Table of Contents

1.1 - Policy Goals of Park-and-Ride

Park-and-ride facilities can play an important role in a region's transportation system. As the region grows and travel increases, reliance on single occupant vehicles becomes a less viable means to efficiently and effectively address transportation needs. Park-and-ride facilities fill the gap between solely automotive and transit based transportation. A well-implemented park-and-ride program can be an effective transition strategy that introduces travelers to the benefits of transit and builds a market for future transit extensions. Park-and-ride can also have direct transit benefits for people who live in areas that are too remote or lack sufficient density to support transit directly. Yet park-and-ride facilities can have disadvantages if they are not well planned. The potential benefits and drawbacks of developing a park-and-ride system are examined in the following section and are broken down into three parts: impacts on drivers, impacts on the transportation system, and impacts on land use.

1.1.1 - Impacts on Drivers

Park-and-ride facilities offer people living in suburban areas, or other areas not typically associated with public transportation, the opportunity to benefit from public transportation for a portion of their travel needs. There are a variety of benefits that riders can realize by using a park-and-ride facility. A survey of Chicago Transit Authority park-and-ride facilities users found that the principal reasons for using the park-and-ride lots included expensive parking at their destination, their dislike of driving, or that park-and-ride provided the quickest way to their destination.[1]

In order to get people to leave their cars behind, they must feel that there are significant advantages to using the park-and-ride facilities. These quality of life advantages can include:

- *Time Flexibility*

When a rider uses a park-and-ride facility, they will ideally save time on the commute. In addition, the time that they do spend on transit becomes available for other purposes such as reading, work, or other activities.

- *Cost Savings*

By using a park-and-ride connection, the rider can realize cost savings through reduced car mileage, insurance, maintenance, and fuel costs. Additionally, the rider may also save on parking fees at their destination.

- *Convenience*

Park-and-rides can offer a convenient alternative to commuters. If parking at their destination is limited or hard to find, park-and-ride can streamline their commute. Additionally, long commutes can be made easier and less stressful if someone else is driving.

- *Time Savings*

As congestion in the Triangle increases, park-and-ride facilities can offer riders an opportunity to save time. Time savings from park-and-ride could occur through facilities feeding the TTA rail link or HOV lanes proposed by CAMPO, enabling transit to avoid bottlenecked sections of freeway. This becomes more important as average commute times increase due to congestion and urban sprawl.

1.1.2 - Impacts on the Transportation System

Park-and-ride can provide some benefits to the transportation system and supplement traditional bus transit. These benefits can include: increased public transportation ridership; reductions in

Vehicle Miles Traveled (VMT) and improvements in air quality; and reduced traffic congestion.

- *Increased Ridership*

The existing benefits of transit can be enhanced by park-and-ride if the addition of stops and parking spaces increases ridership. Several park-and-ride systems in England[2] and the northeastern United States[3] have reported increases in ridership as a result of expanded parking facilities at existing transit stops and the creation of new park-and-ride lots. An increase in ridership can generate a greater return on investment for existing transit facilities and increase the attractiveness of funding future transit improvements.

- *Reduced VMT and Improved Air Quality*

Reduction in VMT can occur if TTA achieves increased transit ridership. VMT, however, are also a function of the location of park-and-ride lots and the number of new buses needed to serve the new facilities. The reduction in VMT on the part of drivers who become park-and-ride users must not be exceeded by the addition of VMT by new buses to serve the lots, particularly for new services where usage is low. Also, the stops must be strategically located to avoid encouraging too many former pedestrians, cyclists, and "long-haul" transit riders to begin driving to lots.

Decision based on TTA ridership statistics alone may not accurately capture region wide effects. According to the previously mentioned study of park-and-ride systems in the United Kingdom, park-and-rides can actually decrease ridership on transit lines outside of the park-and-ride design area[4]. For instance, riders who walk, bike, or use a local transit system to reach a TTA transfer point may decide that it's now more convenient to drive across town to the park-and-ride lot than to ride the bus. Focusing attention on maintaining excellent walk/bike/bus accessibility at stations that do not have park-and-ride facilities can address this concern. A study in Chicago found three new riders were attracted to park-and-ride service for every one former bus rider.[5] This implies that the benefit from new riders outweighs the cost of converted former transit riders. An emissions analysis by KM Chng Environmental Inc. of Houston's park-and-ride found a very minute reduction in air emissions.[6]

Air quality improvements are generally associated with a reduction in VMT, and more significantly with a reduction of the total number of cold starts. At first glance, park-and-ride system that increases ridership should reduce VMT and improve air quality. The relationship between park-and-ride and VMT reduction, however, is complex; some researchers argue that park-and-ride lots can actually have a negative impact on air quality by encouraging a greater number of cold starts and short trips[7]. On the other hand, traditional automobile commuters may make a number of stops on their way to and from work generating more starts and stops than the park-and-ride. A park-and-ride lot can eliminate these short trips in the downtown area, contributing to a local improvement in air quality [8]. A survey of park-and-ride systems across the United States also indicates that 40-60% of new riders formerly commuted to work in single-occupancy-vehicles.[9] Because automobile emissions are affected by a variety of factors it is not possible to assert that park-and-ride lots will definitely cause an overall reduction or increase in emissions, but the evidence suggests that park-and-ride can contribute to a decrease in VMT.

- *Reduced Traffic Congestion*

If economic growth continues in the Triangle, increases in traffic congestion may outpace any relief provided by additional park-

and-ride services. This point, however, highlights the importance of providing transportation alternatives.

Park-and-ride systems enhance the benefits provided by a traditional transit system, but only if they are carefully designed to meet the needs of potential users. In order to be effective, park-and-ride services must be viewed as an attractive alternative over current travel modes available to Triangle commuters. Given the dramatic increase in commuting times throughout the Triangle area over the past decade it is reasonable to expect that, provided adequate service levels, some individuals will be drawn to an expanded park-and-ride system to avoid the aggravation of their daily commutes.

Although one of the chief motivations for creating park-and-rides is to reduce congestion, there is little definitive evidence that park-and-ride systems achieve reductions in practice outside of the immediate vicinity of the transit destination.

One of the chief causes of continued traffic congestion following park-and-ride implementation is conflicting transportation policies at the local, regional, and/or state level. The traditional response to alleviating traffic congestion is to make the traffic move faster through road widening or construction. Current road design practices should be examined closely to determine compatibility with the proposed park-and-ride system.

With park-and-ride facilities that operate as satellite parking, the improved parking situation may result in more automobile trips with no reduction in miles traveled, and may thus actually induce additional regional congestion. If park-and-ride facilities are placed without consideration for the corridors they are serving, they may end up drawing trips to areas that previously did not have congestion problems. Such congestion may also occur in local neighborhoods where traffic flow in and out of the facility is not carefully planned, particularly if short cuts exist on neighborhood streets.

When planning a park-and-ride system it is important to consider the impact of a transit stop on the area surrounding the lot. Poor choices in lot location may lead to an inequitable redistribution of peak travel congestion rather than overall congestion relief.

1.1.3 - Impacts on Land Use

The placement of park-and-ride facilities can have a direct impact on transit-oriented development (TOD); sprawl; and compact development.

- *Transit Oriented Development*

Transit Oriented Development becomes harder when destinations are separated from stations by vast park-and-ride lots. Walkability is a key feature of primary and secondary transit destinations. When a park-and-ride for one corridor is located at a destination point for another corridor, for example, a park-and-ride in Downtown Raleigh, the walkability of the destination for those arriving by transit may be reduced if the facility design is poor.

This issue can be addressed by careful site planning and ensuring that stations are not completely surrounded by parking lots. As transit-focused development takes root, it may be desirable to plan to reconfigure park-and-ride surface lots into parking structures.

It is also important that the redistribution of congestion from popular corridors to the area surrounding the lot not alter the

character of the neighborhood from pedestrian-oriented to automobile-oriented. Situating park-and-ride facilities in poorer neighborhoods, if not done thoughtfully, may diminish environmental equity by isolating the neighborhood from the stop and reducing opportunities for transit-oriented development. The proposed regional rail stops at Alston Avenue and West Raleigh area warrant special consideration for appropriate redevelopment of the surrounding neighborhoods.

- *Urban Sprawl*

Urban sprawl is encouraged by increased mobility. By locating a park-and-ride close to the outer fringe of an urban area on a fast transit line, the net travel time from more remote areas may be reduced enough to create an incentive for further sprawl.

This issue can be addressed by locating park-and-rides on corridors that are low density rather than "no density". For example, such a corridor may be largely built out, but at densities insufficient to support transit directly. Because denser secondary activity is desirable to encourage use of park-and-rides, these facilities are best situated on corridors where low-density development is already in place for a fairly significant distance (10 + miles) beyond the park-and-ride facility location. The facility itself should be designed to encourage dense nearby development.

- *Compact Development*

Park-and-ride can be a vital part of improving land use efficiency at the destination and establish transit corridors that improve land use intensity over time. As transit ridership increases due to improved access and convenience, new riders will insist on pedestrian and bicycle friendly destinations, creating demand for new compact development in areas well served by transit. Park-and-ride lots can also become a focus for a suburban neighborhood and boost nearby commercial activity.[10]

1.2 - Technical Issues of Park-and-Ride

Though park-and-ride can have important benefits both for individual commuters and the region as a whole, there is more to creating a successful park-and-ride facility than simply building a parking lot next to a transit station. The factors that control whether a park-and-ride can realize the benefits presented above are summarized in Table 1.2.1 and explored in detail in the balance of this document

1.2.1 - How does Park-and-Ride Operate?

Successful park-and-ride facilities are designed to serve a particular transportation **corridor**. A corridor is not simply a road segment, but is rather a connection between an important destination and a certain geographical section of the population that uses that destination. In general, a corridor will have several physical links consisting of highways, major arterial roads, bus routes, or the future regional rail line. These links may be used sequentially, or in parallel by different groups of travelers. Since the corridor is defined both by destination and the links taken to reach it, the same link (such as I-40 between RTP and Raleigh) may be part of several corridors (such as from the Western Triangle to RTP, downtown Raleigh, and Cary). The goal of building a park-and-ride facility is to help individuals realize transportation benefits by transferring to a transit link for part of their travel through the corridor. The key to reaching this goal is to maximize the benefits of using a transit link for many these individuals, while minimizing the negative impacts a large parking facility may have on its neighborhood and the environment.

Table 1.2.1: Factors Influencing Use of Park-and-Ride Facilities

Rider Availability
• Suitable volume of travelers to support a park-and-ride facility • Rider acceptance – to what extent will riders be receptive and use a park-and-ride facility • Availability of riders will vary greatly with park-and-ride lot location (density)
Destination Cost
• Ability of rider to realize a benefit (decrease congestion, decrease parking fees, etc.) • Cost to rider of not having vehicle at destination • Destination costs will vary by destination, not by park-and-ride lots
Travel Costs
• Gas and mileage saved by using a park-and-ride facility • Transit fare • Cost to the driver in comfort, safety, and convenience • Net travel costs will vary by lot location
Transit Time Savings

• Positive Savings realized if:
  o Taking transit saves time compared to car
  o Park-and-ride facilities decrease congestion
  o Destination parking limitation exist
• Negative Savings realized if:
  o Taking transit loses time compared to car

Transfer Costs

• Time spent waiting
  o Will vary depending on service frequency
• Hours of Service
  o Must be suitable for riders at all likely hours
• Inconvenient park-and-ride location makes using it more burdensome

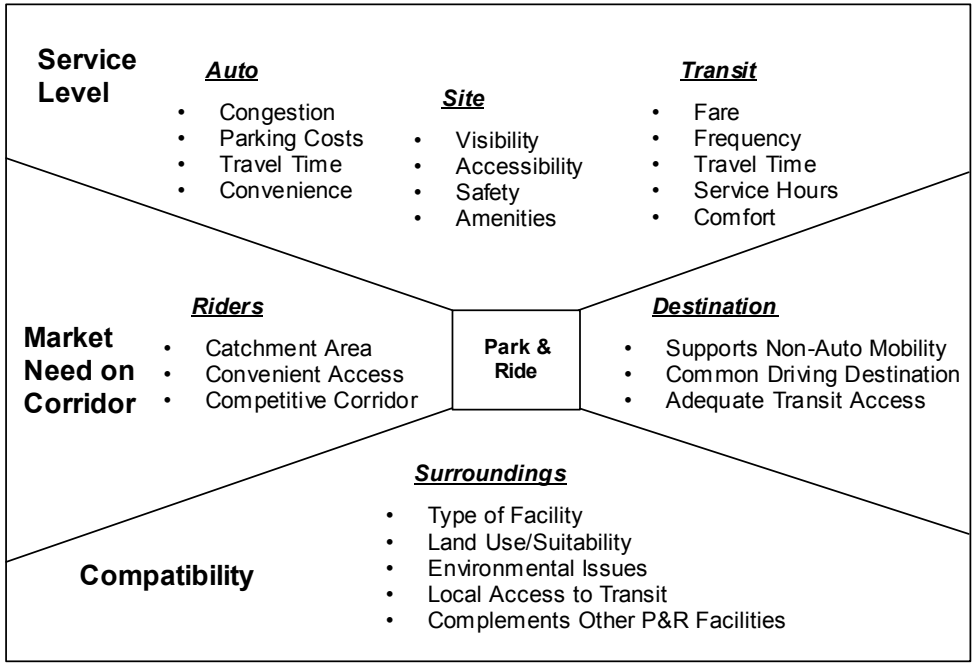
Transit Amenities

• Attractiveness and comfort of service
• Utility of park-and-ride lot
  o Safety
  o Visibility
  o Comfortable Waiting
  o Amenities (such as shelters, restroom, bike racks, phones, benches)
• Return trip
  o Safe and easy access to transit at destination

A number of components contribute to the success of a park-and-ride facility on a corridor, as summarized in Figure 1. The **service level** provided must be sufficient for transit to appear beneficial with respect to saving time and/or money. The **market need on the corridor** must be sufficient to warrant the expense of building the park-and-ride facility and providing sufficient service to it. The market need reflects both characteristics of the corridor destination and of potential riders along the corridor. Finally, the **compatibility** of the site reflects the importance of integrating the park-and-ride facility with its neighborhood, with other planning goals, and with the physical environment.

Analyzing the components of a successful park-and-ride along a particular corridor provides a good basis for determining whether such a facility is feasible at all. This analysis can also help determine the correct location for a park-and-ride along the corridor, as well as the type of facility that will be most effective. Placing a park-and-ride too close to a destination reduces it to a satellite parking facility that will have little potential impact on regional traffic congestion or air quality. Placing it too far away will increase pressures toward urban sprawl without encouraging more transit use. Building a dedicated park-and-ride facility may create necessary additional capacity, but a shared facility may appear more attractive and beneficial to potential transit riders. A shared facility also offers flexibility for location in developed areas and better "fit" with existing land uses.

Figure 1.3.1 Components of a Successful Park-and-Ride



1.2.2 - Service Level

For park-and-ride to succeed, switching to the transit link in the corridor must offer service benefits compared to driving alone.

- *Auto*

Switching to transit from automobile travel may occur when significant obstacles prevent this mode of travel from operating freely. Such an obstacle is present when auto access is constrained because of severe congestion on some part of the corridor (and that congestion does not affect transit service through the same corridor). It may also occur because of parking limitations or parking fees at the destination. Expensive parking at the destination, for example, may induce significant park-and-ride use.[11] These obstacles are frequently specific to a corridor. Travelers to downtown Raleigh from the east, for example may experience different levels of congestion than travelers from the south or west.

- *Site*

The services at a park-and-ride facility must contribute to riders' sense of gain from using transit compared to continuing to drive. Park-and-ride lots should be visible and well-marked, which

serves both to advertise the service and to increase perceptions of safety. The facilities should be freely accessible both to transit service (typically by being located close to a transit stop) and to uncongested automobile links on the corridor. Traffic flow in and out of the facility onto the roadway portion of the corridor should be quick and direct. Walking access to transit stops from the facility should also feel safe and convenient. The facility and its surroundings must be well lit. Presence of other amenities such as heated or air-conditioned shelters, restrooms, or convenience shopping may also help these facilities appear attractive and usable.[12]

- *Transit*

The requirements for transit service that is perceived as good by a significant number of riders will vary depending on the characteristics of the destination and the riders who use it. Important factors are hours of service, service frequency, travel time from the park-and-ride to the destination, and level of service on the return trip. Transit service at the park-and-ride facility should be available at suitable hours, which vary according to the needs of riders bound for certain destinations. State government workers bound for downtown Raleigh have different schedule requirements from technical professionals working in RTP, and both of those differ from riders bound for UNC or NC State. Regardless of the hours of service, service frequency must be great enough that the wait for transit at the park-and-ride does not seem burdensome to the traveler. With fifteen minute rail headways, for instance, an average wait will be 7.5 minutes. Shorter waits are desirable, particularly at peak hours. The overall time spent waiting and the degree of comfort during the wait and the ride are important factors as potential riders decide whether to switch to transit at the park-and-ride or just to keep driving.

The travel time on transit must be competitive with automobile travel over the same section of the corridor. Park-and-ride does not have to be associated with rail transit, if bus service provides tangible benefits of time saving and convenience with no major loss of comfort. More comfortable transit (e.g. rail rather than bus) can help riders enjoy longer rides on the transit segment of their journey.

Transit service at the destination is also an important consideration. It is important that service be sufficient that riders do not feel "trapped" at their destinations (for instance, if service becomes very infrequent during midday hours). Bus stops and transit stations at the destination, as well as the walking approaches to them, must feel safe and comfortable.

1.2.3 Market Need Along a Corridor

- *Riders*

For park-and-ride to succeed, the corridor must serve enough travelers that potential transit ridership will be sufficient to offset the cost of maintaining the park-and-ride facility and a sufficient level of transit service. The corridor must be long enough that a significant number of people travel long distances to their destination. These riders should be receptive to transit. Marketing the service can draw people's attention to the park-and-ride service, but that service must present tangible and easily understandable benefits. Park-and-ride can be a useful strategy for introducing people to the benefits of transit generally and

building a constituency for transit improvements, by presenting it as a strategy for making one's car more useful (since the traveler only has to drive the "easy" part of the corridor). By focusing on congested corridors whose users are likely to recognize and take advantage of benefits from transit, park-and-ride can also create benefits to the region as travelers shift away from congested corridors and stop using costly parking facilities at their destination. By limiting automobile travel to relatively uncongested portions of the corridor, air quality benefits may also be realized.

- *Destination*

Destinations for a successful park-and-ride should be a focus of activity in the form of jobs for commuters or classes for students. The average distance from home to destination along the corridor is significant. The average trip from home to destination should be at least 4 miles to serve some benefit from the mode combination[13]. Destinations where auto use is significantly constrained by congestion, lack or high cost of parking, or a general long travel time are suitable for service with park-and-ride. A very important characteristic is that within the destination core, the automobile is perceived as optional. Within the core, a variety of secondary destinations (restaurants, shopping, banks, etc.) should be easily accessible by foot or high frequency transit service. As noted above with respect to transit service levels, people who use park-and-ride must not feel "trapped" by their decision to use transit. Having a choice of secondary destinations helps magnify the benefit of park-and-ride.

1.2.4 - Compatibility

- *Surroundings*

A poorly located park-and-ride facility can have negative consequences for its surroundings. Large parking facilities have negative effects on stormwater runoff that must be mitigated. They have the potential to increase traffic on neighborhood streets. By facilitating longer overall trips to key destinations, they can facilitate urban sprawl. To overcome these problems, careful attention must be given to the type of park-and-ride facility, the location of the facility on the corridor it serves, and to its relationship to the neighborhood around it.

Park-and-ride facilities are not necessarily dedicated parking lots. They may be shared, informal or dedicated. A summary of facility types and their benefits is presented in Appendix A.

Walking and bicycle access to the transit stop served by the park-and-ride is a key consideration. Such access is even more important when the transit stop the park-and-ride serves is also a destination in its own right, as will be the case with most stops on TTA's Regional Rail line. If the parking facility presents a barrier to access from surrounding neighborhoods, it can reduce the likelihood of transit-oriented development and may also reduce the benefits of development that does occur. Suitable pedestrian corridors into a facility do not necessarily preclude high capacity parking at those stations, but the interaction must be carefully planned to maximize benefits to all transit users, regardless of whether they arrive from a distance by car, or from the local neighborhood on foot or by bicycle.

It is also important that the park-and-ride serve transit riders without becoming "just another parking lot" for users of the destination near that transit stop. This consideration might be important if a park-and-ride facility is built, for example, in downtown Raleigh to serve the corridor connecting areas east of Raleigh to destinations in the western part of the Triangle such as RTP and Duke University. Appropriate pricing policies may be required so that the lot serves transit riders without encouraging travelers from other corridors destined for downtown Raleigh not to use transit.

Regardless of whether the site of the park-and-ride is planned for transit-oriented development, easy access to secondary destinations (shopping, day care, etc.) can improve the utility of the facility to potential users. Such secondary destinations are often the reason for the emergence of informal park-and-ride, and are a significant benefit of shared park-and-ride facilities, both for transit users and users of the destination where parking is shared.

Finally, corridor analysis should aim to situate park-and-ride facilities in locations where they complement each other, rather than compete for riders on the same corridor. It should be clear from a road map which areas are served by which park-and-ride facilities.

SUMMARY

The factors that influence the success of park-and-ride are summarized in Table 1 above. These characteristics can help identify corridors that are amenable to park-and-ride strategies, and they can also help find an optimal location on the corridor for the actual park-and-ride facility.

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[7] Parkhurst, 2000
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