Abridgment

Busway Versus Rail Branch: Analysis of Atlanta's Tucker-North DeKalb Corridor

Richard M. Stanger and Manuel Padron, Metropolitan Atlanta Rapid Transit Authority

The purpose of this study was to evaluate comprehensively the costs, operational effects, and patronage aspects of busway versus rail rapid transit in the Tucker-North DeKalb (T/ND) Corridor in Atlanta.

Conceptually, the role of transit in this corridor is to provide tributary service to the East Rail Line. Two alternatives are considered: a rail branch providing direct, no-transfer service to Five Points; and a busway terminating at East Lake Station and requiring a transfer to the East Rail Line. The rail branch would operate essentially as a separate radial line and, from the users' perspective, be a separate line-haul service. The busway alternative would be a feeder service route. Each facility would provide a different set of costs and benefits. As a busway, the T/ND Line is somewhat unique and offers a new type of busway for analysis. It is similar to rail in operating concept, yet also provides direct area coverage. Specifically, unlike any existing busway, (a) it is not part of a freeway, (b) it provides optional intermediate stops in its line-haul section, and (c) its purpose is to feed a rail trunk line.

BACKGROUND

Atlanta is a rapidly growing region. In 1970, the Atlanta urbanized area had a population of 1 172 000. The 1973 estimated population of 1 587 000 in the seven-county area (Clayton, Cobb, DeKalb, Douglas, Fulton, Gwinnett, and Rockdale) is expanding at an annual rate of 3.4 percent. The official estimate for the year 2000 regional population is 3 500 000. The 1970 median household income for the area was $10 698, and the typical household had 1.4 automobiles. DeKalb County, where the subject corridor is located, is generally a more affluent area. The median household income was $12 137 in 1970, and the average household had 1.65 automobiles. During the last decade, 42.5 percent of the growth in the 1970 Atlanta standard metropolitan statistical area occurred in DeKalb County, which encompasses only 15.6 percent of the land area. Figure 1 locates DeKalb County within the region. The T/ND corridor is a wide sector oriented northeast from the East Lake Station of the East Rail Line, 4.8 km (3 miles) from central Atlanta. It is generally similar to the rest of the county in socioeconomic characteristics and has undergone similar recent and rapid growth. However, its population density is 1020 persons/km^2 (2650 persons/mile^2)—twice that of DeKalb County overall.

DESCRIPTION OF ALTERNATIVES

Rail Alternative

Just west of the East Lake Station, the T/ND rail branch, which has three stations, diverges north from the East Line. The first station is the North Decatur Road Station 6.5 km (4 miles) from the East Line turnout, where there are 850 parking spaces. The second station is 2.4 km (1.5 miles) farther out at North Druid Hills Road and has 1200 parking spaces on both sides of the tracks. At the end of the line, east of Cooledge Road, is the terminal station, which has 3500 spaces.

Busway Alternative

The busway starts at the East Lake Station of the East Rail Line, where there are provisions for easy and convenient transferring, and follows the Seaboard Coastline Railroad right-of-way to the Cooledge Road Station, always east and south of it. It is shorter than the rail alternative: 11.4 versus 14.3 km (7.1 versus 8.9 miles). The North Decatur Road Station has on-off ramps into the busway and enlarged curb-side loading areas off the busway through lanes. The North Druid Hills Station has a 1000-space parking lot, as well as on-off ramps for busway access. Cooledge Road is similar, but larger, with 2800 parking spaces, bus storage and turnaround facilities, and other station amenities.

Feeder Bus Routes

Common to both rail and busway system alternatives is

Publication of this paper sponsored by Committee on Rail Systems Planning and Development.

an identical network of feeder bus routes. A total of 19 feeder routes would use the busway. In all, more than 90 percent of the population in the corridor is within 0.4 km (0.25 mile) of a bus route.

PASSENGER ATTRACTION

The same mode choice model was used in both analyses of patronage attraction. The forecasts reflect some additional growth expected around stations in specific zones, with all other zones remaining equal for both modes. The techniques used to derive these figures are standard and based on an unconstrained demand. The sizes of the stations, parking lots, or feeder bus fleets were not developed until after the total unconstrained demand by access mode had been determined. Access time was found to be the primary variable.

The raw output of the mode choice model was adjusted because some zones are relatively equidistant to two rail facilities. Thus, a certain number of trips from each zone in the corridor were reassigned to the North and East Rail Lines to reflect a more realistic use of these facilities. The access mode to the line-haul stations was then determined by analyzing the relative attractiveness of each access mode (bus, walking, kiss-and-ride, or park-and-ride) for each of the zones contributing patrons to the line-haul stations. The busway is estimated to carry a morning peak-hour volume of 4480 persons in 1995. The rail line volume for the same year is estimated to be 6070. The rail alternative will attract 35 percent more patrons than the busway because of its shorter total travel time, which results principally from the elimination of the transfer at the junction of the T/ND branch and the East Line in the rail alternative. The additional 1590 riders projected on the T/ND rail branch comprises three components:

1. Patrons diverted from automobiles to transit (70 percent),
2. Patrons created by urban development in the immediate vicinity of the rail line stations (10 percent), and
3. Patrons created by the shift of some patrons from the East and North lines to the T/ND rail branch to take advantage of the elimination of the transfer of modes at the junction with the East Line.

With regard to component 2, the inherent advantage of the busway alternative, the elimination of the surface feeder-to-trunk line transfer, works against the creation of accessibility nodes. Component 3 does not, of course, represent a net increase but is highly desirable operationally because the North Line is otherwise projected to be loaded beyond seating capacity by 1995.

Figure 1. DeKalb County and the Tucker-North DeKalb corridor.

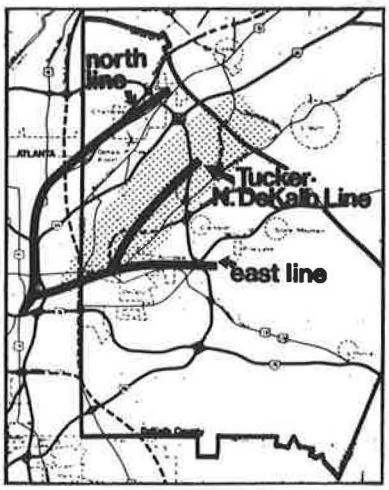

Table 1. Summary of comparative analysis.

Feature or Cost	Busway	Rail Branch
Project length, km	11.43	14.41
Peak-hour passengers (one-way)	4480	6070
Total daily passengers (two-way)	26 900	36 400
Load factor	1.49	0.89
Number of buses	115	84
Additional rail cars	0	8
Operating vehicle-kilometers		
Bus vehicles[a]	11 714 000	6 179 000
Rail cars[b]	9 518 000	13 289 000
Operating costs		
Bus vehicles, $[a]	6 644 000	4 184 000
Rail cars, $[b]	4 729 000	6 603 000
Road or track, $	75 000	150 000
Station, $	100 000	270 000
Total cost difference, $	340 000	
Cost of lower revenues (at 25¢/trip), $	120 000	—
Total operating cost difference, $	460 000	—
Total capital costs, $	102 000 000	180 000 000
Capital cost per kilometer (construction plus vehicles), $	8 909 000	12 462 000
Amortized cost per year (at 8%; rail construction, 50 years; bus construction, 25 years; buses 10 years), $	10 180 000	15 320 000
Total annual cost differential, $	10 640 000	15 320 000

Notes: 1 m = 0.62 mile.
All costs in 1975 dollars.
[a]T/ND corridor service only. [b]From Candler Park East only.

CAPITAL COSTS

The rail line is far more costly to build and equip than the busway alternative. Estimates place the total capital cost of the rail branch, including design management, escalation, and contingencies, at $180 000 000 in 1975. The busway alternative is estimated to cost $101 000 000. Excluding all costs but those for construction, the rail and bus alternatives are estimated to cost $97 000 000 and $54 000 000 respectively.

OPERATING COST

Table 1 summarizes the operating features and costs associated with the two alternatives, including the revenue difference (calculated at 25 cents/trip with free transfers) resulting from increased rail patronage. The rail line shows a slight operating cost advantage. However, two points must be kept in mind. The first is that the costs are very sensitive to the physical design of the system such as the terminal and turnback track locations. The second is that the assumed cost per kilometer of operation, no matter how accurately developed from operating experience, can never be precisely known beforehand. Any operating cost trade-off analysis must therefore be done with a great deal of knowledge of system design givens and thorough operations planning analyses.

QUALITY-OF-SERVICE FACTORS

1. Area coverage: The residential collection and distribution bus routes for the two alternatives are identical and, consequently, provide equal area coverage.
2. Frequency of service: Automobile-access patrons will have service headways of 1 min using busway-only buses, but they must transfer to the rail line, which, because of larger train capacity, operates on 3.4-min headways in 1995.
3. Reliability: Both modes should have high schedule reliability.
4. Speed: The rail line speed to Candler Park aver-

ages 74 km/h (46 mph), slightly higher than the busway alternative.

5. Comfort: The primary index of comfort is seat availability, often expressed as load factor. The rail alternative provides a lower load factor because of larger unit train capacities.

6. Number of transfers: Over 49 percent of the busway users (those using the automobile as part of the work trip) require two transfers to reach downtown, a distinct disadvantage over the rail alternative. Almost 89 percent of rail line users transfer once, the rest walk, but none must transfer two or more times.

7. Capacity: Under maximum expected volumes, or any reasonable increase, neither alternative has a capacity problem.

CONCLUSIONS

For the circumstances of the T/ND corridor under the given assumptions, several major conclusions can be drawn:

1. Patronage will be 35 percent higher for the rail alternative;
2. Capital costs are estimated to be 45 percent lower for the busway;
3. Operating costs are estimated to be slightly lower ($500 000/year) for the rail branch; and
4. Quality of service offered the user will be higher with the rail alternative.

These conclusions, in specifics, are limited to the conditions of the study corridor. However, several generalizations can be made.

1. Capital costs of busways are almost invariably lower than those for rail branches. This results mostly from the more substantial station costs needed, in part to handle more riders, and the additional cost of electrification;
2. Operating costs are extremely sensitive to distances involved, turnback locations, and scheduling. Other than to say that it is doubtful that a rail alternative will be more costly to operate than a busway feeder alternative, it is dangerous to generalize; and
3. Rail service into a branch corridor will invariably be of a higher quality than will a busway feeding a main rail line. The reasons for this include the need for more transfers with a busway alternative, the lower headways on rail feeder bus services with the same (or even a smaller) fleet size, and the higher level of comfort that rail vehicles naturally offer.

For these reasons, a rail branch will attract a substantially greater number of riders than will a busway alternative.