

The Role of Public Transit in Sustainable Communities

Randall Rutsch

The Rocky Mountain Land Use Institute

Sustainable Community Development Code
Research Monologue Series:
Urban Form, Transportation

RMLUI
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About the Research Monologue Series
The Sustainable Community Development Code, an initiative of the Rocky Mountain Land Use Institute, represents the next generation of local government development codes. Environmental, social, and economic sustainability are the central guiding principles of the code. Supporting research for the code is represented by a series of research monologues commissioned, presented and discussed at a symposium held at the University of Denver in September of 2007. RMLUI and the University of Denver's Sturm College of Law extend its gratitude to the authors of the papers who have provided their talents and work pro bono in the service of the mission of RMLUI and the stewardship of the creation.

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About the Author

Randall Rutsch, AICP, is Senior Transportation Planner for the City of Boulder, Colorado with a focus in the areas of master planning, regional connections and transportation finance. He is currently the transportation manager for the Boulder Transit Village Area Plan and review of the US 36 EIS. In eleven years with the city, he has managed two updates of the Transportation Master Plan, six cycles of TIP funding applications that secured more than $52 million dollars in federal funding and numerous transportation planning studies. Prior to working for the city he was Regional Planner for the Denver Regional Council of Governments in developing the Metro Vision 2020 regional plan, and has also worked at the county level and in private consulting. He has a Masters in Public Administration from the University of Colorado, Denver.

Definition and Introduction

While public transit has not been the dominate transportation mode in this country for the last 70 years, the United States once led the world in public transit use.[1] In the early part of the 20th century, the rapid population growth of American cities provided ideal settings for introducing new transit technologies. A comparative study of successful transit notes:

> Grid-style street systems, ample land for expansion, thriving economies, mass immigration, and a general willingness by the public to try new transportation technologies fostered a streetcar revolution that swept across the country. By 1920, Americans living in cities were averaging more than 250 transit trips per year, mainly on the nation's 65 000 km of electric railway.[2]

During this period, walking was the dominant transportation mode and transit greatly extended the range of the pedestrian. Hundreds of cities were served by privately operated streetcar lines, often providing transportation to new developments on the edge of town and provided by the developers of these areas. In both Denver and Boulder, recent reconstruction of downtown streets revealed rails laid down by these systems during this time.

However, following World War I, Americans increasingly bought cars, such that by 1930 one in every four households owned a car. Following World War II, the automobile became synonymous with the American way of life and essential for accessing the single family detached homes, malls and office parks of an increasingly segregated land use pattern. Levittown was a harbinger of the suburban development pattern fostered by Euclidian zoning with its strict separation of uses, curvilinear streets and minimum lot sizes. A variety of governmental programs further encouraged and directly subsidized this type of greenfield development on the urban edge. These public policies ensured that most new development would occur away from transit lines and be almost entirely shaped by the automobile. The resulting development pattern was un-supportive or hostile to any other mode of travel, often lacking sidewalks for pedestrians, bike facilities, and was characterized by unconnected, dead end streets and high-speed arterials that are difficult and inefficient to serve by transit. Denver's Regional Transportation District's (RTD) Guide the Ride proposal in the 1990's recognized this reality as it proposed traditional fixed route transit service for Denver and the inner suburbs built prior to World War II, and a flexible "call and ride" service for the majority of the region where the land use pattern is not pedestrian or transit supportive.

The near exclusive reliance on auto travel in most metro areas has produced a 75.7 percent single occupant vehicle (SOV) commute mode share, peak hour vehicle

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[1] Committee for an International Comparison of National Policies and Expectations Affecting Public Transit, *Making transit work : insight from Western Europe, Canada, and the United States*, Transportation Research Board, National Research Council. Transportation Research Board Special Report 257, 2001

[2] *Id.*

occupancy of 1.08, increased travel times[3] and increasing congestion. The Texas Transportation Institute's periodic report on congestion shows that the average American annually spends more than 47 hours in congestion with a resulting national cost of 3.7 billion hours of travel delay and 2.3 billion gallons of wasted fuel with a total cost of more than $63 billion.[4] At the same time, road infrastructure funding is severely lacking for both maintenance and system expansion. The Colorado Department of Transportation's 2030 Statewide Transportation Plan shows the state lacking $39 billion for needed maintenance through 2030, and another $66 billion for needed system expansion to address congestion.[5] Increasing congestion, increasing trip lengths, rising green house gas emissions and the dependence on imported oil all suggest that the dominant reliance on the SOV for travel is not a sustainable transportation system.

Despite the long history of auto-centric planning and financial subsidies, recent trends show that transit may be reestablishing a significant role in American metropolitan areas. National increases in vehicle miles of travel (VMT) flattened in 2003 and actually declined in 2006.[6] In 2005, for the first time in nearly a century, national transit ridership increased faster than VMT. Since 1995, transit ridership is up 25.1 percent compared to a 22.5 percent increase in VMT.[7] The current use of public transportation reduces U.S. gasoline consumption by 1.4 billion gallons each year or almost 4 million gallons a day[8] compared to a total U.S. daily consumption of about 59 million gallons.[9]

A number of factors suggest that increased transit use is a more sustainable transportation option. The first of these is the direct relationship between SOV use and energy consumption. For the past 20 years, the US has consumed about a quarter of the world's petroleum production with the transportation sector accounting for 68 percent of U.S. consumption.[10] Continued growth of the share of petroleum consumed by transportation has been largely driven by growth in the light truck sector, which includes the SUVs exempt from mileage efficiency standards. Travel behavior experience shows that a once a person leaves home as a SOV driver, they tend to make virtually all trips during that day in the car. In contrast, a transit rider tends to be a pedestrian at one or both ends of the transit trip, and will make a majority of trips during the day as a pedestrian with the associated energy savings.[11] Since the 2005 Hirsch report,[12] the

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[3] Reschovsky, Clara, Journey to Work: 2000 Census 2000 Brief, March 2004

[4] Schrank, David, and Lomax, Tim, *The 2005 Urban Mobility Report, Texas Transportation Institute*, The Texas A&M University System, May 2005

[5] Colorado Department of Transportation, *2030 Statewide Transportation Plan*, 2004

[6] U.S. Department of Transportation, Federal Highway Administration, Office of Highway Policy Information, *Traffic Volume Trends*, available at http://www.fhwa.dot.gov/, as of August 2007.

[7] American Public Transportation Association, *Public Transportation Ridership Up In 2005, Media Advisory*, April 4, 2006

[8] Bailey, Linda, *Public Transportation and Petroleum Savings in the U.S.: Reducing Dependence on Oil,* ICF International, January 2007

[9] U.S. Energy Information Administration (2006). Petroleum Navigator, Accessed at http://tonto.eia.doe.gov/dnav/pet/pet_pri_gnd_dcus_nus_a.htm

[10] Davis, Stacy, and Diegel, Susan, Transportation Energy Data Book, U.S. Department of Energy, Oak Ridge National Laboratory, 2007

[11] National Research Center, Mode Shift Report, 2003 for the City of Boulder, 2003.

concept of peak oil has been part of US energy policy discussions, with the dominant expectation that future petroleum supplies will be increasingly limited and higher in cost. The reality is that, on average, the typical public transit rider consumes half the oil consumed by an automobile user, responds to limited oil supplies and is a clear step toward sustainability.

As most transit riders are also pedestrians, closely related factors in sustainability are the potential air quality and health benefits of increased transit use. Increased transit use is a traditional strategy to improve air quality. In addition, the use of ultra-low sulfur-diesel fuel in combination with particulate matter filters has enabled new buses to experience a 90 to 95 percent reduction in emissions. Alternatively fueled vehicles, compared with private vehicles, produce 95 percent less carbon monoxide, 92 percent fewer volatile organic compounds, 45 percent less carbon dioxide and 48 percent less nitrogen oxide on average per passenger mile.[13] Potential health benefits result from improved air quality, increased activity levels and reduced stress. Transit users tend to walk more as the traditional urban settings that support pedestrians and transit generate about half the automobile trips of similarly sized modern-day suburbs.[14] In addition to increased exercise, a recent study documented reduced stress in commuters who shifted to using rail service to New York City.[15] Finally, in terms of fatalities per million miles of travel, all modes of transit are far safer than personal vehicles. Depending on vehicle type, transit is 26 to 79 times safer than auto travel,[16] resulting in an estimated 190,000 fewer deaths, injuries and accidents annually as well as $2 billion to $5 billion in safety benefits, based on 1994 data.[17]

While often overlooked, increased transit use also contributes to sustainability by improving both personal and regional economics. A two adult "public transportation household", defined as a household located within ¾ mile of public transportation, with two adults and one car saves an average $6,251 every year, compared to an equivalent household with two cars and no access to public transportation service. When put in perspective of other household expenditures, including an average of $5,781 spent on food, $6,848 spent on mortgage interest and fees, and $3,925 in mortgage principal in 2004, transit savings are significant. These savings are due to driving less, walking more, and owning fewer cars.[18] Household savings on transportation also translate into significant regional effects. In the case of Portland, residents of the metro area drive an

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[12] Hirsch, Robert L, Bezdek, Roger, Wendling, Robert, Peaking Of World Oil Production: Impacts, Mitigation, & Risk Management, February 2005

[13] *Shapiro, Robert J. et al, Conserving Energy and Preserving the Environment: The Role of Public Transportation*, *July 2002*

[14] American Public Transit Association, *The Benefits of Public Transportation, The Route to Personal Health*, 2003

[15] Richard Wener, Gary W. Evans, Jerome Lutin, *Leave the Driving to Them: Comparing Stress of Car and Train Commuters, Investing Today for a Brighter Tomorrow, 2006*

[16] Litman, Todd, *Evaluating Public Transit Benefits and Costs,* Victoria Transport Policy Institute, 2006

[17] Campaign for Efficient Passenger Transportation, Dollars and Sense: The Economic Case for Public Transportation in America, June 1997

[18] Bailey, Linda, *Public Transportation and Petroleum Savings in the U.S.: Reducing Dependence on Oil,* ICF International, January 2007

average of 4 miles per day less than the average metro area, resulting in an estimated 2.9 billion miles of reduced vehicle travel, a direct cost savings to the region of $1.1 billion and time cost savings of $1.5 billion.[19] These travel cost savings results in an estimated $800 million dollars staying within the local economy. The reduction in vehicle travel is a result of increased transportation options and a compact, diverse land use pattern that puts many daily needs within a short travel distance.

The land use challenge in helping the country move to a more sustainable transportation system is to retrofit the suburban landscape into a development pattern that is bicycle and pedestrian oriented, transit supportive and permanently integrated with high quality transit service. While the relationship between fixed guideway transit, such as light rail and passenger rail, and land use change is well documented in the material related to transit oriented development (TOD), for most communities a majority of their transit service will be bus-based. Bus-based transit has only been marginally integrated into land use planning and the development process as it is often seen as temporary. A recent survey of bus-based planning efforts notes, "Bus transit elements are not often considered when planning land developments. The survey revealed that many transit agencies are frustrated by the lack of impact that they have on land development plans."[20] This study shows how little bus transit operators are involved with the land development process, with only one agency reporting being a "full partner" while fewer than half of development projects had "some coordination" with the local transit agency. The challenge to local communities is to break the cycle of ignoring bus-based transit in their planning and development activities that ensure an environment that is not transit supportive and has low transit utilization. To do this, communities need to make prominent and permanent changes to support bus-based transit.

Prominent and permanent strategies for moving toward a bus-based, transit supportive community include, enhancing the pedestrian environment, changing land use, operational improvements to maintain or increase transit speeds, improving passenger amenities and information, and transportation demand management measures including managed parking. The pedestrian environment is fundamental as virtually all transit patrons are pedestrians at one or both ends of the transit trip and will likely remain a pedestrian for most trips during the day if they commute by transit. A significant volume of literature exists on designing the pedestrian environment, starting with providing adequate facilities such as sidewalks that are fully accessible, as well as protection from the elements and vehicles provided by street trees, awnings and planting strips. Visual interest, amenities such as benches and drinking fountains, a variety of potential activities and activity on the street combine to move the pedestrian environment to one that invites and stimulates pedestrian activity.

In addition to good pedestrian design, density and a mix of land uses support pedestrians and transit use. The standard guidelines are shown in the table below:

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[19] Cortright, Joe, *Portland's Green Dividend,* A White Paper from CEOs for Cities, July, 2007

[20] Transit Cooperative Research Program, *Bus Transit Service in Land Development Planning*, TCRP Synthesis 67, 2006

Transit Service Level Minimum Residential Density[21]

	(Dwelling Units/Acre)
Minimum Bus Service (once an hour or longer)	4
Intermediate Bus Service (two to three times an hour)	7
Frequent Bus Service (more than three times an hour)	15
Light Rail	9
Rapid Rail	12
Commuter Rail	2

These guidelines are in part determined by the effective travel shed of the transit mode. The bus-based travel shed is generally considered to be up to one half mile; but, this can be expanded with an inviting pedestrian environment and high quality transit service. Density and a mix of uses provide potential transit patrons and contribute to a pedestrian environment that allow for a variety of daily needs to be met in the local area as a pedestrian. A mixture of residential and employment uses also help to balance transit trips as that travel occurs in both directions.

Capital investments can also be made to maintain or enhance bus-based transit service. These operational improvements are intended to either improve bus travel times to increase competitiveness with the auto, or to maintain travel times to preserve the frequency of service without needing to add additional vehicles. Techniques that can be implemented by a local jurisdiction include:

- Dedicated bus lanes or bus/bike lanes that remove the bus from congestion;
- Signal priority/preemption which gives the bus priority through signalized intersection;
- Queue jump lanes allowing the bus to move to the front of the queue at signalized intersections; and,
- Improved passenger loading facilities to reduce stop dwell time such as level boarding platforms or prepaid fare facilities.

Portland has conducted a systematic streamlining program focused on improving passenger access and bus movement through signalized intersection. The program produced an increase in passenger ridership, fares greater than the investment, and the results "achieved to date will result in long-term benefits for TriMet, as it postpones the year when a bus needs to be added to a streamlined route."[22] The full implementation of

[21] J Charlier, M Jacobsen, C Hernandez, B Herman, L Ellis, *Rail-Oriented Development: Strategies And Tools To Support Passenger Rail,* Colorado Department of Transportation, Research Branch*, 2001*

[22] Peter Koonce, Kittelson & Associates, Inc., Paul Ryus, Kittelson & Associates, Inc., David Zagel, TriMet, Young Park, TriMet, Jamie Parks, Kittelson & Associates, Inc*., 2006 An Evaluation of Comprehensive Tranist Improvements- TriMet's streamline Program, Journal of Public Transportation, 2006 BRT Special Edition*

these kinds of improvements and others result in bus rapid transit (BRT) service. BRT is typical described as "rail lite" and includes improved travel ways, distinct branding, low floored vehicles for level boarding, multiple doors, prepaid fares, and enhanced customer information such as real time bus location information. Depending on their level of implementation, operational improvements and BRT service have resulted in a 30 to 200 percent increase in transit ridership,[23] and there is growing evidence that the permanent investment in these bus-based transit facilities can produce the kind of real estate investment that results from rail transit.

Communities can also invest in passenger amenities, including features that increase the security, comfort and certainty of the transit patron. These commonly include fully accessible bus stops, lighting, shelters, seating, and route information but can now include real time information on bus arrival times and bus location. Such improvements have a documented positive effect on passenger satisfaction and attraction,[24] and are things that can be required of developers through the local development review process.

Finally, communities can include ongoing requirements and programs for transportation demand management. Transportation demand management (TDM) is a program of specific strategies that promote more efficient use of the existing transportation system by influencing travel behavior in terms of the time, route or mode selected for a given trip. TDM strategies manage the demand placed on the transportation system by increasing travel choices; encouraging the use of alternate modes – carpooling, vanpooling, public transit, bicycling, walking, and teleworking; and, reducing the incentives to use the single-occupant vehicle.

While a variety of TDM strategies can be applied and included in the development review process, managed and paid parking has been shown to have the greatest effect on land development and transit use. Transit mode shares are the highest to central business districts in large part due to managed and paid parking in these areas, which removes the subsidy to auto use represented by free parking. Donald Shoup provides the definitive analysis of the effects of free parking[25] and has documented repeatedly that excessive parking requirements are almost universally required by local governments. The minimum parking requirements contained in most zoning codes are based on a shaky foundation of limited data and a misunderstanding of its meaning,[26] and are the single biggest obstacle to creating a pedestrian and transit supportive environment. Even in transit poor environments, the simple strategy of parking cash out that allows the employee to choose to buy parking or keep the cash, results in at least an 11 percent mode shift away from the SOV.[27] In Boulder, Colorado, paid parking in the downtown and University activity centers

[23] National Bus Rapid Transit Institute Web site, http://www.nbrti.org/ , accessed 10/1/07

[24] Kittelson & Associates, Inc., KFH Group, Inc., Parsons Brinckerhoff Quade and Douglass, Inc., and K. Hunter-Zaworski. 2003. *TCRP Report 100: Transit Capacity and Quality of Service Manual*, 2nd Edition. Washington, D.C.: Transportation Research Board.

[25] Shoup, Donald, *The High Cost of Free Parking*, Planners Press, 2005

[26] Shoup, Donald, *The Trouble with Minimum Parking Requirements,* Transportation Research Park A 33, p. 549-574, Pergamon, 1999

[27] Shoup, Donald , *Evaluating the Effects of Parking Cash Out: Eight Case Studies*, prepared for the California Air

is a major contributor to increasing alternative mode share by a factor of two to six times over Boulder employees as a whole.[28] While politically difficult, the careful modification of parking requirements and pricing as part of a comprehensive TDM program in bus served corridors is the surest and most significant change that a local community can undertake to support transit.

Potential Sustainability Measures:

1. Percent of population within the trip shed of transit service, defined by transit type and service levels
2. Increase in pedestrian, bike and transit mode share within the transit service area, for both work and non-work trips
3. Increase in density and mix of uses within TODs and transit service corridors
4. Percentage of those living in TODs and transit corridors that use transit
5. Percent of managed parking within major destinations, and ultimately within the transit service area

Land Use Code Strategies:

Removing Obstacles

1. Remove or greatly reduce use restrictions within the zoning code to create mixed use environments allowing a variety of needs to be met locally as a pedestrian
2. Minimize planning and discretionary review time for projects in transit zones that are transit supportive

Incentives

1. Within transit overlay zones, provide incentives to landowners for pedestrian/transit supportive development by reducing parking requirements, encouraging shared parking, and allowing for increased density and a mix of uses
2. Allow for reductions in parking over time and corresponding increases in development based on the changing character of the area, TDM programs and travel behavior change.

Regulation

1. Move toward a form based code with a design emphasis on the pedestrian environment
2. Implement transit overlay zones within high service transit corridors to incentivize transit supportive development
3. Establish parking maximums and unbundled parking requirements in transit overlay zones

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Resources Board, 1997

[28] National Research Center, Boulder Valley Transportation Survey: Comparison of Survey Results, prepared for the city of Boulder, 2005

4. Establish and expand paid parking at major destinations with high levels of multimodal access
5. Increased density and housing choices in transit zones
6. Specify minimum densities or height requirements in select areas in the immediate transit zone
7. Require a complete and connected grid of streets at a pedestrian oriented scale of 300-400 foot block faces
8. Require a high-quality pedestrian design environment within major destinations and in the transit service area
9. Include transit stop enhancements as a requirement in the development review process
10. Include transit level of service in the traffic impact assessment required through the development review process
11. Require that buildings front the street with entrances serving pedestrians and transit patrons and include street-front parking.
12. Include an ongoing TDM program in development review requirements, including continued funding and monitoring of progress

Strategic Success Factors:

1. Create comprehensive and sustainable transportation demand management (TDM) programs as part of transit overlay zones that manage parking and promote walking, biking and transit use
2. Create a dialogue between city planners and city transit organizations to help plan transit stops and sites most likely to benefit from TOD
3. Work with transit providers to ensure frequent, high quality service and implement improvements in travel time and reliability