Improving the Effects of Elevated Transit Stations on Neighborhoods

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Effects that elevated transit stations in residential neighborhoods have on the value of single-family homes are debatable. Some contend that the effects are adverse, because transit stations impose noise, traffic, and other nuisances on neighborhoods. These effects result in declining house values. Others contend that stations improve the accessibility of neighborhood residents to commercial activity centers. This convenience results in increasing house values. Which view is correct? Are both influences present? If so, which influence dominates, and what is the revealed price gradient of homes with respect to distance from elevated transit stations? Elevated transit stations in single-family residential neighborhoods in and around Atlanta, Georgia, are analyzed. Transit planning in Atlanta is summarized, design and planning concessions made in response to vocal neighborhood groups are reviewed, a theory that considers both the positive and negative influences such stations may have on single-family house value is introduced, and the association between neighborhood-oriented elevated transit stations and single-family house values is analyzed. Although both positive and negative influences may have been present, the revealed price gradient was positive in the study area. These results suggest that a planning and design process aimed at preserving established neighborhoods may be successful in minimizing the adverse effects of elevated transit stations on single-family housing values.

In 1968, metropolitan Atlanta voters said no to a heavy-rail rapid transit system. The vote was a blow to the Metropolitan Atlanta Regional Transit Authority (MARTA), which had been created by the Georgia General Assembly in 1965. Analysts attributed the failure of the referendum to four factors: (a) voters were not asked to approve a comprehensive transit package but rather a futuristic proposal for a rail system; (b) voters opposed use of property tax assessments to finance the project; (c) voters were uncertain of the extent to which federal participation could offset costs; and (d) voters did not know exactly what they were being asked to vote on, because the plan had been developed with little public involvement (*1*).

Concern about citizen participation in transportation system planning and design in Atlanta paralleled national trends. The neighborhood preservation movement of the 1950s and 1960s was created in reaction to the eminent domain appetites of urban renewal and federal highway programs that literally bulldozed neighborhoods (*2*). Neighborhood organizations also fought plans for airports, sewer and water treatment plants, drug treatment centers, and even hospital expansions that would have disturbed or destroyed neighborhoods. The objective of neighborhood preservation movements was to influence plans of development agencies to stop, slow, or redirect construction of facilities perceived to be harmful to neighborhoods (*3*).

In response, Congress acted to ensure that decisions regarding disruptive public projects would not be made until the implications had been considered and the affected citizens had exercised their "right to participate in decision-making processes which might result in such disruption" (*2*, pp. 112–113). In this environment, Atlanta voters initially rejected heavy-rail transit development. But the environment also led to greater citizen participation in a redoubled effort to create a rail system.

Over the 3 years following the initial defeat, public participation in MARTA planning activities was accommodated. Transit planning focused more sharply on station location, function, and design. By 1971, planners had identified the major functions each station should perform, the principles on which each station area should be located and designed, and the ways in which each station could be designed to reduce adverse impacts on neighborhoods. As a result of citizen participation, twin objectives of station area planning emerged: developing opportunities for the rapid-transit system and protecting established neighborhoods (*4–6*).

Transit stations became classified as one of four types: (a) high-intensity, mixed-use stations, primarily in the Atlanta central business district (CBD); (b) community-center stations serving as centers of commercial, office, and higher-density residential activity; (c) transportation interface stations designed to serve commuters; and (d) neighborhood stations, in established low- or medium-density residential areas. A schematic representation of the neighborhood station design is shown in Figure 1.

Neighborhood stations serve established low- or medium-density neighborhoods. The plans for these station areas stress the protection of such neighborhoods by prohibiting new commercial or industrial development in the vicinity of stations except where compatible. Where there are opportunities for development or redevelopment, low- or medium-density residential uses are usually recommended.

Each station plan contained a description of the existing development patterns surrounding the station site; a policy plan, consisting of goals, objectives, and policies to guide future changes in the service area of the station; a concept plan, identifying physical changes that were anticipated and

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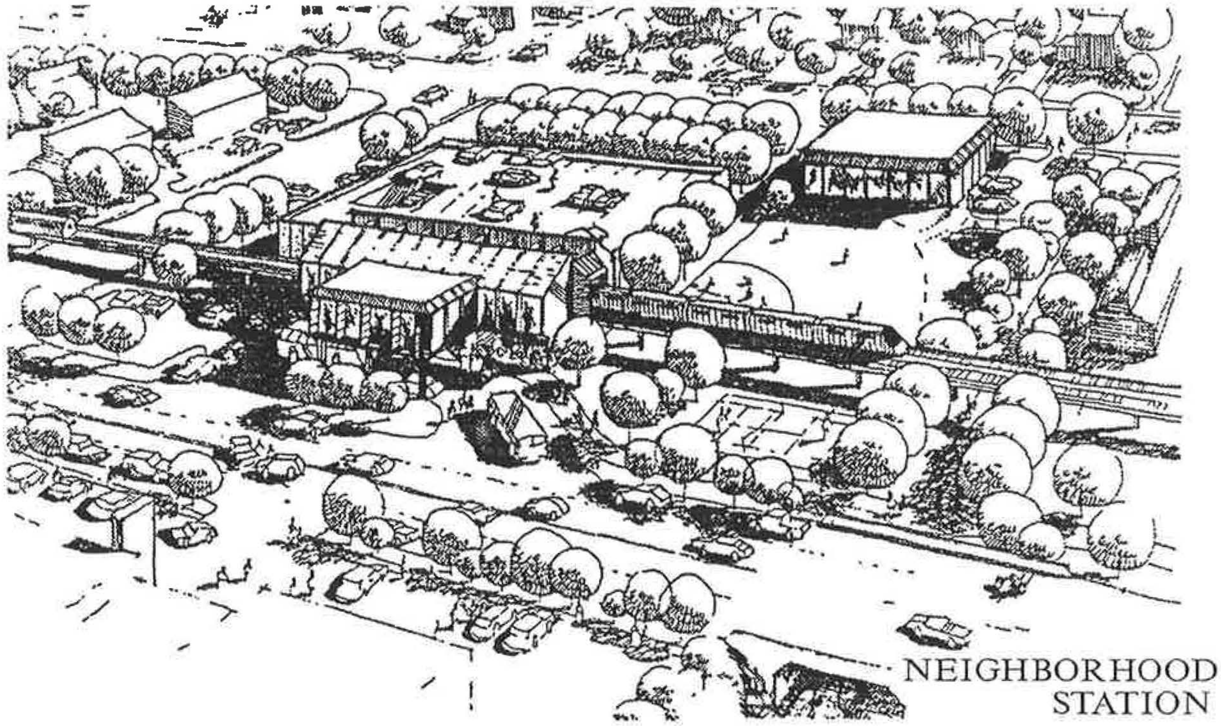

FIGURE 1 Schematic representation of the neighborhood station design.

recommended as a result of constructing the transit station; and a design plan, detailing the land use, circulation, and site plan for the immediate area.

The revised MARTA plan included purchasing and improving the existing city bus system, constructing and operating 53 mi of heavy rail, and operating 8 mi of exclusive busway (see Figure 2). Federal funds were obligated, contingent on voter approval of a 1 percent dedicated sales tax to generate local matching funds.

On November 9, 1971, the new MARTA plan was approved by voters in Fulton and DeKalb counties. MARTA began business.

PLANNING AND DESIGN OF ELEVATED NEIGHBORHOOD TRANSIT STATIONS

Elevated neighborhood transit stations have an influence on nearby property values. The objective of the planning process was to minimize the adverse effects of transit stations on established neighborhoods. This objective was effected through the parallel efforts of local governments and MARTA (*5,7–10*). For their part, Fulton and DeKalb counties and the cities of Atlanta and Decatur implemented the following land-use planning guidelines affecting neighborhood stations:

- Midrise and high rise residential units were prohibited in the vicinity of neighborhood transit stations,
- Expansion of commercial uses was restricted to neighborhood-oriented activities in existing or proposed shopping nodes,
- Additional industrial use of the surrounding area was prohibited,
- Existing single-family residential zoning was continued, and
- Any future air rights development over the MARTA station, line segment, or parking lots was limited to necessary community facilities.

In the design of elevated transit stations, MARTA followed certain design principles:

- Extensive landscaping was included around the perimeter of stations and their parking lots, especially where station grounds were adjacent or near to residences. Landscaping was also included within the station groups to provide additional visual relief.
- Lighting, which is crucial for safety, was directed onto the station groups. Although stations would be highly visible, the glare or illumination of nearby residences would be avoided.
- Sound systems announcing train schedules can be disruptive. Speakers were therefore situated and designed to broadcast sound to the platforms and not into parking areas or toward nearby residences. This effort does not completely eliminate sound drift, but it does minimize it.
- Pedestrian and traffic flow to and from stations can adversely affect residences along access streets. Neighborhood stations were designed to have traffic routed away from pockets of residences where possible. This policy entailed constructing or reconstructing preferred access routes and directing traffic in such a manner that easiest access was achieved by bypassing most neighborhood streets.
- Rail sound was minimized through use of electrical guides and special track welding. It is almost impossible to hear a train from off the station grounds.
- Provision was made for onsite security personnel.

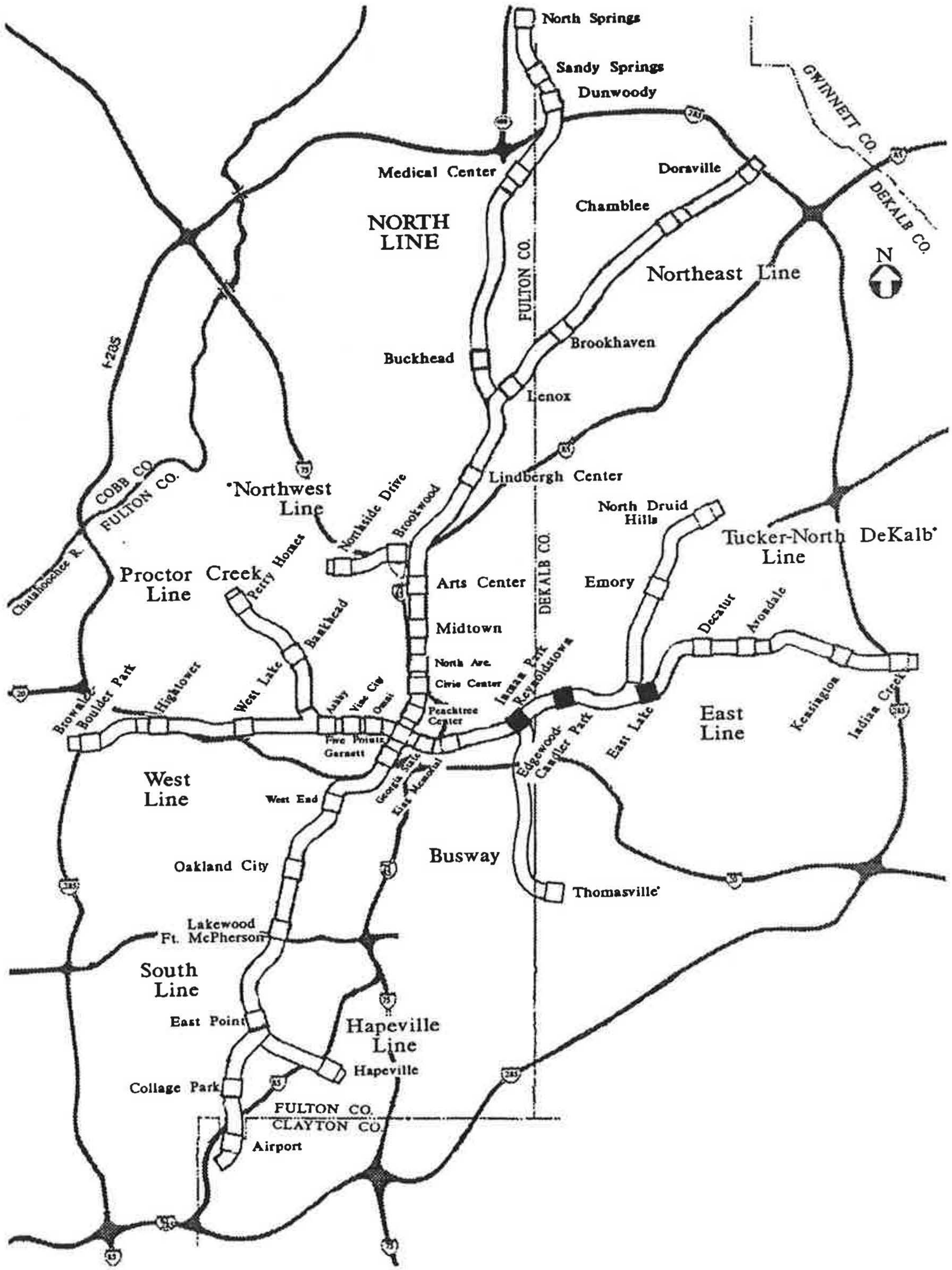

FIGURE 2 Area operator routes.

Major changes in land use or intensity because of the presence of the stations were not intended. Planning and zoning designations prevent higher-intensity land uses. Declining areas within stable neighborhoods were expected to be revitalized, because transit stations make neighborhoods more accessible and attractive (*11*).

Although it is MARTA policy to minimize the adverse impact of elevated transit stations in established neighborhoods of single-family homes, the effectiveness of this policy needs to be evaluated. The evaluation involves theory and model building, analysis, and interpretation. Theoretical considerations are posed first.

THEORETICAL IMPACTS OF ELEVATED TRANSIT STATIONS ON HOUSE VALUES

Transit stations improve the access of nearby residents to the CBD as well as other parts of the urban area served by such transit. Transit stations should thus influence urban residential values to rise in relation to station proximity (*12–19*). Commercial property value also rises with its proximity to transit stations (*18,20–23*). From a theoretical perspective, elevated transit stations should be associated with improvement of accessibility. Proximity of homes to these stations should be internalized in the market as a benefit in the manner shown by line R^a in Figure 3. That is, the closer the home is to a station, the higher its value.

Where elevated stations are associated with environmental disturbances imposed on nearby residents, residential values will fall in relation to station proximity. This is because nuisances such as noise, increased pedestrian and automobile traffic near the station, and the perceived accessibility of heterogeneous social groups to otherwise homogeneous neighborhoods will be internalized in the market as negative externalities (*24–27*).

Burkhardt (*28*) and Dornbusch (*29*) report that residential properties near Bay Area Rapid Transit stations (San Francisco region) suffered value decreases because of such nuisances. Baldassare et al. (*30*) report opinion survey research showing that where transit stations are elevated above residential areas, there is reduced preference for homes near those stations and the value of single-family homes presumably falls in relation to transit station proximity. In theoretical perspective, one may hypothesize that the distance from elevated neighborhood stations is associated with a declining single-family home sales price in the manner shown by line R^n in Figure 3. That is, the closer the home is to a station, the lower its value.

Which view is correct? Indeed, following Li and Brown (*31*), both may be correct. Li and Brown studied the nature of activities that generate both positive and negative influences at the neighborhood level. Positive and negative influences are collinear if they emanate from the same source in the same location and affect the same properties. Those influences vary across space perfectly and are thus unbundleable. The sign of the slope could be positive if home buyers viewed proximity as more benefit than nuisance, or the slope could be negative if buyers viewed proximity as more nuisance than benefit.

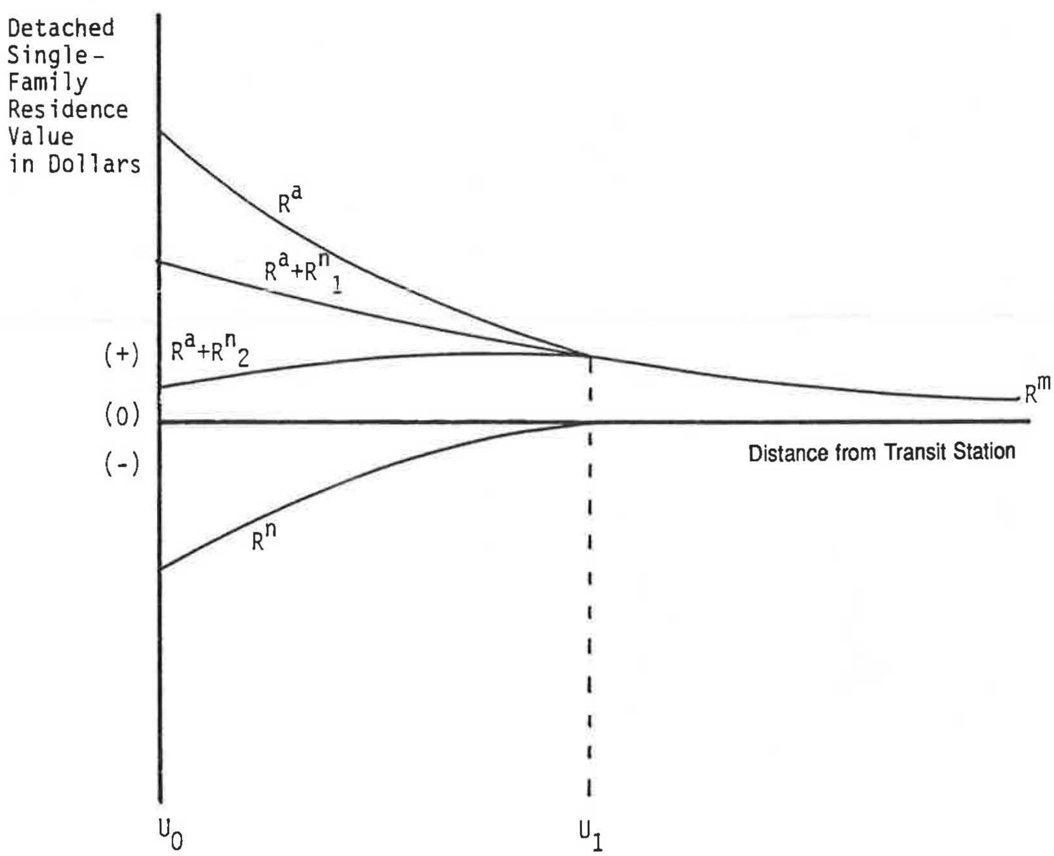

FIGURE 3 Effect of residential heavy-rail transit stations on neighborhood residential property values.

These twin possibilities are shown in Figure 3. If proximity to elevated transit stations was viewed more as a benefit than a nuisance, the revealed gradient would be the line $R^a + R^n_1$. That is, the nuisance influence of proximity, R^n, would be more than offset by the benefit influence of R^a. The slope would be positive but flatter than expected if there were no adverse value effects. On the other hand, if proximity was viewed more as a nuisance than a benefit, gradient $R^a + R^n_2$ would be revealed.

The individual beneficial or nuisance influences of elevated transit stations on single-family homes cannot be identified. Analysis can only reveal the observable gradient. However, whether on balance elevated transit stations of the sort planned and constructed by MARTA affect single-family home prices positively or negatively can be determined. Baldassare et al. (*30*) indicate the probability of a negative gradient. From Allen and Mudge (*12*), Boyce et al. (*13*), Davies (*14*), Davies (*15*), Langfield (*16*), Lee (*17*), and Spengler (*19*), a positive gradient appears likely.

The initial null hypothesis is that there is no significant influence of elevated neighborhood transit stations on single-family home values in adjacent neighborhoods. If that hypothesis is rejected, the alternate null hypothesis is that there is no significant and positive influence of elevated neighborhood transit stations on single-family home values in adjacent neighborhoods. If that hypothesis is rejected, the view of Baldassare et al. (*30*) is supported. If it is not rejected, the view of Allen and Mudge (*12*), Boyce et al. (*13*), Davies (*14*), Davies (*15*), Langfield (*16*), Lee (*17*), and Spengler (*19*) is supported.

STUDY AREA

The evaluation was applied to selected neighborhoods near elevated transit stations in DeKalb County. In particular, the evaluation was applied to the East Line of the MARTA system as it extends into DeKalb County (Figures 2 and 4). As

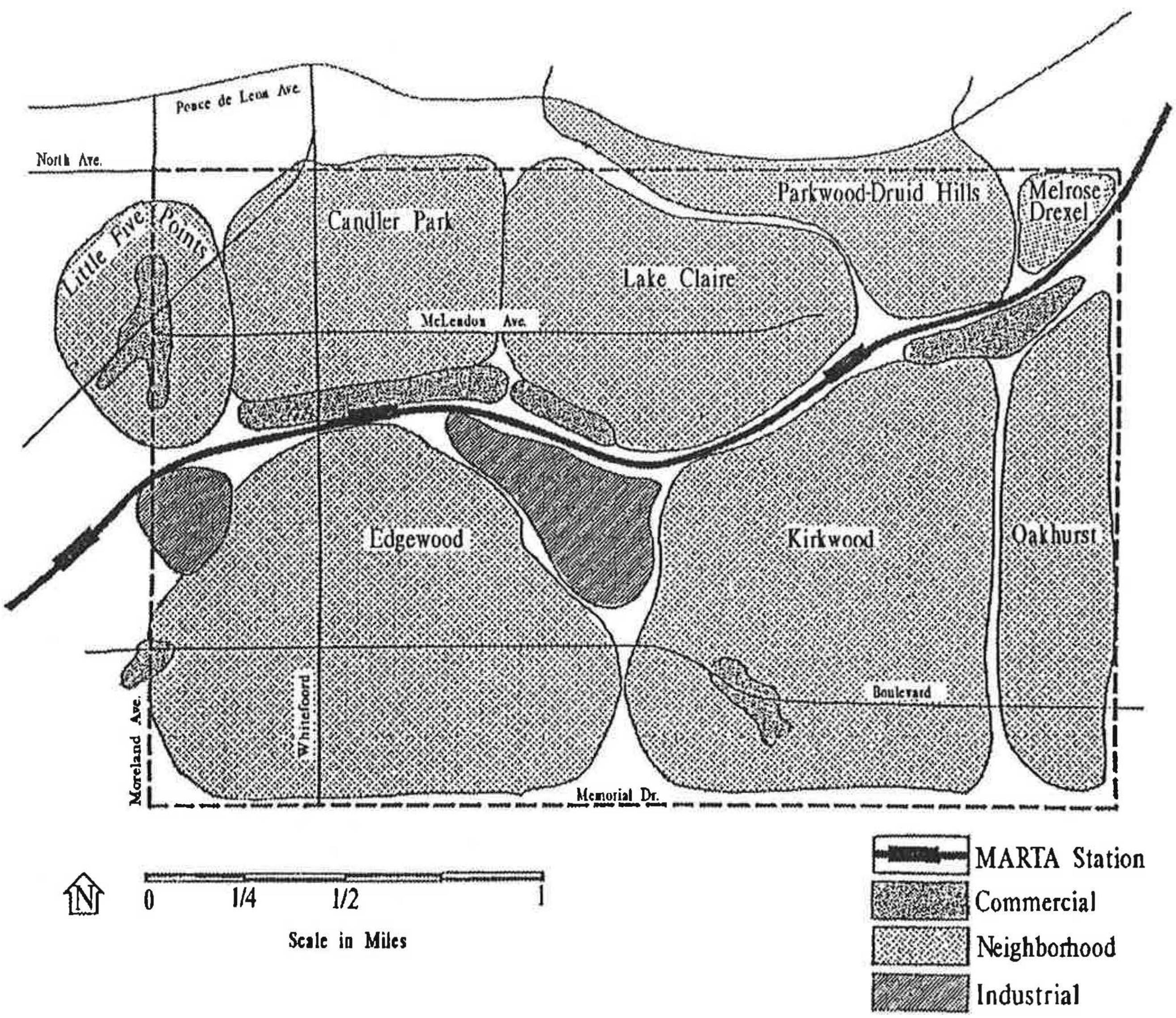

FIGURE 4 Study area neighborhoods.

Figure 4 shows, the study area is rectangular and measures approximately 2.7 mi east to west by 1.7 mi north to south. Arterials frame the area to the south (Memorial Drive) and east (Moreland Avenue). The northern boundary is a line from the intersection of Moreland and North avenues to Adair Park. The western boundary is a line from Adair Park to Memorial Drive. The entire study area is within DeKalb County. Roughly 80 percent of the study area is within the city of Atlanta, and 15 percent is within Decatur city limits. The remainder is in unincorporated DeKalb County. The study area contains six neighborhoods: Edgewood, Kirkwood, and Oakhurst south of the railroad corridor, and Candler Park, Lake Clair, and Melrose-Drexel to the north.

Of the 29 open transit stations (as of 1989), 9 are underground. Of the 20 surface and elevated stations, 13 are either designed to accommodate high-intensity development in their surrounding areas or set amidst commercial and industrial development away from single-family residences. Only 7 are designed for or set amidst primarily single-family homes. Of those, 2 are in south Atlanta and 2 are in west Atlanta. They are generally neighborhoods of transition. Only 3 elevated transit stations are along the same line, in sequence, and in stable neighborhoods dominated by single-family homes. Those are along the East Line. One station is just inside the Fulton County line, and the remaining two are between the county line and downtown Decatur, in DeKalb County. Unlike other parts of the system, the East Line neighborhood transit stations are not interrupted by stations that aim at serving nonneighborhood functions or that are otherwise amid nonresidential activity. Within the study area, the three closest transit stations are all neighborhood-oriented. This study area provides the largest uninterrupted segment of the system for analytical purposes.

The analysis was limited to this portion of DeKalb County for four additional reasons. First, these are among the oldest stations in the system. Some neighborhood transit stations (including those in northern DeKalb County) have only recently opened. There is concern that neighborhood markets near these new stations have not had time to fully internalize the influences of stations on home sale prices. The second reason was a matter of convenience. The property sale records of DeKalb County appeared to be better organized, more accessible, and more reliable on balance than the records of Fulton County. For example, although DeKalb County has instituted a geographic information system that incorporates property records, Fulton County has only recently engaged in such efforts. Third, the study area is relatively homogeneous in terms of housing stock age and household socioeconomic characteristics. This homogeneity allows relatively uncomplicated analysis of station influences. Fourth, the study area lent itself to manageability. No funds were available for this research. Rather, one graduate student spent 1 year collecting and analyzing data under the direction of a professor. The study area size afforded personal investigation and data collection on all 286 cases (house sales) used. It also generated a suitable number of cases on which to apply multivariate statistical analysis.

Even if sponsorship had allowed the inclusion of other neighborhoods near elevated transit stations, the analysis may not have been improved, largely because of the reasons cited earlier. The research design may be applied to those areas in the future, as the system matures and if sponsorship becomes available. This work clearly has potential limitations. The results reported here are at minimum a preliminary indication of the price effects of elevated neighborhood transit stations on single-family homes in adjacent neighborhoods. However, the results adequately address the question at hand and are generalizable to situations in which neighborhood-oriented, elevated transit stations are set amidst neighborhoods of single-family homes.

MODEL AND VARIABLE SPECIFICATION TAILORED TO THE STUDY AREA

A model of the theory can be expressed as

$$P_i = b_0 + b_1\mathbf{e}_i - b_2\mathrm{TS}_i + w$$

where

b_0, b_1, b_2 = model coefficients;
P_i = the market price of transacted home i;
$\mathbf{e}_i$ = a vector of extraneous variables affecting each transacted home i;
TS_i = the value of distance of each transacted home i from a neighborhood transit station in 100-ft units; and
w = the stochastic disturbance.

The variation in detached single-family residential property prices with respect to transit station distance is of primary interest. The categories of attributes (the $\mathbf{e}_i$ term) are described in the following paragraphs.

Structural characteristics of a residential property are described by the square footage of both house and lot; the number of rooms; the number of stories; the presence of basement, foundation, enclosed porch (a market amenity idiosyncratic to Atlanta), garage, central air conditioning; and the age in years. A neighborhood identifier is included, because properties south of the rails are typically inside a city (Atlanta or Decatur) and populated by low- to moderate-income households, whereas homes north of the rails are typically outside a city and populated by households of moderate income. The two sides are otherwise similar in levels of crime, public education quality, and zoning.

Distance to the CBD is typically included in housing price equations as a gross measure of relative locational advantage (*31*). A CBD distance variable was not included in this study, however. The entire study area lies approximately 3 to 5 mi from downtown Atlanta, making differences between sites small. The travel time between stations within the study area is only 2 to 4 min.

Other variables considered important were zoning (whether a property was zoned for 8,500-ft^2 lots), whether the property was a corner lot, and whether the home was adjacent to a nonresidential property, such as a business. No homes were immediately adjacent to transit station property lines; few homes were actually adjacent to transit stations, although many were across a dividing street or intervening landscaping.

The data on 1986 sales of 286 single-family residences used in the empirical analysis were obtained from the DeKalb County tax assessor's office. For each case, this information included the sale price; the lot size; the square footage of the house; the number of stories; the number of rooms with windows; the presence (1) or absence (0) of a basement, foundation, garage, carport, central air conditioning, and enclosed porch; and the location south (1) or north (0) of the MARTA tracks (a proxy for neighborhood income status). The age of each house was expressed, such that the older the house the more likely it was to be renovated and desirable from a gentrification aspect. The price effect of corner lot status was also considered. The distance to the nearest MARTA station was expressed in 100-ft units. The quadratic expression of MARTA station distance was the square of distance. The quadratic specification allows the possibility of detecting convex or concave forms of the gradient.

Ordinary least squares regression was used. The double log specification was reported, except that the distance to MARTA stations was quadratic specification, age was linear, and noninterval relationships were binary (1,0). Other specifications did not perform as well. All specifications revealed similar relationships between the independent and the dependent attributes. All coefficients on attributes significant at the 0.05 level of the one-tailed *t*-test possessed the expected signs for this study area. Regression results are presented in Table 1.

RESULTS

All significant house attributes had the anticipated sign: house age, presence of a basement, presence of central air conditioning, presence of a house foundation, house size in heated square feet, and number of rooms. Nearly significant and possessing the expected sign was the presence of an enclosed porch. The presence of a garage was not significant; the mild climate, carports, and adequate street parking probably account for this. The positive sign for the age of housing stock indicates a preference for older homes. This was expected, because older homes are desirable throughout stable neighborhoods in Atlanta; gentrification has produced a level of renovation and modernization resulting in older homes being more modern than homes built in later eras.

The significant site attributes included lot size and corner status. Larger lots commanded a higher value, even at the margin. The local market preference was for greater space, and therefore privacy, within the rather narrow variation of lot sizes in the study area. Virtually no site can be subdivided, due to zoning restrictions. Corner lot status was not desirable, perhaps because corner lots were bounded by two streets and had smaller private yards than neighboring properties (because of double-street setback requirements).

Zoning (8,500- or 10,000-ft^2 minimum lot sizes) was not significant. This is not surprising in relatively homogeneously developed neighborhoods.

Although the coefficient on the binary variable indicating adjacency to nonresidential land uses was not significant, the coefficient had the correct sign.

Of primary interest was the fact that distance from the nearest MARTA station had a significant impact on property values. Within the neighborhoods studied, property value increased in relation to proximity to a MARTA station. The first null hypothesis, that there is no significant association between home values and transit station proximity, was rejected.

TABLE 1 RESULTS OF LEAST SQUARES REGRESSION

Variable	Coefficient	*T*-Score
Lot size in square feet (log)	0.115357	2.768[a]
Age of house in years	0.002036	2.186[a]
Presence of basement (1 = Yes, 0 = No)	0.101579	3.050[a]
Presence of central air conditioning (1 = Yes, 0 = No)	0.168880	2.540[a]
Presence of enclosed porch (1 = Yes, 0 = No)	0.050358	1.45712
Presence of foundation (1 = Yes, 0 = No)	0.102184	2.43951[a]
Presence of garage (1 = Yes, 0 = No)	0.045808	1.05742
House size in heated square feet (log)	0.309196	3.62139[a]
Number of stories	0.122412	1.46621
Number of rooms (log)	0.289236	3.14346[a]
Location (1 = south of tracks, 0 = north of tracks)	−0.709327	18.33000[a]
Adjacent to commercial use (1 = Yes, 0 = No)	−0.009364	0.05358
Corner lot (1 = Yes, 0 = No)	−0.095314	2.13229[a]
Distance from nearest station (100-ft units)	−0.007077	1.89947[a]
Distance from nearest station squared (100-ft units)	0.000115	1.83069[a]
Constant	3.407924	
N	286	
Coefficient of determination	0.777	
Standard error of estimate	0.236975	
F-Ratio	62.563138	

[a]Significance at the 0.05 level of the one-tailed test.

The alternative hypothesis, that there is no positive association between house value and station proximity, was not rejected. (The quadratic term was also significant and possessed the correct sign.)

The regression equation was also run separately for cases within ½ mi (179 cases) and beyond ½ mi (107 cases) of the nearest MARTA station (not reported here). The performance of the distance-to-station variables was ambiguous; that is, coefficients were not significant although signs were consistent with signs from the previously described regression. Such weak performance cannot be explained except that other house attributes are really more influential in predicting price than proximity to MARTA stations. In fact, the coefficients from the first regression are rather small and really do not influence price substantially (albeit significantly) relative to other attributes.

SUMMARY

Whether the revealed gradient of house value in relation to elevated transit station proximity incorporates both beneficial and nuisance influences cannot be determined for reasons explained by Li and Brown (*31*). However, these results support the view expressed by Allen and Mudge (*12*), Boyce et al. (*13*), Davies (*14*), Davies (*15*), Langfield (*16*), Lee (*17*), and Spengler (*19*), that transit station proximity is beneficial to residential values. The results contradict inferences by Baldessare et al. (*30*) that elevated transit stations may adversely affect property values. On the other hand, this study was based on behavior revealed in home sales, whereas Baldessare et al. (*30*) relied on opinion survey research.

Yet, Baldessare et al. (*30*) may be perfectly correct in their inference that when such stations are not located and designed with sensitivity to surrounding neighborhoods, the market will reveal adverse price effects on homes. Indeed, MARTA's second round of planning included considerable design attention directed at minimizing adverse effects. Sensitivity to the impact of elevated stations on established neighborhoods was ensured because of citizen participation in the planning and design process. Ignoring citizen concerns delayed MARTA construction until those concerns were reasonably satisfied. The lessons learned should be obvious.

At minimum, design features used by MARTA should be considered by other rapid-rail planners who are concerned about extending elevated transit stations into established neighborhoods where the intent of those stations is to serve neighborhoods rather than accommodate higher-intensity activities.

Despite the analytical limitations of this research, the results and insights are generalizable to other areas of the country now engaging in rapid-rail transit that include elevated transit stations. More research is needed to determine the extent to which specific locational, design, and participatory features of a rapid-rail planning process minimize adverse effects and maximize beneficial effects. This study is but a building block in those future efforts.

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