Determining the Ridership Potential of Commuter Rail Routes

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Commuter rail service is seen as one way to relieve highway congestion and broaden the mix of transit options. One problem is that ridership cannot be determined until after the project is built. Therefore, it is necessary to gather estimates of the ridership potential along each possible rail corridor. This paper reports on the results of an assessment of ridership potentials along three possible corridors linking the cities of Akron and Cleveland, Ohio. We identify specific subpopulations likely to utilize commuter rail, and determine how many of these subpopulations lived within 1.6 kilometers of each potential corridor. We then examine the prevailing land use and population projection data to assess how the characteristics of each corridor are likely to change in the next 20 years. Finally, we estimate ridership for each of the three corridors.

Keywords: commuter rail, mass transit, demand forecasting

The passage of the Intermodal Surface Transportation Efficiency Act of 1991 opened up the way to funding transit options other than new highways, an approach that was continued with the Transportation Equity Act for the 21st Century (TEA-21), passed in 1998. Commuter rail service has come to be seen as one way to relieve highway congestion and broaden the mix of transit options, particularly those longer commutes that converge in the central city. Monies have been released to metropolitan areas interested in developing commuter rail, heavy rail, or light rail service. Commuter rail is particularly attractive because it appears as a lower cost alternative when compared to the other two options. In many cases, commuter rail lines use already existing alignments, although these may be supplemented by additional lanes created specifically for the service (APTA 1997). This offers cost advantages, but also can create conflict between passenger and freight uses (Vantuono 1997).

The decision of where to place rail routes ostensibly has much to do with the balance of costs and potential ridership along each specific corridor. In many respects, the overall costs can be more confidently predicted than the potential ridership, since costs involve capital expenditures and operating expenses, whereas potential ridership involves thousands of separate decisions by individuals who may or may not forsake their automobiles for a train. While rail service today is built with the expectation of some transit deficit, there is a clear desire to keep these deficits to a minimum. A healthy ridership base can accomplish this.

A proposal to bring commuter rail to Northeast Ohio serves as an interesting case of what must be considered in determining ridership. The Northeast Ohio Commuter Rail Feasibility Study (NEORAIL Study 1998), produced by the consulting firm of Parsons Brinckerhoff, had sought to determine whether commuter rail service connecting urban and suburban centers in the region was feasible. The most recent project allocation from November 1998 recommended continued exploration of commuter rail service in Northeast Ohio, although there is yet no commitment to build. If such a service were constructed, the Ohio Department of Transportation estimates the costs at $250 million (all amounts in US$). As such it would be important to select routes that would minimize costs while maximizing the potential ridership.

While there is increased attention towards commuter rail, there remain severe limits on the number of routes which can be constructed. The choice of routes depends on comparing ridership potentials. Several models exist to forecast ridership although many of these carry exacting data requirements, including knowledge of all possible destinations or extensive surveys of nearby populations (Preston 1991). Many models are impractical before rail stations are identified.

The purpose of this study is to develop a relatively simple approach, using existing census data, to estimate commuter rail ridership potential, for both total and specific subpopulations, along three alternative routes in Northeast Ohio. These routes were among several dozen initially considered in the NEORAIL Study, and each route stretches from downtown Cleveland to downtown Akron. In this paper, we consider the potential ridership base along each of the three routes for separate subpopulations living within a 1.6 kilometer distance on either side of the rail lines. Moreover, we use carpooling as a measure of latent demand that identifies those individuals who may be amenable to taking commuter rail if it becomes available. We also project how the potential ridership base may change within the next two decades.

Commuter Rail Service and Sources of Ridership

Commuter rail is but one mode of mass transit in American cities. It is defined as public transportation that uses existing rights of way and track for transporting passengers in arrangements of four or five cars hauled by a single engine. Commuter rail is distinguished from either light rail or heavy rail, which are self-contained systems designed and built to specifications. Examples of light rail systems are those in Portland, Oregon and San Diego, California (APTA 1998). Recently built heavy rail systems include the Bay Area Rapid Transit (BART) and the Washington, D.C. Metro system (APTA 1998). Commuter rail systems in this country include Chicago's Regional Transit Authority, the Southeast Pennsylvania Transit Authority, and the Long Island Railroad (APTA 1998).

Of all mass transit options in the U.S., commuter rail falls into third place behind bus and heavy rail in terms of passenger usage (Table 1). Commuter rail operates in seventeen metropolitan areas and resulted in 353 million trips. Moreover with an average trip length of 38 kilometers (23.7 miles), commuter rail accounts for a much higher percentage of total passenger miles.

Commuter rail, like all other forms of transit, including automobiles, requires substantial government subsidies (Delucchi 1997; Fielding 1995). Pack (1992) estimates that the subsidy cost for all rail systems is roughly double the actual revenue generated by fares. Indeed, rail systems in the U.S. have been operating at a severe "transit deficit" (the shortfall between actual costs and costs recouped by fares) for at least three decades (Fielding 1995; Gomez-Ibanez 1996). In Boston, the transit deficit increased 639 percent in real money between 1965 and 1991, even though ridership remained fairly stable (Gomez-Ibanez 1996). Table 1 indicates that commuter rail carries the cheapest operating costs per passenger mile of any of the available mass transit options. Commuter rail is only second to heavy rail in having the lowest "transit deficit" per mile.

The costs of rail travel can be balanced against its benefits, including the decrease in highway accidents due to lower automobile use, reduced auto congestion, savings in travel time, decreases in the pollutants discharged by automotive traffic, increased energy efficiency, and the advantage of transportation redundancy (Pack 1992; Fielding 1995; Flem and Schiermeyer 1997; APTA 1997). Pack (1992), for example, estimates that these benefits outweigh the costs of commuter rail service by between $38 and $75 million for Philadelphia. The American Public Transit Association estimates that commuter rail yields $5.2 billion in benefits every year; five times the amount spent by the federal government (Railway Age 1997). From a broader perspective, commuter rail service could be considered as vital to a sustainable transportation network that is less reliant on automobiles (Black 1996).

Over the past decades, transit ridership has declined. Between 1970 and 1990, the percentage of workers using transit fell from 8.4 percent to 5.5 percent. This decline can be attributed to increased competition from automobiles, dispersal of workplaces, higher rates of female employment, and increased investment in highways by government. Yet, in those areas where mass transit is feasible, it has more than held its own. According to data assembled by the U.S. Department of

Table 1 Transit Service Consumption and Cost by Mode for the United States, 1996

Mode	Unlinked Passenger Trips (millions)	Passenger Miles (millions)	Average Trip Length (miles)	Operating Costs (millions US$)	Capital Costs (millions US$)
Bus	4911	18860	3.8	10660	1948
Commuter Rail	353	8371	23.7	2295	1741
Heavy Rail	2157	11530	5.3	3420	2228
Light Rail	261	953	3.7	447	833
Trolley	117	184	1.6	135	19

Mode	Average Fare (US$)	Operating Cost per Passenger Mile (US$)	Total Cost per Passenger Mile (US$)[1]	Transit "Deficit" per Mile (US$)[2]
Bus	0.70	0.57	0.67	(0.38)
Commuter Rail	3.24	0.27	0.48	(0.14)
Heavy Rail	1.08	0.30	0.49	(0.09)
Light Rail	0.55	0.47	1.34	(0.32)
Trolley	0.47	0.73	0.84	(0.44)

[1] Total cost equals operating plus capital costs
[2] Calculated as the fare-operating costs for an average trip, divided by the average trip length
Source: 1998 APTA Transit Fact Book

Transportation (Hanson 1995), Central Business District bound work trips by transit did not decline between 1970 and 1980 and even increased slightly in some markets. Commuter rail has proven to be particularly robust. Between 1993 and 1996, ridership increased 8.8 percent (Railway Age 1997). In California, more people rode trains to work in 1997 than any other previous year since 1954 (http://cnn.com/US/9807/27/new.train.stations). The stabilization in transit usage by people who work in urban downtowns indicates that transit usage continues to be an important part of the overall transportation picture.

Assessing Commuter Rail

Transit systems require a density of supply in the form of potential users (largely residential) and density of demand. Commuter rail can be considered when it can connect locations of demand with supply along or near existing rail routes, where journey length is long, and where operating costs are low (Fielding 1995).

These locations of demand are still based primarily on employment opportunities and the nature of the residential environment. The most successful transit markets seem to exist for work trips to the CBD. The demand for various uses of transit is related to the amount of non-residential floor space in the CBD, which is a surrogate for employment opportunities (Pushkarev and Zupan 1977).

Within the residential environment, neighborhood type and density are key factors in determining transit use. An early study showed that transit use increased sharply above a density of seven dwelling units per acre (Pushkarev and Zupan 1977) and the relationship between density and transit use holds just as true today (Cervero and Gorham 1995). Furthermore, the type of neighborhood is important. In an analysis of the Bay Area, Cervero and Gorham (1995) found that older neighborhoods with a grid street pattern generated about 70 percent more transit trips and 120 percent more pedestrian/bicycle trips than newer, more auto oriented suburbs. Transit does best in high-density residential areas where many low-income individuals and students live, and along rail corridors connecting the suburbs with the CBD or other commercial centres (Fielding 1995).

A major market for transit is low-income families residing in central cities. This group made 12 percent of its work trips by transit, and low-income households make twice as many trips per household on transit than the nation as a whole (Table 2). Travel by bus is the preferred mode, largely because it is the only one available. Many low-income households only own one automobile or none at all, although auto ownership rates have increased somewhat. When the lone vehicle is used for the work trip, all other trips by household members, for example, to medical centres, shops, and school, depend on the availability of public transit

At the same time, non-work trips represent an increasingly significant component of mass transit use. In 1990, work trips accounted for 55 percent of all weekday transit trips, down from 70 percent in 1970. College and high school students form another important market, as more than fourteen percent of all transit trips are school related. School travel usually coincides with work-related demands, and is concentrated into peak periods. Women, another traditional transit user group, formerly used transit in the midday for shopping and social purposes, however, this level of demand has declined as increased employment by women has raised household income and the availability of automobiles (Fielding 1995).

The demand for midday transit by women has declined, especially in the suburbs where transit's share of all travel fell from 2.0 percent in 1983 to 1.3 percent in 1990. However, the use of transit for shopping trips continues to be significant. The viability of any mass transportation option has to be considered in terms of its accessibility to educational, recreational, and shopping opportunities, as well as its accessibility to employment. Fox (1995) reported on some efforts to examine transportation within a situational, activity-based approach. These surveys help to illuminate how households plan their daily travel, and may still produce the kind of data that can be used to determine aggregate demand. Unfortunately, most transportation studies continue to focus exclusively on the work place, probably because the most consistent data are available for this type of travel.

Table 2 Transit Trips in Urbanized Areas Within the United States, 1990

	Percentage of transit trips	Percentage of total population
Urbanized Areas (Population)		
over 1 million	89.7	37.8
250,000 to 1 million	7.0	13.5
under 250,000	3.3	12.4
Total	100.0	63.7
Annual Household Income (US$)		
under 15,000	26.8	16.9
15,000-50,000	53.4	52.6
over 50,000	19.8	30.5
Total	100.0	100.0
Trip Purpose		
Work	54.6	
School	14.6	
Shopping	9.1	
Medical	6.0	
Other	15.7	
Total	100.0	

Source: American Public Transit Association and U.S. Department of Transportation

If origins and destinations are clearly indicated, it is possible to utilize one of a family of spatial interaction models in order to estimate individual flows. Such models utilize attributes of the origin, attributes of the destination, and attributes of the distance between origin and destination (see Fotheringham and O'Kelly 1989 for an extended treatment). Applications to rail ridership might include population in proximity to the origin station, job or shopping opportunities at the destination station, and the time and/or cost of train travel compared with other modes. Preston (1991) discussed that calibrating these models for one trip does not transfer to other trips in different places; the parameter values shift. Moreover, spatial interaction models are not practical when stations have yet to be designated. Our approach is far simpler, and we believe better suited for assessing the overall volume of potential ridership along one rail line.

Methods

Study Sites

The three alternative rail alignments investigated in this report were identified in the Northeast Ohio Commuter Rail Feasibility Study (NEORAIL Study 1998). For all three alignments the beginning and end points are downtown Cleveland and Downtown Akron (Figure 1). The three alignments are referred to as:

Portage Direct - Connects Cleveland with Akron via Kent using the Conrail Cleveland Line from the Cleveland Lakefront Amtrak Station to Southeast Cleveland, then the Wheeling and Lake Erie Railway Cleveland Line via Bedford to Kent. The Summit Port Freedom Secondary connects Kent with downtown Akron.

Portage Extension - Connects Cleveland with Akron via Solon and Kent using the Conrail Randall Secondary to Solon, the Wheeling and Lake Erie Line from Solon to Falls Junction and then to Kent, and the Summit Port Freedom Secondary to Akron. South of Solon, Portage Extension follows the same route as Portage Direct.

Summit Direct - Connects downtown Cleveland with Downtown Akron using the Conrail Line to Hudson and the Summit Port (Pennsylvania Railroad) Line through Cuyahoga Falls to Akron, without passing through Portage County.

A fourth alignment, labelled Aurora Extension, connects downtown Cleveland with Aurora via the Conrail Cleveland Line to Erie Crossing and the Conrail Randall Secondary to Aurora. The Conrail Secondary from Erie Crossing to Aurora was buffered separately, and estimates of population employment and land use were generated for only this part of the alignment.

Data

The data used for this study come from a variety of sources, including the 1990 Census of Population and Housing, 1990 Public Use Microdata Sample (PUMS), 1990 Census Transportation Planning Package (CTPP) and 1995 Census Bureau Topologically Integrated Geographically Encoded Reference (TIGER) files. Forecasts for population, employment, and land use provided by the Akron Metropolitan Transportation Study (AMATS) and the Northeast Ohio Areawide Coordinating Agency (NOACA) were also used.

The potential number of commuter rail users within a 1.6 kilometer buffer around each of the three alternative rail alignments was estimated using data from a variety of sources. This buffer width was chosen at a good compromise between the half mile and two mile buffers utilized in the NEORAIL study. These data are recorded for block groups and traffic analysis zones (TAZs). They include both existing and forecast totals for relevant variables. Most of the tabulations, estimates, and maps in this report are given for census block groups and TAZs. Except for the population and employment projections, these data are for 1990. While more recent estimates are available for large units such as municipalities, our methodology

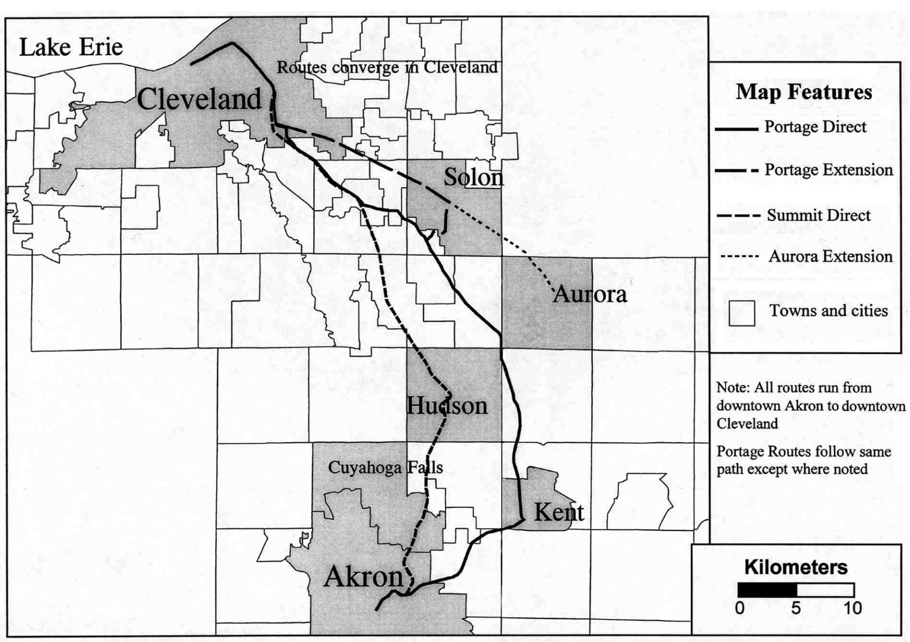

Figure 1: Alternative rail arrangements connecting Cleveland, Ohio and Akron, Ohio

required the use of block groups accurate only in census tabulations.

Once desired data were prepared, variables indicative of ridership potential within the 1.6 kilometer buffer were extracted using AtlasGIS, a Geographic Information System (GIS) (see Peng 1997, for a similar approach). This is accomplished in a computer environment by placing each rail alignment on top of a digital map containing a variable of interest, for example, number of car-poolers in each block group. A 1.6 kilometer buffer zone is then placed around each rail alignment to capture data in each block group falling wholly or partially within the buffer (Figure 2). The computer software then sums the total number of car-poolers lying within the relevant block groups. For those block groups lying partially within the buffered zone, the GIS assigns a proportion of the count to thebuffer. For example, if sixty percent of the area of a block group lay within the boundary of the buffer, then sixty percent of the count (e.g. car-poolers) is assigned to the buffered zone and is included in the total number of car-poolers within 1.6 kilometers of the rail line. This procedure was repeated for each rail line with every variable of interest.

This study differs from the data and methodology utilized in the NEORAIL Study. While there is no explicit discussion of how data were used in the NEORAIL Study to make ridership projection, from what we can gather, estimates were based on 1990 journey-to-work data for the population at large.

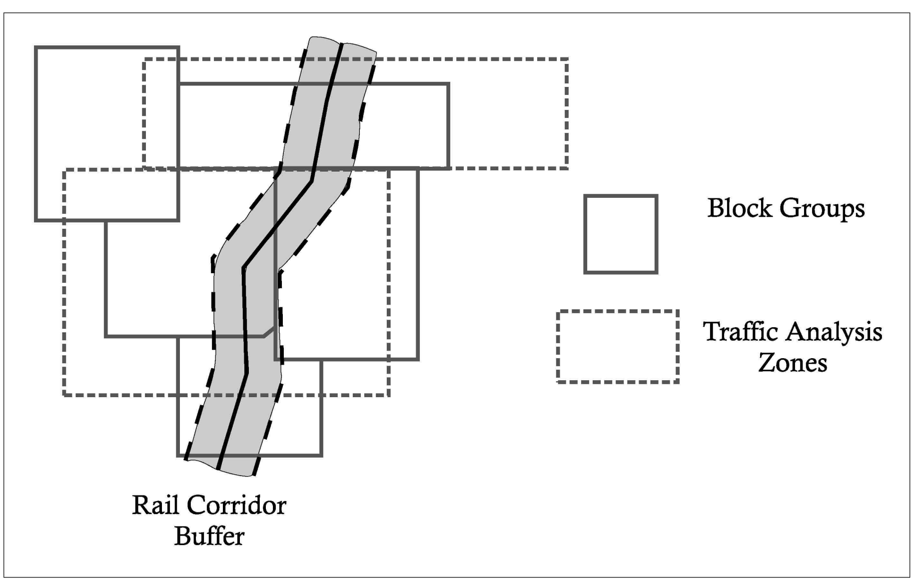

Figure 2: Creation of buffer zones around each rail alignment

Evaluating Potential Ridership

In evaluating potential ridership, we first took into account the population within 1.6 kilometers of each of the alternative routes. This was followed by our analysis of selected subpopulations. We were especially interested in evaluating the routes with respect to: 1) the ridership potential for corridors that are in close proximity to major activity centers, with special attention to low income residents, current transit and carpool users, and special trip generators (e.g., educational institutions, recreational facilities, high employment zones), and 2) the potential changes in land use and population along each of the corridors.

Population Characteristics by Rail Alignment

Population characteristics in 1990 for the three-county study area encompassing the proposed rail alignments were aggregated within a 1.6 kilometer buffer of each alignment. Table 3 provides an in-depth look at the demographics along each alignment.

Population: Overall, the demographic profiles are fairly even across the three alignments, with the Portage Extension and Summit Direct alignments having slightly higher totals for most variables. Population figures are very close among all three alignments. Summit Direct goes through more populated areas than either of the Portage routes, however, the difference between the routes is quite small.

Transit and carpool users: Measuring the number of existing transit users is a first step in exploring the potential base of ridership, but such figures are hampered by the fact that many locations do not presently enjoy mass transportation as they offer no opportunity for those who may wish to utilize commuter rail. Determining latent demand is a difficult proposition since the opening of new rail systems attracts people who once drove to work. Carpoolers may reflect those riders likely to utilize transit if it should become available. While solo drivers do shift to transit, Flem and Schiermeyer (1997) reported that 60 percent of all Los Angeles Metrolink passengers are ex "drive alones' they may be less likely than carpoolers to shift to mass transit without serious incentives at their destination (e.g., excessive parking costs). As is apparent in the table, Portage routes have an edge over others. Both Portage routes, and especially the Portage Extension alignment, demonstrated higher absolute numbers of existing users. Moreover, these two routes also indicated higher percentages of working population who currently use transit or carpool.

Welfare population: While most commuter rail riders have the option of driving, transit systems serve a critical function in providing transportation to those who do not have reliable vehicles. For example, in many inner-city Cleveland neighborhoods, more than half of the households lack access to even one automobile (Kaplan 1999). The NEORAIL study identified welfare recipients as a key population in deciding where to place the commuter rail route. Of the three alignments examined, the Portage Extension route has a higher number of people on welfare. It also has a higher population of people under the poverty limit. These absolute numbers also reflect higher percentages of welfare recipients.

University and college riders: The three-county area includes a larger number of universities and colleges, with mostly local enrollment. Unfortunately, the ridership potential of students is not reported in literature and ridership propensities are unavailable for the student population. Logic suggests some transit potential, given that many students do not have access to automobiles and that many of the proposed alignments are close to college and university destinations. Data in Table 3 indicate that the Portage Extension route captures a higher number of college students, followed by Portage Direct. In addition, these two routes also enjoy greater transit demand in that they include Kent State University and John Carroll University, as well as University of Akron, Cleveland State University, and Case Western Reserve University.

The evidence suggests that for those subpopulations that are most likely to use commuter rail, the Portage Extension route has the largest absolute totals. These groups, identified in the literature, are those currently using transit: carpool riders, college and university students, and low income persons. The Portage Extension route also encompasses higher absolute and relative shares of unemployed persons, who would most likely benefit from increased access through a transit option to workplace concentrations.

Mode, Land Use and Employment by Rail Alignment

Workplace mode of transportation, current land use, and projected changes in population for each rail alignment are based on Traffic Analysis Zone (TAZ) level data supplied by the regional planning agencies for the Cleveland and Akron areas, and on data extracted from the 1990 Census Transportation Planning Package of the U.S. Census (CTPP). The results of the analysis are presented in Table 4.

Workplace mode of transportation: In looking at mode of transportation from the workplace (the figures in Table 3 consider mode from the residence), the Portage Extension route captures the highest total of commuters when all modes are considered, followed by the Summit Direct and Portage Direct routes, in that order. Car-poolers and transit-takers are more numerous within 1.6 kilometers of the Portage Extension route, but the absolute and relative shares of these potential commuter rail users are fairly evenly spread across the three alignments.

Land use and capacity for future development: Among the three alignments, there is a huge difference in the amount of vacant land. Land along the Summit Direct route is more likely to be developed or built up, and with the smallest amount of total acreage, the share of developed land along this alignment is the highest. Absolute and relative amounts of vacant land are considerably higher along both the Portage Direct and Portage Extension alignments. This situation reflects in part the larger amounts of total land along these routes, and the result of past development of Akron, Cuyahoga Falls, and southeastern Cuyahoga County, through which the Summit Direct alignment passes.

Population and employment projections: Projected population and employment along each of the alignments were calculated for the period 1990 to 2020, based on data supplied by NOACA and AMATS. Both population and employment are projected to decline along all three routes, but to varying degrees.

Table 3 Population Composition Within One Mile Distance of Proposed Commuter Rail Lines

Route	Direct Portage		Extension Portage		Direct Summit		Extension Aurora	
Population								
People	228,603		238,356		246,217		6,005	
Families	55,786		58,114		61,021		1,667	
Households	88,720		90,883		96,381		2,141	
Men	108,475	47.5%	112,182	47.1%	117,260	47.6%	2,911	48.5%
Women	120,128	52.5%	126,173	52.9%	128,957	52.4%	3,094	51.5%
Homeplace Mode of Transportation								
Solo driver	62,878	72.7%	63,076	71.0%	71,136	74.8%	2,577	89.5%
Car pooler	10,040	11.6%	10,753	12.1%	10,423	11.0%	186	6.5%
Transit user	7,100	8.2%	8,569	9.6%	6,649	7.0%	12	0.4%
Bike or walk	5,296	6.1%	5,145	5.8%	5,361	5.6%	20	0.7%
Work at home	1,230	1.4%	1,285	1.4%	1,559	1.6%	84	2.9%
Age Structure								
Under 15	49,280	21.6%	52,771	22.1%	52,888	21.5%	1,337	22.3%
15 to 24	38,023	16.6%	39,791	16.7%	38,730	15.7%	719	12.0%
25 to 34	39,329	17.2%	39,688	16.7%	43,052	17.5%	860	14.3%
35 to 44	30,314	13.3%	32,159	13.5%	32,894	13.4%	1,175	19.6%
45 to 54	20,777	9.1%	22,586	9.5%	21,989	8.9%	610	10.2%
55 to 64	20,416	8.9%	21,527	9.0%	22,178	9.0%	588	9.8%
65 and over	30,464	13.3%	29,834	12.5%	34,488	14.0%	789	13.1%
College Students	20,204	8.8%	21,130	8.9%	19,596	8.0%	287	4.8%
Labor Force								
Total Labor Force	100,633		104,705		109,668		3,048	
Total Unemployed	11,105	11.0%	12,801	12.2%	11,333	10.3%	122	4.0%
Family Income (thousands of US$)								
Under 15	36,236	40.8%	37,410	41.2%	37,371	38.8%	230	10.7%
15 to 25	15,767	17.8%	16,280	17.9%	17,425	18.1%	301	14.1%
25 to 35	13,147	14.8%	12,981	14.3%	14,508	15.1%	304	14.2%
35 to 50	12,693	14.3%	12,399)	13.6%	14,211	14.7%	411	19.2%
50 to 75	7,989	9.0%	8,346	9.2%	9,449	9.8%	460	21.5%
over 75	2,887	3.3%	3,467	3.8%	3,417	3.5%	435	20.3%
Welfare and Poverty								
Welfare Population	17,440	19.7%	19,084	21.0%	17,248	17.9%	17	0.8%
Poverty Population	59,069	26.7%	63,711	27.6%	57,212	24.0%	152	2.6%

Source: Based on block group level data from the STF3a series

Table 4 Land Use and Change Within One Mile of Proposed Commuter Rail Lines

Route	Portage Direct		Portage Extension		Summit Direct		Aurora Extension	
Workplace Mode of Transportation (by population)								
All modes	249,769		272,203		265,638		2,917	
Carpoolers	31,282	12.5%	33,187	12.2%	32,997	12.4%	414	14.2%
Transit takers	30,113	12.1%	31,034	11.4%	30,007	11.3%	11	0.4%
Current Land Use								
Total land	66,490		71,239		64,609		6,206	
Population per Acre	3.44		3.35		3.81		0.97	
Residential land	17,316	26.0%	18,044	25.3%	17,531	27.1%	815	13.1%
Industrial land	4,194	6.3%	5,070	7.1%	4,841	7.5%	97	1.6%
Commercial land	4,330	6.4%	5,025	7.1%	4,604	7.1%	134	2.2%
Recreational land	4,171	6.3%	4,110	5.8%	5,680	8.8%	575	9.3%
Other built-up land	9,662	14.5%	10,273	14.4%	10,359	16.0%	1	0.0%
Vacant land	26,818	40.3%	28,718	40.3%	21,591	22.4%	4,132	66.6%
Projected Changes 1990-2020								
Change in population	-7,452	-2.8%	-6,769	-2.5%	-12,594	-4.5%	2,898	68.7%
Change in employment	-3,521	-1.2%	-7,454	-2.3%	-1,525	-0.5%	681	48.4%
Employment by Sector								
Base employment 1990	87,535	29.9%	108,163	33.2%	92,210	30.1%	428	30.4%
Base employment 2020	65,181	22.6%	80,368	25.3%	70,773	23.2%	318	15.2%
Retail employment 1990	30,124	10.3%	36,538	11.2%	32,759	10.7%	279	19.8%
Retail employment 2020	31,854	11.0%	38,343	12.1%	34,806	11.4%	475	22.7%
Service employment 1990	174,781	59.8%	180,898	55.6%	181,084	59.2%	699	49.7%
Service employment 2020	191,884	66.4%	199,434	62.7%	198,949	65.3%	1,295	62.0%
Base employment change	-22,354	-25.5%	-27,795	-25.7%	-21,437	-23.3%	-110	-25.7%
Retail employment change	1,730	5.7%	1,805	4.9%	2,047	6.2%	196	70.3%
Service employment change	17,103	9.8%	18,536	10.2%	17,865	9.9%	596	85.3%

Source: Based on Taz level data provided by CTPP, AMATS and NOACA

The Summit Direct route is projected to lose the largest absolute and relative amount of population but the smallest absolute and relative amount of employment. Expected declines in population and employment for parts of southeastern Cuyahoga County account for the large projected loses along the Portage Extension route. An examination of projected employment changes by sector, points to a shift away from manufacturing and towards service employment along all three alignments.

Estimation of Possible Ridership

Any calculation of ridership potential is purely speculative, and is often politically manipulated (Wachs 1995), especially since many of the corridors along the proposed alignments are currently not served by existing mass transit, there is no way to know exactly how individuals will behave when a rail option becomes available based on income structure and current transit propensities. In general, forecasts of ridership have been overly optimistic (Wachs 1995), often because they build into the forecasts exogenous changes concerning parking costs, labor costs, and feedback loops regarding how rail transportation may shape future land use. These projected impacts often do not occur, as Giuliano (1995 p.338) notes, "transportation investments do not have a consistent or predictable impact on land use."

Excessively cautious projections may not work either. If rail service is made attractive, convenient and affordable, many automobile riders even solo drivers will switch (Flem and Schiermeyer 1997), and consequently commuter rail has experienced increases in many locales (Railway Age 1997; Gomez-Ibanez 1996). Together, these uncertainties make the estimation of ridership almost impossible.

Our ridership estimates are based on data from the 1990 Public Use Microdata Sample (PUMS) that allows us to calculate current transit propensity by income and welfare status (Table 5). Propensities are determined by the combined proportion of people in Ohio using mass transit plus people who carpool divided by the total number of workers. These propensities are used to estimate the number of people who may utilize commuter rail on a daily basis. We do not incorporate potential modal shifting among those individuals who currently drive alone, nor do we include non-work trips. We do not include the effects of non-work transportation, for recreation, education, or shopping. We also make no assumptions regarding changes in exogenous or feedback factors that may cause people to drive less or alter land use patterns along the transit corridor. We therefore feel that our estimates are fairly conservative in this regard. Balancing this would be the fact that we do not subdivide the population by their commuting paths. Therefore, these estimates include several individuals who may need to get to destinations other than those served by the proposed commuter rail.

Table 5 Possible Ridership Based on Income and Welfare Status

Route	Direct Portage	Extension Portage	Direct Summit
Household Income (US$)			
Under $5000	1,846	1,961	1,836
$5000-$10,000	1,848	1,894	1,939
$10,000-$15,000	1,316	1,313	1,397
$15,000-$25,000	2,236	2,309	2,471
$25,000-$35,000	1,318	1,301	1,454
$35,000-$50,000	1,272	1,243	1,424
$50,000-$75,000	567	592	670
over $75,000	205	246	242
Ridership	*10,608*	*10,859*	*11,433*
Welfare Status			
Welfare	4,076	4,461	4,032
Non-welfare	8,545	8,607	9,486
Ridership	*12,621*	*13,068*	*13,518*

Our estimates indicate that, based on both income and welfare status, all of the proposed alignments would yield a daily ridership of at least 10,600. Among closely matched choices, the Summit Direct alignment enjoys a slight advantage over the others. Overall, the Summit Route is estimated to attract 500-600 more riders than the Portage Extension Route and 800-900 more riders than the Portage Direct Route.

The NEORAIL Study estimates a feasibility range of 3,000 to 5,000 riders per day by individual line. Their ridership estimates are based on 1990 journey to work data and projected journey to work as of 2020, but their methods of establishing ridership totals are not disclosed. We worry that they did not adequately account for latent demand, especially in consideration of the fact that most of these corridors are not presently served by regular mass transportation. Our methods are therefore likely to account for different factors in separate ways. With our totals suggesting a projected ridership of between two and three times that number along each of the three primary alignments, it would seem reasonable to assume that the feasibility threshold of riders per day can be met by each line.

Conclusion

This study assesses the relative ridership potentials for three possible alignments in Northeast Ohio. All three corridors pass from downtown Akron to downtown Cleveland, but they take different paths. The newest set of recommendations from the Ohio Department of Transportation suggested that preliminary studies of this project be continued (www.dot.state.oh.us/trac as of January 7, 1999).

According to our analysis, all three routes comprise the necessary demand, at least when existing ridership propensities of subpopulations are calculated for groups within 1.6 kilometers of each of the corridors. Of the three routes, the Summit Direct has the largest total population, but among the more transit oriented riders, e.g., current mass transit users, car-poolers, welfare recipients, and college students, the Portage Extension alignment has the highest potential ridership. Estimated ridership gives a slight edge to the Summit Direct route. Greater existing amounts of developable land and projection estimates indicate that Portage Extension has greater potential for population growth.

The methodology used in this study, a tabulation of various subpopulations within a 1.6 kilometer buffer of possible alignments, utilizes the power of Geographic Information Systems to buffer and aggregate, although the modelling is far simpler than is utilized in some ridership forecasts. At the same time, given the poor performance of ridership forecasts in the past (Wachs 1995), we are confident that we have conservatively estimated the potential population that would use commuter rail in Northeast Ohio.

Acknowledgments

This research was funded by the Kent State University Campus Bus Service. The authors especially appreciate the inspiration and advice from Tom Clapper and Dave Kotting of the Campus Bus Service. We are also indebted to the expert skills of Michael Binkley, who was instrumental in creating the geographic information system upon which this analysis is based.

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