stop sprawl

Community Characteristics Promoting Transit and Walking

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(from "Using Residential Patterns and Transit To Decrease Auto Dependence and Costs"; Natural Resources Defense Council, June 1994)

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Several analysts have identified the densities necessary to support transit systems. Certainly, transit can be operated at high frequency in low density areas with adequate subsidies or fares. Costs can be cut on low ridership routes by using smaller vehicles or automating the system (automating can backfire and substantially raise the capital and operating costs of complex systems). However, considering the unwillingness of the American public to subsidize "empty buses" in normal operation, these guidelines are useful. These studies provide an indication of patronage changes with density. Other studies have shown the efficacy of mixing uses and locating shopping near housing concentrations on reducing driving.

Two California agencies have guides for developing pedestrian and transit accessible communities: California Air Resources Board (1993 Draft), and Nancy Hanson of the California Energy Commission (1993, with updates).

From their study of 32 major cities around the world, Peter Newman and Jeffrey Kenworthy (1989) report on a United Kingdom study and conclude that below 20 persons/hectare (8 persons/acre, and 8-10 du/res acre (dwelling units/residential acre) at household sizes and land uses common to San Francisco area cities) there is a marked increase in driving, and below 30 persons/hectare (12 persons/acre, 12-16 du/res acre) the bus service becomes poor. They recommend densities above 30-40 persons/hectare (12-16 persons/acre, 12-20 du/res ac) for public transit oriented urban lifestyles.

[March 2007 update: Urban Design to Reduce Automobile Dependence Peter Newman & Jeffrey Kenworthy Opolis: An International Journal of Suburban and Metropolitan Studies, Winter 2006. http://repositories.cdlib.org/cgi/viewcontent.cgi?article=1013&context=cssd/opolis

"Conclusions

"Considerable variations in urban design and development are found around the world. But there is a widespread desire to find ways of minimizing car use in urban centers to make them more viable. This article tries to show that achieving less automobile dependence will require a certain minimum of urban intensity (residents and jobs). The value of the 35-per-hectare minimum has been found to have some basis in the literature and the authors' own data. It has been explained in theory through the traveltime budget and the levels of amenities required to ensure that people do not have to rely on a car.

"The redevelopment or new development of urban areas can facilitate the reduction of automobile dependence if Ped Sheds of 300 hectares (1 kilometer radius) are used around Local Centers/public transit nodes, and 3,000 hectares (3 kilometer radius) around Town Centers. These should have minimum development goals of 10,000 and 100,000 people plus jobs, respectively.

"An automobile-dependent city can be restructured around a series of transit cities of 20 to 30 kilometers in diameter, with a Town Center as its focus and Local Centers linked along the transit services feeding the Town Center. Although linked across the city for many functions, these transit cities with their centers can provide a level of self-sufficiency that can form the basis for a far less car-oriented city."

Ed note: 35 persons/hectare = 14 persons/acre = 7 - 12 or more households/residential acre, depending on houshold size and fraction of land in residential acres.]

Boris Pushkarev and Jeffrey Zupan (1982) recommend the following densities (dwelling units per residential acre):

Bus: minimum service, 1/2 mi between routes, 20 buses/day 4 du/res ac
Bus: intermed serv, 1/2 mi between routes, 40 buses/day 7 du/res ac
Bus: freq serv, 1/2 mi between routes, 120 buses/day 15 du/res ac
Light rail: 5 min peak headways, 9 du/res ac, 25 - 100 sq mi corridor

Rapid tr: 5 min peak headways, 12 du/res ac, 100 - 150 sq mi corridor
Commuter rail: 20 trains/day, 1 - 2 du/ res ac, on existing track

The Institute of Transportation Engineers (1989) recommends the following minimums:

1 bus/hour, 4 to 6 du/res. ac, 5 to 8 msf of commercial/office
1 bus/30 min, 7 to 8 du/res ac, 8 to 20 msf of commercial/office
Lt rail and feeder buses, 9 du/res ac, 35 to 50 msf of commercial/office

Marcia Lowe recommends at least 7 du/res ac for local bus service and 9 du/res ac for light rail (1992).

Sacramento Rapid Transit recommend at least 10 du/res ac within 1/4 mile and 5 du/res ac outside that for bus service, and 10 du/res ac for light rail service (1987).

Consultants determined that 43 du/res acre within 1/8 mile and 10 du/res acre in the next 1/8 mile would be necessary for rail transit (Barton-Ashman Associates, 1990).

Snohomish county planners similarly found 7 to 15 du/residential acre can support frequent local bus service. They found that a large, pedestrian accessible, area at these densities might also support light rail (Snohomish County Transportation Authority, 1989).

Seattle planners have concluded that transit ridership increases significantly when the density of jobs exceeds 50 employees per acre in centers with at least 10,000 jobs (Seattle METRO, 1987).

The rate of auto travel to a central business district shopping area well served by rail and bus transit was found to be 75% lower than that to a comparable suburban shopping area (JHK and Associates, 1993). Compared to the suburban mall, auto use at the urban center dropped from 95% to 38% of shoppers, while transit use increased from 4% to 32%, and walking increased from 1% to 29%.

A survey of five cities found that over 70% would switch from auto to walking or bicycling for shopping and personal business if the trips were only 1/2 mile and pedestrian walkways were provided (Ferrol Robinson, et al, 1980). Nancy Hanson calculates that if half of the shopping or personal business trips that are between 1/2 mile and 5 miles could be shortened to 1/2 mile, and half those trips taken by foot, then total vehicle trips would decline by over 5% (1993)

While only 3 to 8% of mid-day lunch or errand trips were found to be by walking in typical single-use office parks, walking increased to 20-30% in pedestrian accessible mixed-use areas (David Unterman, 1984).

A survey of suburban centers found that 27-33% of the employed residents living in the center also worked at the center (Kevin Hooper, 1988).

A study of 400 Portland neighborhoods showed "that households in pedestrian friendly neighborhoods make over three times as many transit trips and nearly four times as many walk and bicycle trips as households located in neighborhoods with poor pedestrian environments" (1000 Friends of Oregon, 1994). Households in the highest pedestrian friendly areas drive half as mulch as those in the least pedestrian friendly areas. "The analysis suggests that vehicle miles traveled per household in pedestrian hostile neighborhoods would be reduced by as much as 10% with a significant improvement in the pedestrian environment." The measures of pedestrian friendliness were density, proximity to employment, grid pattern streets, continuous sidewalks and easy street crossings.

The California Air Resources Board has recommended the following actions to reduce auto use (1993).

	XVMT or trip reductions at site	VMT or trip reductions in region
Bike, pedestrian, traffic flow improvements	1 - 10%	
Mixed uses, higher densities	20 - 50%	4 - 11%
Improved transit, ridesharing, traffic flow	--	5 - 10%

Walking Distances To Transit

How far people are willing to walk to work, shop, visit friends or to transit depends upon many factors which make up pedestrian accessibility, including hilliness, the availability and condition of sidewalks, trees and such street furniture as awnings for protection from sun or rain, seating and other amenities, other pedestrians and interesting stores or vistas along the walk, the amount and speed of the street traffic and the ease and safety of street

crossings. Studies should find greater willingness to walk as the pedestrian accessibility of an area increases. As communities improve neighborhood shopping and achieve higher densities with more pedestrians, the distance its residents are willing to walk should increase.

Boris Pushkarev and Jeffrey Zupan report that the median (half are longer and half are shorter) walk to the New York subway is .35 mi, and the median walk to New Jersey commuter rail stations is .5 to .6 mile (1980). They use 1/2 mile walking distance as "rail territory".

The National Personal Transportation Study found that 70% of Americans will walk 500 feet for normal daily trips, 40% are willing to walk 1,000 feet (1/5 mile), and 10% will walk a half mile (David Unterman, 1990). This study shows little willingness to walk in the pedestrian-unfriendly environments of most Americans.

The NPTS also found that 10.3% of those living within 1/4 mile of public transit used it to get to work, while only 3.8% of those living within 1/4 and 2 miles used it, and less than 1% of those living farther away used it (U.S.DOT, 1986). Michael Bernick found that 30 to 40% of apartment residents living within 1/2 mile of Walnut Creek and Pleasant Hill BART stations took BART to work and another 25% used other public transit, compared to 13% using transit regionwide (1990).

Pedestrian analyst Michael Replogle found that Montgomery County, Maryland residents will walk 1/4 mile median distance to a bus and 1/2 mile to a rail stop, and recommends assuming those distances for analyses (1984).

A trip survey in the San Francisco area gave an average time for all walking trips of 12.5 minutes, which is 0.625 mile at 3 mph, a common average walking rate (U.S. DOT, 1988).

References:

Barton-Ashman Associates, Research Triangle Regional Transit/Land Use Study, prepared for the North Carolina Department of Transportation, 1990

Michael Bernick, The Promise of California's Rail Transit Lines in the Siting of New Housing, Bay Area Rapid Transit District, Oakland CA, 1990

California Air Resources Board, The Linkage Between Land Use, Transportation and Air Quality, June 1993

Nancy Hanson, Energy Aware Planning Guide, California Energy Commission, 1993

Kevin Hooper, "Travel Characteristics at Large-Scale Suburban Activity Centers: Status of Current Research", ITE Compendium of Technical Papers, 1988

JHK and Associates, Analysis of Indirect Source Trip Activity at Regional Shopping Centers, November 1993

Marcia Lowe "City Limits", World Watch, January 1992

Peter Newman and Jeffrey Kenworthy, Cities and Automobile Dependence: An International Sourcebook, Gower Publishing, 1989

Boris Pushkarev and Jeffrey Zupan, Urban Rail in America: An Exploration of Criteria for Fixed-Guideway Transit, U.S. DOT, 1980

Boris Pushkarev and Jeffrey Zupan "Where Transit Works: Urban Densities for Public Transportation", in Urban Transportation: Perspectives and Prospects, ed. by H. S. Levinson and R. A. Weant, Eno Foundation, 1982

Michael Replogle, Bicycles and Public Transportation, 1984

Ferrol Robinson, Jerry Edwards and Carl Ohrn, "Strategies for Increasing Levels of Walking and Bicycling for Utilitarian Purposes", Transportation Research Record #743, 1980

Sacramento Rapid Transit, Design Guide for Bus and Rail Facilities, Sacramento CA, 1987

Seattle METRO, Encouraging Public Transportation Through Effective Land Use Actions, Seattle WA, May 1987

Snohomish County Transportation Authority, A Guide to Land Use and Public Transportation for Snohomish County, Washington, December 1989

1000 Friends of Oregon, LUTRAQ Update, Portland OR, January 1994

David Unterman, "Accommodating the Pedestrian: Adapting Towns and Neighborhoods for Walking and Bicycling", in Personal Travel in the US, Vol. II, A Report of the Findings from 1983-1984 NPTS, Source Control Programs, U.S. DOT, 1990

U.S. DOT, Personal Travel in the U.S., Volume II, A Report of Findings from the 1983-84 Nationwide Personal Transportation Study, November 1986

U.S. DOT, Characteristics of Urban Transportation Demand: An Update, 1988

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