are at the time a ride request call is received. Through a series of decision trees, the computer matches the ride request to a vehicle and dispatches the ride order to the driver or, if no capacity exists on the vehicle, schedules the ride request to be filled by the first available vehicle. Providing transportation services in this flexible format may have significant and fundamental impacts on how demand-response and fixed-route services are provided.

The Regional Transportation District in Denver has implemented an AVL system for 833 fixed-route buses and 66 supervisor vehicles at an estimated cost of $10,400,000. The Dallas Area Rapid Transit system is installing an AVL system for a total of 844 buses, 216 commuter coaches, 245 demand-response vans, and 300 supervisor vehicles. Similar systems are being developed in Milwaukee and Baltimore. The Baltimore system will include signal preemption for buses running behind schedule.

The existence of real-time dispatching and ride-matching systems creates the need for linking the public to the service. The smart traveler system concept provides a quick link by phone, kiosk, or computer to the service dispatching system. A caller would request a ride, the system would examine vehicle availability in response to the ride request, and inform the caller where and when the rider would be met. The system may also suggest other mode choices available to the caller. The entire transaction need take only a few minutes. If an acceptable match cannot be made, the system may offer to fill the request with a taxi ride.

These new technologies may seem quite advanced for a new start transit system in Cedar City. However, these developments are realistically the wave of the future for transportation systems. Such technological advancements improve transit efficiency, quality of service, and service for all types of public transportation in urban and rural areas. Depending on the service options decided upon, this may well become a necessity for scheduling of trips.

## SUMMARY

This chapter has identified various capital needs that should be taken into consideration when providing public transit service. The capital items required for public transit service include vehicles, transit office and vehicle facilities, passenger amenities (such as shelters and benches), administrative computer programs and web pages, bicycle/pedestrian facilities, and advanced public transportation system technologies. The capital needs identified above should be considered to provide an efficient public transit system within Cedar City and Iron County. Specific capital needs are presented in detail in Chapter VIII.