A Critical Look at Transit

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Part I - Transit in the Bay Area: A Comparison of Berkeley and Pleasanton

Can transportation planners provide adequate mobility for suburban communities? This task is daunting and often involves frustrating compromise. Towns like Berkeley provide a transit service that allows people without cars to have access to jobs, shopping, and recreation; but motorists are slowed to a crawl on the narrow streets. Towns like Pleasanton have excellent freeway access and wide streets, but leave non-motorists virtually stranded. How can an entire community be accommodated? How can urban and suburban layout and design help? What are the ramifications of building a society upon the armature of a transit system versus an automobile system? The cities of Berkeley and Pleasanton offer excellent opportunities to answer these questions.

In this report we will examine Berkeley and Pleasanton, who live there, and how they get around. We will see how the scale and physical layouts of their streets correspond to the transportation mode on which their initial development was premised. Finally, what potential exists for encouraging transit, and is this a worthy goal?

How Do People Get Around?

According to a 1990 census, 91.9% of Pleasanton residents commute to work by car (81.2% drive alone). 58.4% of Berkeley residents commute to work by car (48.0% drive alone). So, how do the rest of Berkeley's residents get to work? 16.2% use transit (1.6% in Pleasanton), 13.1% walk (1.6% in Pleasanton), 4.8% use a bicycle (1.1% in Pleasanton), 1.9% use other means (0.8% in Pleasanton) and 5.7% work at home (3.0% in Pleasanton). A similar profile emerges when we compare the share of commuters who work in Berkeley and Pleasanton. 91.3% of Pleasanton workers arrive by auto (79.4% drive alone). 68.8% of Berkeley workers arrive by auto (57.0% drive alone). Similarly, we ask, How do the rest of Berkeley's workers get to work? 10.2% use transit (1.8% in Pleasanton), 10.6% walk (1.8% in Pleasanton), 4.0% ride a bicycle (1.2% in Pleasanton), 1.9% use other means (1.0% in Pleasanton) and 4.5% work at home (3.0% in Pleasanton). Clearly, transit use is much higher in Berkeley than in Pleasanton. What explains these differences?

Effects of the Streetcar Era

Our first task is to understand the function and layout of a streetcar town. As cities became more prominent in the United States as a viable alternative to farm life, the need to transport workers to manufacturing centers intensified. At first, horse-drawn trollies enabled workers to increase their distance from employment centers, thus increasing their opportunities

for better employment and housing. Later, electric streetcars replaced the trollies. What was the developed streetcar system like?

The typical streetcar suburb of the turn of the century was a continuous corridor whose backbone was the road carrying the trolly tracks (usually lined with stores and other local commercial facilities), from which gridded residential streets fanned out for several blocks on both sides of the tracks. (Muller)

At the peak of its efficiency, the streetcar system provided transit to essentially everyone, not just workers. The ubiquity and low fare of the electric trolley now provided every resident access to the intracity circulatory system, thereby introducing truly mass transit to urban America in the closing years of the 19thcentury. (Muller) This aspect is impressive when compared to the current "motorized metropolis" of the Bay Area in which "5.5 percent of the region's workers live in households with no car and...11.9 percent of the region's workers live in households with less than one car per worker." (Jones) Such advantages made the streetcar system very influential in the development of cities that experience much of their growth during the early part of the century.

The layout and design of Berkeley's downtown clearly identify it as a product of the streetcar era. Shops are clustered around transit nodes and housing is spaced closely so as to allow access to transit lines. Relative to Pleasanton, most aspects of Berkeley's layout encourage transit use over auto use. The residential and non-residential land uses are co-mingled, especially along major arterials. The grid arrangement of Berkeley streets makes pedestrian access between residential and commercial areas relatively easy because it uses a large amount of land for residential street space and creates many blocks, many intersections, and many access points. Berkeley's primary shopping and employment centers are readily accessible by transit, but not by freeway. Parking is difficult. The transit system is spaced throughout the downtown area and it is relatively easy to gain access to the transit grid.

Effects of the Freeway Era

As America continued to produce affordable automobiles and interstate highways on which to drive them, developers began providing automobile-scaled environments located farther from the urban center than commute times previously allowed. Michael Southworth lists some of the factors involved in this transformation:

> Large real estate interests, together with the emerging field of city planning, successfully pushed for the adoption of subdivision, zoning, and engineering standards for streets and infrastructure.

The results included drastic changes in urban design. One product of automobile emphasis was "quiet streets that are relatively safe for children," but an "almost total reliance on loops and cul-de-sacs (that) reduces pedestrian access to anywhere but a neighbor's house and the local school." (Southworth) Urban designer Andres Duany points out that such looping road systems force a large part of the traffic onto a small fraction of the total road surface. (Steger) As we will see, cities built for cars have many drawbacks. A look at a map of Pleasanton shows how

important the freeway system has been in the formation of the town. Built around the cloverleaf of highway 580 and highway 680, Pleasanton's life comes directly from the highways. Relative to Berkeley, Pleasanton's layout makes auto use much easier than transit use. Residential and non-residential areas are separated by roadways. Commercial areas are generally based upon a grid, but residential areas usually employ curving streets.

Stoneridge mall and the business parks are easily accessible by the freeway systems but are difficult to approach by transit. Parking is free and easy. Transit exists but only services major routes.

Walk of the Town—Berkeley

"Walkability" is an essential component of an effective transit system. It is also critical in providing mobility to residents who do not drive due to age, income, or whatever other reason. In a walkable community, transit riders can walk from the local transit nodes to their destination in a reasonable amount of time. Alternately, residents may be able to accomplish some tasks, such as shopping or going to school, entirely on foot. The difference in walkability between Berkeley and Pleasanton is keenly felt by anyone who has walked through them.

Berkeley has several factors that contribute to its walkability. Commercial and residential land uses are intermingled along Shattuck Avenue, with the businesses on the main street and housing just a block away on the smaller streets. A resident could easily go shopping for groceries, or even books or specialty items, without walking more than ten minutes.

It is also interesting to note the piecemeal development around the downtown. Apartments and old housing stock exist close together, suggesting that the area has been built up over a long period of time by many builders rather than all at once by a single developer. This has led to a diversity of housing stock and a diversity of population and income levels. This suggests the availability of transit, which might target lower-income apartment dwellers, to higher-income home owners.

One difficulty when designing for walkability is reducing auto traffic without compromising pedestrian access. The neighborhood around Mariposa and Amador streets demonstrates such walkability. There is very little through traffic because there is really nowhere to go. Henry Street, the nearby arterial, carries the through traffic. The only reason to drive through the neighborhood is to get to the neighborhood. Without using pedestrian-deterring cul de sacs, the street layout keeps through traffic to a minimum.

The location of schools is also important. When elementary schools are accessible to most of their students by walking, the burden of driving is lifted from parents. In a transit-dependent family, this advantage is critical. Families in the Eunice Street area can walk their children to school without having to cross a busy street. On the other hand, freeway access is very inconvenient. Although Henry street leads to two major arterials that run to the highway, a driver must allow ten to fifteen minutes to reach to highway due to the many traffic lights. Clearly, freeway access was not a prime consideration for the original developers. A look at a map of Berkeley shows that the community's original design emphasized local arterials such as

University Ave, Shattuck Ave, Sacramento St, and San Pablo. In fact, freeway access was adapted long after much of Berkeley was well established, to which the ill-fitted arterial extensions from San Pablo attest. Somehow, people were attending to their daily needs and getting where they needed to go for a long time before the freeway was in place.

Although freeway access is limited, transit is very accessible along Shattuck. Shattuck carries a major bus line and connects with BART near University Ave. Of course, the streetcar laid the foundation for today's transit system in this area. A streetcar ran from downtown Berkeley north to Solano Ave and south to Oakland and San Francisco. So Berkeley's original design and development with transit in mind has allowed a relatively easy conversion to more modern forms of transit.

Parking availability is another indicator of auto-domination versus walkability. While many homes have off-street parking and some parking lots offer free parking, in general, parking in Berkeley is grim. Most downtown areas have three parking options—metered, paid lots, and free-but-you-had-sure-better-buy-something-at-our-store lots. The parking scarcity alone may be enough to discourage auto use in favor of other options.

The high price and demand for parking is related to the relatively small share of the city's land area used for parking and street space. This small proportion of auto area reflects a de-emphasis on auto use when the plots were laid out. It also means that little room exists for expanding auto-use spaces.

In contrast, a generous amount of space is provided for pedestrian use. In many ways the layout and design of the community is conducive to walking. Sidewalks are continuous and crosswalks are available at all intersections. Pedestrians are visible throughout the downtown area and also in residential sections. When crossing streets, pedestrians expect—and are quickly given—the right of way. Unlike many auto-dominated suburbs, pedestrians would not feel awkward or out-of-place to be seen walking several blocks or waiting for a bus.

Given its inherent walkability, most parts of the city are accessible by transit. In large measure this is due to the grid structure of most of Berkeley. A transit user does not have to wind through long streets or walk around cul de sacs to get to a transit node. Most residences are within a few blocks of a bus stop. Where the grid works well for transit, it often performs poorly for auto use. Many cross streets mean many intersections and many stops. Either traffic on major thoroughfares must stop, or tributary traffic must fight its way into the mainstream. Narrow streets and limited parking compound the difficulty of driving, especially when one lane is completely blocked by a delivery truck. No doubt, most drivers will take great pains to avoid unnecessary trips through Berkeley. Thus, Berkeley's walkability, transit use, and drivability are all closely related. How do they compare to Pleasanton?

Walk of the Town—Pleasanton

The walkability of Pleasanton is vastly different from that of Berkeley for many reasons. One reason is the stark stratification of commercial and residential land uses. Residential neighborhoods are strictly housing. Shopping is available only in designated centers and businesses are found only in business parks. Furthermore, housing and shopping seem to be determinedly separated by arterial roads. What would be a ten-minute shopping trip by foot in Berkeley translates to a ten-minute drive to the plaza in Pleasanton. Shopping for durable goods in Pleasanton means a drive to the mall, not a walk downtown.

A map of Pleasanton shows how the region was developed around the freeways and the major roads. Major tributaries such as Valley Trails Dr and Paseo Santa Cruz, which connect dozens of cul de sacs, give evidence that vast areas were carved out by single developers in a short span of time. A walk through these separated single family residences shows a homogeneous housing stock. Clearly, the majority of Pleasanton was developed to be sold to a residence-only, relatively isolated, suburban market. For the most part, residential areas are protected from the intrusion of through traffic by the curvilinear street layout and the use of cul de sacs. However, much of the housing is on major tributary roads. These roads will experience higher auto traffic volume and higher speeds than the dead-end cul de sacs. Thus, compared to a grid system, walking will be hampered by the cul de sac configuration and traffic hazard may be just as great along arterials and major tributaries.

Schools are another indicator of walkability. Some neighborhoods (surrounded by arterials) have schools located in the middle of them, but other neighborhoods do not. For these later neighborhoods, walking to school is not an option. If both parents work, they will have to make arrangements to drop the child at school and, more significantly, pick him up in the afternoon. Even a bus would have difficulty covering the winding streets of some neighborhoods in a reasonable amount of time. However, once the child were dropped off, getting to the freeway could probably be accomplished from anywhere in Pleasanton in five to ten minutes. Virtually all arterials lead to the freeway system and have well-constructed cloverleaf-style on and off ramps. Freeway access clearly took precedence in the initial design and development of the community. This carries a profound implication for the city. With auto transportation being a central (if not the central) design consideration of development, Pleasanton positioned itself as a place to leave or visit—not a place to live. Pleasanton was not intended to be self-sufficient. Residents were, and are, supposed to work somewhere else. Shoppers were supposed to come from somewhere else. As an isolated community, Pleasanton's businesses (alone) could never support all of its residents, its residents (alone) could not support its shopping mall, and all three sectors (industry, commercial, and residential) would fail to support civic needs. The city would implode under drastic recession. So the decision to make Pleasanton a freeway town led the market to develop it into a place that could never be anything else. Of course, Pleasanton is not entirely dependent upon its freeways for mobilization of its work force. BART plays an important role. Workers have the option of taking BART into San Francisco or Oakland. But this is not transit access in a full sense. The local station is not close enough to any housing areas to be within walking range. One must drive, bike, take a bus, or take a taxi. Taxis add a heavy burden of expense onto the daily expense of taking the BART, buses only travel along the arterial outskirts of residential areas, and bicycles are not allowed during rush hour. The only

economical and dependable means of reaching the transit node is by auto. This means that much of the potential benefit of retrofitting Pleasanton with a "transit" system is lost.

Yet what Pleasanton lacks in walkability in compensates with in drivability. Parking is free and ubiquitous. Roads are wide, even in low-traffic areas. Building facades are "auto-scaled," in that they are easily read at 40 miles per hour but feel overwhelming and far away to a pedestrian. With so much land area devoted to auto use, buildings get pushed apart. It doesn't much matter if two buildings are adjacent or miles apart, since no one is expected to walk from one to the other. Other than Stoneridge Mall, which may be considered a destination unto itself, there are no centers where one is intended to accomplish several disparate tasks by walking.—App. 1 Land areas are pulled apart like sun-dried earth. Crossing streets feels like swimming the English channel. Empty sidewalks disappear beneath one's feet. A walk across town feels more like a walk from one town to another. Walking alongside the local traffic is not particularly functional, safe, or pleasant. It may call to mind Bob Dylan's erstwhile warning that "your streets are getting empty and your highway's getting filled." This is not to say that transit is unavailable in Pleasanton. As mentioned, buses circle the major arterials and connect to both the BART station and the shopping mall. But the overall layout and design of the city is not conducive to transit use. It is difficult for most residents to reach the transit loops from their houses. Not only are residential street layouts designed to discourage through traffic (including buses) and walkability (though not necessarily by intention), but local residents would no doubt oppose initiatives to route noisy, smelly busses through their neighborhoods, especially late at night and especially to service so few riders. Also, transit authorities would have little incentive to push for expansion into areas which would bring in very little revenue.

Still, the city works for most people very well. No doubt, most residents would not even think of transit as being a serious issue. That is because Pleasanton is entirely drivable and residents have vehicles. The minority of "carless," "car-impaired," or "under-carred" individuals who must provide for themselves will likely move to denser urban areas where they can rely on transit or walking to get around.

Other Factors—A Look at the Populace

Many factors besides the physical layout and design of Berkeley and Pleasanton make them more or less oriented toward transit. Profiles of the population provide some insights.

According to a 1998 Metropolitan Transportation Commission (MTC) report, the mean household income for Pleasanton residents is $70,000/year; for Berkeley residents it is $50,000/year. A 1994 MTC report shows that urban Alameda County (including Berkeley) carries 20% of the Bay Area's carless population, whereas suburban Alameda County (including Pleasanton) carries only 5%. This suggests that the number of carless households is four times greater in Berkeley than it is in Pleasanton.

1998 MTC data also shows a larger average household size in Pleasanton than in Berkeley--2.9 persons compared to 2.2-- and more single family dwellings--47,000 compared to 31,000. Conversely, Berkeley has far more multi-family dwelling units than Pleasanton (36,000 compared to 12,000), more people living in group quarters (12,000 compared to 4,000), and a

higher share of elderly persons (14.3% compared to 8.5%). This data would suggest that people who need to use transit self-select to live in places like Berkeley. Of course this creates a self-reinforcing loop. Areas like Berkeley, with higher density, more carless households, lower incomes, and more elderly persons, attract transit users and create more demand for transit, thus rewarding both transit users and transit providers.

Reinforcing this conclusion is the share of households by number of occupants. In other words, where do families with children choose to settle, and why? The '98 MTC data shows that the share of one-person households is twice as high in Berkeley as it is in Pleasanton (No doubt, due largely to the student population). The number of two-person households is about the same for each city—about a third of the total. But the share of three- four- and five-person households are all higher in Pleasanton than in Berkeley. This difference may be due, in part, to a preference for families to live in an auto-accessible environment. With the population profile of Pleasanton weighted heavily toward favoring such an environment, we might wonder whether carpooling serves the functional equivalent of transit for suburban communities. MTC indicates that the carpool share is significant—about 10% of workers—but not significantly higher (0.3%) than the share in Berkeley. Carpools are more convenient than transit for suburban residents because they offer door-to-door "service," but less convenient in that they require very tight coordination among riders. Evidently, the conveniences and inconveniences roughly balance at about the same point in both Pleasanton and Berkeley.

Lessons Learned

What lessons might we cull from our examination of transit use in Berkeley and Pleasanton? First, we have seen how critical a city's physical layout and design are to its development and potential for effective transit use. Second, we have seen that, once a city chooses to favor one mode of transportation over another, it will attract residents who also favor that mode of transportation. The result is a physical development and a populace that will both favor maintaining the current transportation mode and oppose change. Even if the passing of time brings about a greater need for change (as from auto use to transit) or even a greater awareness (in some) for the need to change, the same passing of time will bring a greater intractability and resistance to change. Thus, efforts toward sweeping reform of an established area's transit system are often misguided.

However, any transit system can be improved. But, how? What costs will such improvements likely incur and for whom? Who would benefit and to what extent? We explore these questions in part II.

Part II - Traffic Congestion in U.S. Cities: How Can Transit Help?

For the last several decades, planners, politicians, and the populace at large have been grappling with the problem of traffic congestion in U.S. cities. The freeways and arterials of major metropolitan areas have become notorious for rush-hour delays. Workers lose time that could be spent earning money or relaxing. Employers lose money when commuting employees experience especially long delays. Drivers spend more money on gasoline which turns into more air pollution. They also become more anxious and tense as more of their concentration must be devoted to the stop-and-go driving task. More people are injured or killed in accidents. People wonder why someone doesn't fix the problem.

Of course, the "no-brainer" approach to reducing freeway congestion is to simply build more freeways. Anyone who has sat in traffic as cars in the commute lane whizzed by has likely thought, "If only there were a few more lanes"—or a parallel freeway. This approach was actually standard policy during the seventies and eighties. But, eventually, rights of way were gone. The parallel freeways and extra lanes were full at rush hour. What else could be done? The natural solution appeared to lie somewhere outside the realm of the personal automobile. Planners looked to transit. Politicians looked to transit. People everywhere looked to transit. They all drove to work and talked about it. People told politicians, "We want transit." Politicians told planners, "We want transit." Planners got excited and provided transit. People bought cars and moved to the suburbs. What went wrong? Why don't frustrated commuters leave their cars at home and take the bus? Why is transit use spiraling downward? Can transit work? If transit has any chance of coming to our rescue, we will first have to reconcile a striking schizophrenia, namely, the downward trend of transit ridership and the upward trend of political expectations. Policy makers cling to mass transit as if it were a life preserver in a sea of discontent. Too few understand its limitations. Too many overlook the real potential of transit to relieve congestion.

Waxing Burden, Waning Might

How has transit's performance measured against its promoter's expectations? The trend is not encouraging. Consider the following changes that have occurred in U.S. metropolitan areas from 1960 to 1990:

Metropolitan population: up 60%
Working population: up 106%
Household vehicles: up 128%
Metropolitan workers who commute by automobile: up 180%
Metropolitan workers who commute by transit: down 15%
Share of metropolitan workers who commute by automobile: up 37%
Share of metropolitan workers who commute by transit: down 59%

Clearly, neither the increase in congestion nor the increase in expectations for transit to relieve congestion has been met. Transit is losing ground. Why? The primary reasons for transit's

declining market share are increasing auto ownership, the shift from central city population and employment to suburban, and the resultant growth of suburb-to-suburb commuting.

Transit Killer #1: The Automobile

It is difficult for most of us in the United States to imagine a world without cars. Since World War II, American suburbs have flourished, and the automobile has been absolutely intrinsic to the formula. What effect has the irresistibility of the auto and the suburb had on transit? Consider the design implications.

Developers want to provide quiet, safe, private housing on large lots. That is what their market demands. Private housing on large lots requires houses to be spaced far apart. For quiet, houses must be kept away from industrial and commercial areas. With the auto, these requirements can be achieved easily. Of course, cars can be dangerous, so developers discourage through traffic with maze-like street patterns. Since land is expensive (and nobody walks anyway), sidewalks are expendable. The result is a quiet, safe, private neighborhood suited to auto use, but impossible to walk and impenetrable to transit. As automobile ownership increases, the disparity widens.

So, how much has auto ownership increased in the last 50 years in the U.S., and how does this compare with other industrial nations? Consider the following comparisons of auto registrations and relative percentages of change (following four tables based on USFHWA data):

	1950	1995	% change
U.S.	61.7 million	135.0 million	219
U.K.	5.6 million	24.3 million	434
Germany	4.9 million	40.5 million	827
France	5.0 million	25.1 million	502
Japan	0.5 million	44.7 million	8,940

Two things become very clear from these numbers. First, The U.S. has had, and still has, far more vehicles than any other nation. Second, the other nations are catching up. In fact, the descending order of auto ownership by nation in 1950 becomes a roughly ascending order of increase since then. The U.S. auto registration has increased 219%, but Japan's has increased an amazing 8,940%. Still, the U.S. is a big place. Do we simply have more cars because we have more people? No. Compare the number of automobiles per 1000 persons to the annual vehicle miles traveled per person in these same five countries:

	Autos/1000 persons	Annual VMT/person
United States	566	8,613
Germany	460	4,048
France	416	4,836
United Kingdom	395	4,446
Japan	298	3,293

Not only do Americans own more cars per capita—more than one car for every other person—we also use them more. We drive about twice as much as the people of the other major industrial nations. This is useful information to understand the context of urban congestion, but does not yet address relative city driving habits. Notice the differences among U.S. cities (average of 10), European cities (average of 10), and Asian cities (average of 3).

	American	European	Asian
Autos/1000 residents	533	373	163
Share of commute by car	83%	44%	15%
Gallons gas/person	317	72	30
Share of non-auto work trips	17%	56%	85%

Again we see that auto ownership is higher, but more significantly, auto and gasoline use is much higher. It is important to remember that car ownership in itself does not cause congestion, auto use does.

Why do Americans drive more? Certainly there are several factors. One major economic factor is the price of gasoline. What relationship do gasoline prices, fuel economy (miles per gallon), and annual miles per vehicle have?

	gas prices ($)	MPG	MPV
United States	1.24	20.2	13,213
United Kingdom	2.86	30.4	9,467
France	3.31	27.4	8,736
Germany	3.34	24.5	8,401
Japan	4.14	22.7	6,700

Not surprisingly, we see a direct relationship between gas prices and vehicle miles traveled. What are gas prices telling the Japanese? "Take the train." What are gas prices telling Americans? "Jump in the car." No wonder auto ownership in America is on the rise. No wonder gas-guzzling sport utility vehicles are the latest craze. If we're going to be stuck in traffic anyway, and gas is cheap, we might as well be comfortable.

Transit Killer #2: The Suburban Shift

We are moving to the suburbs. We have been moving there for decades, and, if we are not there yet, we want to be. The U.S. population has grown, but suburbia has grown much faster. Consider the growth from 1950 to 1990 (Pisarski, "Commuting in America ll," p 18):

Area	1950	1990	% change
All U.S.	151.3 million	248.7 million	164
Central city	49.7 million	71.9 million	145
Suburbs	35.2 million	116.8 million	331

The trend is clearly in favor of rapid suburban growth. Does transit work well in the traditional suburban setting? Suburban transit usually involves one of two experiences. In one case, a hopeful rider stands (or if fortunate, sits) exposed to the sun, rain, or cold, waiting for a bus to take him from one remote location to another. Perhaps he is going shopping or perhaps he is traveling to a low-paying service job nearby. In any event, he certainly has no car. In the second case, the rider is actually a driver/rider. He drives a few minutes to get to the Park & Ride (maybe he is a parker/rider), where he leaves his car and takes a train or express bus to work. Are these cases of transit working efficiently?

When it comes to efficiency, we would surely get two solid "no" votes for our first scenario. One would likely come from the rider, who is wet (from rain or perspiration), late, and embarrassed to have been a carless spectacle as his neighbors drove by. The other nay vote would be cast by the bus company, as it begs the local government for subsidies to pay its drivers $15/hour to drive $200,000 buses around to shuttle a handful of passengers.

The second case (the park-and-ride) may seem more productive, but also has serious limitations. What appears to be an effective use of transit can be misleading. It is tempting to look at a parking lot full of cars near a BART stop and say, 'Look at all the vehicles that are not causing congestion or pollution—let's make more of these lots until the congestion and pollution are gone.' Unfortunately, this reasoning is flawed on both counts. Congestion on the freeways and lack of downtown parking (along with other factors such as price of land) have had two effects. The first is to make park-&-ride transit more appealing. The second is to make suburban business relocation appealing. Why should a business pay more money to locate within the central business district (CBD) when it can settle comfortably and cheaply a few miles away and still maintain its business contacts? Furthermore, a business in the suburbs that can offer an easier auto commute will attract more qualified employees who will be willing to work for lower wages, thus reducing overhead and improving output. Thus, the park-and-ride approach only works if a person must park and ride, not if a person must park and ride and park. By decentralizing the employment nodes to the suburbs, the market has created a limit, if not a decrease, in the effectiveness of this form of suburban transit. A last sad note regarding pollution abatement: Most of a vehicle's emissions are discharged during warm-up, cool-down, and just sitting idle. The amount of pollution reduced by driving five minutes to the transit stop instead of fifty minutes to the final destination is minimal.

Realistic Expectations for Mass Transit

So, what are realistic expectations in terms of transit's potential future contribution to congestion relief? Obviously, that depends upon how we, as planners and policy-makers, influence this future. The control option is to do nothing, or, at least, nothing different. Fortunately (for our curiosity), this outcome has already incubated to maturity in the laboratory known as Los Angeles. The Bay Area and other U.S. metropolitan centers are following. So are the metropolitan centers in the rest of the world. Western Europe is about a generation away from reaching U.S. levels of congestion. Some Asian centers are two generations away. Will we lead the world, full-speed, into a traffic jam?

Battling the Auto

Congestion is directly related to the cost of transportation. If the cost to purchase, insure, maintain, fuel, and park a vehicle is less than the comparable cost of transit, and transit is an option, then people will use transit. One way to clear the streets is to make any of the many vehicle costs prohibitive. If vehicles, insurance, maintenance, gasoline, or parking were suddenly and unilaterally ten times as expensive, transit would experience a surge in ridership—and income.

Would we be morally wrong to increase the price of, say, gasoline tenfold? Not necessarily. Consider the case of a commuter who has 'done all the math' and realized that she spends exactly the same amount of money whether she commutes by freeway or by transit. Furthermore, let us pretend that they are exactly as convenient, timely, and useful for all the trips she has to make. So, which means will she use tomorrow? At first, she tells herself it makes no difference. Then she realizes that she has already paid her insurance for the month. She won't get any of it refunded if she leaves the car parked all day. She has also paid the registration for the

year as a lump sum. She just paid $900 for a new transmission. And when she calculated her expense for the vehicle, she subtracted the estimated trade-in value from the purchase price (including interest) and divided by the number of days she expected to drive the car during its lifetime. She then realizes she has already paid for her commute whether she takes it or not. Except for the price of a trifling amount of gasoline, if she takes transit, she pays twice.

So what if, with our magic wand, we could transfer as many fixed costs as possible (it's a small wand) to per/use costs. Let's leave the initial purchase up to our driver. She can just call it an investment with a very low (negative) rate of return. Let her also foot the maintenance bills (she is building up her investment). So we will amortize the registration and insurance (basic liability for everyone) and add them to the gasoline price. A surtax is already in place to maintain the roads. But we are interested in transportation, not roads. So let's add another tax to help fund transit, until it becomes solvent. Also, who better to finance the costs of pollution than those who cause it? We can determine what percentage of air/water/soil emissions are directly attributable to gasoline use, how and how much it costs to clean them, and add the expense to the price of gasoline. Then, when our driver tallies her expenses, she can choose to leave her car in the driveway, gaining or losing value, and take transit. Transit has become relatively cheap.

Actually, a very similar proposal has been ventured. It was a stripped-down version. The proposal was "Pay-at-the-pump" insurance. Everybody needs gasoline and everybody should have liability insurance. Why not add the cost of liability insurance to gasoline and pay for it at the pump? People who drive more, pay more for insurance. People who drive less, pay less. Who could oppose such an idea? Only trial lawyers, oil companies, insurance companies, and auto manufacturers. Unfortunately, aside from tobacco companies and the NRA, no one has more money invested in lobbyists than trail lawyers, oil companies, insurance companies, and auto manufacturers. Clearly, commitment to congestion management and air quality will have to reach a very high level before price incentives make a drastic change in the use of transit. Even then, some of the air quality benefits may be superficial. Consider the minimal reduction in CO2 emissions that can be achieved with a 20% increase in transit in U.S. cities:

CO2 factors factor	share	share of world total
fossil fuel	95%	95%
U.S. fossil fuel	23%	22%
U.S. transportation	31%	7%
motor vehicles	80%	5%
passenger vehicles	80%	4%
commute travel	23%	1%
20% more transit	1%	0.01%

Thus, on a worldwide basis, even a dramatic 20% increase in transit in U.S. cities would improve air quality (and fuel consumption) by only a hundredth of a percent. In fact, virtually all improvements in air quality in recent years "can be traced primarily to vehicle and fuel emissions standards," not transit. (MTC Transactions magazine, Jan 99)

Transit Where?

In what segments of the metropolitan marketplace can transit compete most effectively? This question involves both Who and Where. If we start with the premise that using transit is not a positive experience (it may not be negative, but it is seldom more than neutral), then we look for those people who have no other option (no personal vehicle) or an even less desirable option (parking in the city). Where are they found? Unfortunately, everywhere. Where can transit best serve them? Primarily where employment is densely clustered (in the urban core) and where housing is densely clustered. Only in these areas can transit expect to compete in its fullest sense, that is, completely without use of automobiles.

Is transit service already available in most of the market segments in which it can compete most effectively? Perhaps this should be a qualitative question instead of a binary one. If I walk five minutes to my local bus stop shelter on a beautiful day, wait three minutes for my ten-minute ride which ends outside my place of employment, I will think, "Boy, transit service is readily available for me!" If I walk twenty minutes to the nearest bus stop pole in a storm and wait another twenty minutes for the first of three transfers in my 45-minute ride, I will think, "Boy, transit service is not readily available for me!" Quality of service can make a quantitative difference.

Transit funds should be directed toward strengthening routes that transit can serve well. Unfortunately, transit is currently leaving routes in which it can compete in order to serve routes in which it cannot. Many transit authorities are sacrificing critical downtown transit service in order to expand service deep into outlying corridors, thus discouraging inner-city transit use and encouraging corridor development. So, ironically, as transit provides better service to corridors, developers will build housing ever farther from the CBD, encouraging more motorists to move in and increasing corridor congestion.

The Suburban Market

Does this mean that transit should abandon the suburban market completely? Not necessarily. There is still a need for transit in suburbia. A household with one running vehicle per person, and one qualified driver per vehicle does not have a need for transit. For all other households (those with children, seniors, and carless second workers), the quality of life is closely related to the availability of transit. If the current suburban demographic/layout/transit dynamic fails to provide supplementary mobility at a reasonable cost, what can change?

The demographic make-up is possibly the most self-regulating of the three (demography, layout, and transit). A household that experiences severe inconvenience due to a lack of transit availability in the suburbs can move. Generally, if the household has enough disposable income to live in suburbia, it has the means either to purchase more vehicles or to relocate to an area

nearer transit. This may be an unpleasant decision if only one member—for whatever reason—does not drive and they family has strong ties to (or economic interest in) the house, location, or community.

Another option is to change the layout of the community. Obviously, this is not an overnighter. What is in place stays. But in many areas, development is incomplete. Is a commercial area available for development or redevelopment? Perhaps this is an opportunity for several necessary functions to be grouped together near a transit stop. Is a residential tract available for development? Why permit another battery of three-car-garage tract homes on half-acre lots? Instead, mandate that the developer develop some of the land as higher density multi-family dwellings within walking distance of transit (or, better yet, the shopping center). The same layout that makes transit work very well on a large scale can help transit work reasonably well on a smaller scale, namely, centralized business/commercial areas and denser housing. The current trend in micro planning is following the macro pattern established by the market: scattered points of origin and scattered points of destination. This trend can be reversed. It may not reach the ideal commute situation of the live/work space in walking distance of shopping and recreation, but at least we know in which direction to head.

And what changes can transit make in our suburban mix? Perhaps we can re-evaluate our concept of transit. When people in the Bay Area think of transit, they likely think "BART" or "big bus." Bigger is better when demand is high. What about when demand is low? Then, smaller is better. Today, our option is ‘big’ or ‘nothing.’ The biggest problem with ‘big’ is that it is difficult to adapt. It is inconvenient—and annoying to everyone—to have huge buses combing residential streets. Taxis do it all day, but taxis are expensive for many riders. Is there a middle ground? Already, airports, schools, and other institutions have seen the value in using vans or small buses to shuttle people from diverse locations to a central node? Why can’t such vans shuttle people from diverse locations to other diverse locations? True, present bus routes can be confusing enough, but people quickly learn how to get where they need to go when they do it day after day. Planners cannot tell people where to live, but they can provide more options for transit-friendly suburban living.

We have discussed some possibilities for improvement in suburban areas. What other possibilities exist? First, what can be done about large-scale suburban business relocation? For workers who live and work in the same suburb, there is little problem. In fact, this becomes a great solution. But in our volatile and capricious job market, job security is more associated with one’s ability to change, not keep, a job. And people do not want to move every time they change jobs. That is a hassle. So a significant trend is for workers to live in one suburb and to work in another. Transit stands little hope of competing effectively in this environment. Does this mean it is a bad situation? Not entirely. From the standpoint of congestion there is both good and bad news. The bad news is increased loads on critical segments of freeway. This works entirely counter to the original intent of the freeway to be a fast way to travel long distances. The good news is that potentially fewer man-hours may be spent on the freeway, since trans-suburban commuters spend only a short time on crowded freeways, albeit moving slowly. Although it is technically beyond the sphere of transit (and this paper) more energy could be devoted to accommodating this new commute pattern efficiently, while maintaining a high level of urban design integrity. By admitting that “multinucleation” is an inevitable by-product of market forces

beyond their influence, planners can more effectively fight sprawl and congestion by promoting new "sub-centers" of high density residential and commercial areas. They can also use existing rights of way to strengthen arterials between suburban communities, allowing commuters to have an alternative route and freeing precious space on freeway corridors.

Ideal Urban Design

Unfortunately, most planning is damage control and most urban design is retrofitting. If we had a clean slate, how could we plan for transit? The "1000 Friend of Oregon" publication, "Making the Connections" offers some suggestions.

Transit stops—locate adjacent to commercial buildings in core commercial areas.

Street configuration—all streets provide direct auto, bicycle, and pedestrian connections to transit, core commercial areas, schools, and parks. Commercial configuration—retail and commercial space clustered near transit.

Building entries—commercial building entrances should be oriented to plazas, parks, or pedestrian-oriented streets, rather than interior blocks or parking lots.

Mixed housing—areas have mixed densities and prices.

Auto-oriented uses—limited or prohibited.

Even though all of these aspects may not be possible when redeveloping an urban area, they are useful goals and guidelines.

Conclusions

Transit has the potential to improve the problems of mobility in U.S. cities. However, the degree of improvement will vary greatly depending upon how we view, treat, and plan for transit. First, we must have realistic expectations of what transit can accomplish. Otherwise we will be misdirecting our efforts and making things worse. Second, we must maintain existing facilities. Expanding corridors while CBD transit deteriorates is a waste of effort and money. Third, we must manage corridor development to minimize the impact of long distance commuting. Fourth, we must improve and modernize central city transit so it can compete effectively with the auto. Fifth, we must integrate transit planning into urban and suburban design.

Retrofitting our cities for transportation efficiency won’t be easy or quick, but, by focusing attention on the true potential of transit in U.S. cities, we can make things a little better.