

Commission Briefing Paper 4D-08

Implications of Alternative Land Use Policies on Future Passenger Travel Demand

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Introduction

This paper is part of a series of briefing papers to be prepared for the National Surface Transportation Policy and Revenue Study Commission authorized in Section 1909 of SAFETEA-LU. The papers are intended to synthesize the state-of-the-practice consensus on the issues that are relevant to the Commission's charge outlined in Section 1909, and will serve as background material in developing the analyses to be presented in the final report of the Commission.

This paper presents information on the relationship between land use and development, transportation infrastructure, and the passenger travel demand in metropolitan areas, as summarized from past research.

Background and Key Findings

The findings presented in this paper are extracted from recent research reports and from well-established theories on urban transportation, development patterns, and travel demand behavior. References are included at the end. Key findings include:

- Current urban development patterns and transportation infrastructure reflect the influence of personal vehicles as the dominant technology for intraurban passenger transportation over the past half century. Existing urban infrastructure cannot simply be abandoned or easily reversed. Moreover, achieving significant changes to historic trends of development patterns will require strong constraints on land development and/or personal vehicle use.
- Development decisions made in the private sector are based primarily on economic principles; specifically, minimizing the costs of acquiring and developing land and maximizing the expected selling price for the developed units. Certain types of land use controls can change the economics of development decisions and thereby influence development patterns.
- Land use policies are typically implemented and enforced by local jurisdictions, while transportation planning and development is conducted by metropolitan or regional planning agencies. Competition for new development among local jurisdictions often undermines the regional coordination of transportation and land use policies. In addition, rapid turnover of staff and political decision makers in local jurisdictions often results in inconsistent and changing land use policies.

- The degree of access provided by transportation infrastructure is one of several factors that influence land development, but typically is not the primary factor. Moreover, in many metropolitan areas, new transportation infrastructure is often built in response to existing land development, rather than as a catalyst to shape future development.
- Microscale land use development (e.g., transit or pedestrian oriented mixed-use developments) can reduce some auto trips, but cannot replace the personal vehicle as the dominant transportation technology. Moreover, such developments will only be marginally effective in the absence of a coordinated regional land use policy.

The Role of Transportation in Shaping Urban Development

Transportation infrastructure is typically given too much credit (or blame) for shaping the growth and pattern of urban development. A review of the history of cities suggests that evolutionary changes in transportation technology had much more to do with the growth and pattern of urban development than did specific transportation projects.¹ Prior to the mid 1800's, virtually all cities were built at a scale commensurate with "walking" as the dominant means of transportation. Most major European cities, as well as early U.S. cities like New York, Philadelphia and Boston, were characterized by high residential densities, mixed land use, and narrow, dense road networks within an urban radius of no more than 2 to 3 miles.

With the introduction of steam railroads in the 1830's and electric streetcars in the 1890s, cities expanded outward along the rail lines. These rail lines enabled wealthy families, followed by the middle class, to escape living in the city core, but to still have access to downtown jobs, shopping and cultural attractions. Development in these rail corridors was predominantly lower density residential, extending outward for several blocks from the rail or streetcar line, but within walking distance of the station or stop. Many streetcar lines were actually built and operated at a loss by land developers, because they opened up large tracts of developable land to a growing middle class market. By 1920, the size of many major U.S. cities had expanded to 10 miles or more along the rail corridors, but with significant amounts of undeveloped "green space" between the corridors, which were beyond reasonable walking distance from a rail line or the original city core.

With the end of WWII, the rapid rise in automobile ownership combined with a number of factors to accelerate the growth of suburban development. These factors included the formation of new households and the resultant "baby boom"; good paying manufacturing jobs, which helped to create a large, consumer-oriented middle class; low-interest federal housing loans; and a vision of the "suburban lifestyle", which was now affordable to a large share of the population. The personal vehicle, combined with the rapid construction of expressways, the Interstate Highway System and other high quality highways, provided the necessary means of access to new communities located beyond walking distance to rail lines or the city core. Early residential development "bedroom communities" were soon followed by suburban employment growth both to support growing consumer demand and to take advantage of suburban labor markets. Households no longer needed to commute to the city core on a daily basis, and could move even further out to purchase larger homes at lower costs. Despite growing debate on the environmental and social consequences of these trends, this pattern of metropolitan growth has continued largely unabated for the past half century.

These trends in urban development are not unique to the United States. Most European nations are also experiencing increased suburban "sprawl" as new residential development moves outward from older urban centers.ⁱⁱ This trend is occurring despite Europe's significantly higher fuel prices (\$5 - \$6 per gallon), and the absence of government incentives for home ownership (e.g., low interest mortgages and mortgage interest income tax deductions).

Factors Influencing Land Development

Land development follows rational economic principles. Land developers seek to maximize profits by reducing their costs to purchase and develop land, and by selling the developed property at the highest price supported by the current market. Typically, land located on the periphery of an urban area is less costly than land located closer to the city center. Developers can often purchase large, contiguous tracts of cleared undeveloped land (e.g., farms), which allow them to build and sell more units while realizing economies of scale during the construction phase. By contrast, tracts located in built up areas are typically smaller, yielding fewer developed units, and often require additional costs to demolish existing structures or conduct environmental remediation.

Another important factor in land development is the duration and predictability of time and cost required to go from initial land acquisition to sale of the developed property. Longer times result in higher costs for construction loans. Construction times can vary significantly within a metropolitan area, depending on the zoning and building regulations imposed of local jurisdictions. Developers prefer to work in jurisdictions where zoning and building regulations are less restrictive, or at least predictable. This often favors outlying jurisdictions that are seeking new development and more willing to accommodate developer's requests.

Local jurisdictions can significantly influence the type of development that occurs in their area through land use and zoning regulations, and through financial incentives or disincentives that change the economics of land development. Examples include zoning regulations that favor high-density, multi-use development over low-density single-use development, real estate tax incentives for infill or "brownfield" development in established urban areas, and "impact fees" on new "greenfield" development to support public infrastructure improvements such as roads, schools, water and sewer, and public safety.

In 2004, the Urban Land Institute convened a panel of real estate and planning professionals to provide insights regarding the relationship between transportation infrastructure and local land use patterns.ⁱⁱⁱ The panel concluded that while regional transportation investment plays some role in land use planning decisions, it is rarely the driving force in these processes. Particularly in "green field" developments at the urban fringe, it is usually not feasible for developers to wait for transportation infrastructure improvements to be completed; so land development projects are often undertaken in anticipation of future construction of supporting transportation infrastructure.

New, large-scale land developments without adequate supporting transportation infrastructure place tremendous pressure on local jurisdictions to improve the existing infrastructure after the fact, in response to growing traffic congestion. Local jurisdictions, in turn, identify these improvements as priority projects in the regional transportation plan and/or transportation

improvement program (TIP). Consequently, metropolitan planning organizations (MPO) are put in the difficult position of including transportation projects to address traffic congestion caused by existing land developments, instead of planning transportation in coordination with future land development.

Institutional Barriers to Coordinated Transportation and Land Use

Perhaps the single greatest barrier to the effective coordination of land use and transportation policy is that in most metropolitan areas transportation planning is carried out at the regional level by metropolitan planning organizations (MPOs), while land use decisions are under the control of local, subregional jurisdictions. In addition to a disconnect between transportation and land use planning, local jurisdictions are in competition with one another to attract "desirable" development, and jealously guard their authority to approve, regulate and tax new development within their borders.

Federal laws and regulations requiring MPOs to coordinate with land use and other planning officials in developing long range transportation plans are helpful, but do not ensure that local land use policies will be consistent with, or supportive of, regional transportation plans. In metropolitan areas comprised of multiple local jurisdictions, regional land use forecasts often represent either an uncoordinated collection of local jurisdictions' development goals, or a politically negotiated compromise among the local jurisdictions, with no requirement that these forecasts be based on sound land use planning principles, or even that they are realistic. Nevertheless, these forecasts provide the regional distribution of future population and employment that are critical inputs to the travel demand forecasts developed by MPOs. In coordinating with land use planning officials, MPOs may (and often do) provide feedback on the reasonableness of land use forecasts, but typically have no authority to revise the forecasts on their own.

No federal department or agency has responsibility for overseeing land use planning in the United States. Land use policy, including zoning regulations, building codes, real estate taxes and impact fees, have historically been a State and local prerogative, and are likely to remain so into the foreseeable future.

The following sections describe various regional and local land development strategies aimed at changing travel patterns that have been implemented throughout the United States, and discusses what we know about the impacts these strategies have had on regional travel demand. These strategies are often defined collectively as "smart growth" policies.

Regional Land Use Strategies -- Urban Growth Boundaries

Some States, most notably Oregon, Washington and Tennessee, have enacted legislation to impose regional controls on urban land development through the establishment of "urban growth boundaries." Urban growth boundaries are regional boundaries established through state or local legislative processes, which circumscribe an urban area. Land development outside the boundary is strongly discouraged or prohibited, while inside the boundary, high-density land development is encouraged. Urban growth boundaries cannot be maintained without the imposition of regional land use controls that supersede local land use policies (e.g., granting of zoning variances), and designation of a regional agency to manage the boundary.

To date, the impacts of urban growth boundaries have been less dramatic than hoped for by advocates or feared by opponents.^{iv} In Portland, Oregon, for example, the urban growth boundary seems to have promoted higher levels of infill development than in similar sized western cities, while housing prices have increased at rates comparable to those in the other cities. On the other hand, Portland's urban growth boundary has not substantially curtailed the growth in personal vehicle use. Between 1982 and 2000, daily vehicle miles of travel (VMT) per capita in Portland rose by about 79 percent (from 11.6 to 20.8 miles/person/day). This is comparable to increases experienced in many other U.S. cities (e.g., Atlanta's VMT increase was 77 percent (from 19.8 to 35.1 miles/person/day)).

Oregon's urban growth boundaries were not designed to permanently freeze the size of urban areas, but rather to ensure that future urban growth is orderly and consistent with established land development densities and availability of supporting public infrastructure. By State statute, urban growth boundaries are to be re-evaluated at least every five years, and the boundaries expanded so as to maintain a 20-year supply of developable land within the urban growth area. Since Portland's original urban growth boundary was established in the late 1970's, the boundary has been adjusted more than 30 times, adding about 40 square miles or 9 percent to the original urban land area.

Perhaps the most significant transportation benefit of Portland's urban growth boundary is that the agency responsible for maintaining the urban growth boundary, Metro, is also the designated MPO for the Portland metropolitan area. This greatly facilitates coordination of land use and transportation planning in the Portland metropolitan area, and increases the likelihood that transportation plans will be supported by consistent land uses (e.g., incentives for high density development around light rail stations).

Regional Land Use Strategies – Jobs/Housing Balance

Another land use strategy that has been applied both at the local and regional levels is to control development within a specific geographic area (e.g., a local jurisdiction or county) so that the total number of jobs within the defined area is roughly equivalent to the total number of potential workers living within the area. The rationale for this strategy is that providing employment opportunities closer to where people live can reduce the average commuting distance within the region, because workers will be inclined to take jobs near their residences.

Research on the effectiveness of this strategy has been inconclusive, but suggests that measures of regional travel are relatively insensitive to changes in the jobs/housing ratio.^v One explanation for this insensitivity is that land use controls based on jobs/housing balance do not typically account for the need to match job requirements with labor force skills. While many entry level and lower paying jobs (e.g., retail sales) can draw from a large potential labor pool, high skilled technical and professional jobs can only be filled by a much more limited group of workers who may reside anywhere in the region. Consequently, having a good jobs/housing ratio in an area does not guarantee that the workers living in that area can (or even want to) fill the nearby jobs.

Local Land Use Strategies – Mixed-Use Development

A distinguishing characteristic of “sprawl” is large areas of single-use development (e.g., single family home residential developments and campus style office or industrial complexes). Single-use developments discourage non-motorized transportation modes like walking or bicycling, because of the large distances needed to travel to other activity destinations. By contrast, mixed-use developments, where different land use activities are built in close proximity to one another, can potentially reduce personal vehicle use for certain types of travel.

Local land use regulations may discourage, or even prohibit mixed-use development by specifying single-use (e.g., residential) zones with minimum lot sizes within those zones. Many of these zoning ordinances were passed to protect residential areas from “noxious” developments (e.g., trailer parks, junkyards), or to encourage a certain “class” of residential construction (e.g., 5-acre “mini-estate” lots). Restrictive land use policies like these often need to be revised or updated by local jurisdictions to support mixed-use developments

Research on the effectiveness of mixed use developments in reducing vehicle use suggests that the impacts are generally localized around the development, and vary depending on the type of activities present.^{vi} Mixed-use developments that combine personal business and convenience services (e.g., banks, restaurants, convenience shopping, etc.) with either major employment or higher density residential land uses, tend to have higher “internal capture” rates than other types of single- or mixed-use developments.^{vii}

Local Land Use Strategies – Pedestrian-Oriented Development

Pedestrian-Oriented Development (POD) represents a type of mixed-use development, which includes various design features and amenities to encourage walk trips within the development. Vehicular traffic is typically routed around the periphery of the development, along with parking and freight delivery points. Within the pedestrian area, amenities such as open concourses with benches, plantings, etc., are designed to create an aesthetically pleasing and safe pedestrian environment.

Pedestrian enhancements to mixed use developments appear both to increase the attractiveness of the mixed-use site as a destination, and at least in some instances, to decrease the share of all trips that access the site by personal vehicle. However, insufficient research has been done to conclude that PODs can reduce personal vehicle use beyond the immediate vicinity of the development.

Local Land Use Strategies – Transit-Oriented Development

Transit-Oriented Development (TOD) is yet another category of mixed-use development consisting of relatively high-density mixed-use development with convenient access to a regional public transit system (usually heavy or light rail). TODs often include a broader mix of land use types (e.g., high-density residential, office buildings, regional shopping, hotels, etc.), all within reasonable walk access to the transit station. TOD generally refers to new development in suburban areas, in contrast to older developed areas near the city core, which are already transit oriented and have considerably less travel by personal vehicle.

The effectiveness of a TOD in reducing personal vehicle use varies significantly, depending on the attractiveness of the development as a regional destination, and on how well the regional

transit system connects the development to other regional destinations and population centers. Establishing a TOD at a single station on a regional transit system may result in a small number of new transit trips attracted to the destination, but is not likely to have a significant impact on regional transit mode share or regional VMT. Alternatively, a regional transit system in which TODs are built at all (or most) stations creates sufficient concentration of residential, employment, and commercial activities to make transit a practical and attractive alternative to the personal vehicle for a significant portion of regional trips.

There is little or no empirical data to measure the impact that a network of TODs might have on overall regional travel because (1) no regional transit system built in the United States to date has specifically included a TOD at each suburban station, and (2) the long time frame (i.e., 20+ years) required to construct a fixed-guideway transit system introduces substantial confounding effects (e.g., economic cycles, demographic changes) that make it difficult, if not impossible, to isolate the direct effects of the TOD. All that can be said with certainty is that a network of TODs connected by a well functioning rail transit system can generate a significant number of regional trips in which transit is competitive with the personal vehicle.

Land use policies that appear to have the greatest potential impact on regional travel demand and reduction of personal vehicle use are:

- **Urban growth boundaries** – While the boundaries themselves may have less impact on development patterns than originally envisioned, implementation of urban growth boundaries requires establishment of a regional land use agency having some control over local jurisdictions' land use policies. Establishment of a regional land use agency is a critical first step in effectively coordinating land use and transportation at the regional level.
- **Transit-oriented development** – Construction of higher density, mixed-use developments with convenient walk access to transit stations maximizes the number of potential regional trips that for which transit can provide a competitive alternative to the personal vehicle.

Summary

The personal vehicle is the dominant transportation technology for intra-urban travel in the United States today, and will continue to be so into the foreseeable future. Potential changes in vehicle propulsion technologies (e.g., gasoline-electric hybrid vehicles, hydrogen fuel cells) will likely mitigate some of the negative environmental impacts of the internal combustion engine, but will not induce American travelers to eliminate or significantly curtail their use of personal vehicles. No other forms of transportation offer the convenience or mobility of personal vehicles, and therefore can be competitive only in specific circumstances, where the travel time and/or cost of using a personal vehicle exceed that of alternative transportation options.

For the past half century or more, urban land use and supporting infrastructure have developed in recognition of the dominant role played by personal vehicles. These development patterns cannot simply be abandoned or easily reversed. Any significant changes in existing land use patterns would occur gradually, replacing current structures as they age with higher density mixed-use developments. Moreover, efforts to reverse current development trends on a region-

wide scale will require the imposition of strong regulatory controls to counteract the economic drivers that influence current land use development.

An alternative perspective is presented in a report by The Brookings Institution, titled *Toward a New Metropolis*.^{viii} This report asserts that by 2030, about half of the buildings in which Americans live, work, and shop will have been built after 2000. The nation had about 300 billion square feet of built space in 2000. By 2030, the nation will need about 427 billion square feet of built space to accommodate growth projections. About 82 billion of that will be from replacement of existing space and 131 will be new space. Thus, 50 percent of that 427 billion will have to be constructed between now and then." While these projections may seem overwhelming, they also demonstrate that nearly half of what will be the built environment in 2030 doesn't even exist yet, giving the current generation a vital opportunity to reshape future development."

Transportation can play a supporting role in shaping land use development, but it can be effective only when done in concert with a proactive land use strategy implemented at the regional level. Regional land use policies need to supersede or at least provide bounds on local land use regulations, which are often inconsistent with regional development goals (e.g., single-use zoning laws). The Federal government has little or no authority to regulate land use at the State or local level. Consequently, major efforts to change future land use will likely have to be initiated by State or regional governments.

Land use can play a role in shaping and reducing the demand for transportation. However, given that most new development is not oriented toward reducing transportation demand, and that new development represents a small portion of total development in an urban area, changes in land use patterns will have only a marginal impact on total travel.

ⁱ "Transportation and Urban Form: Stages in the Spatial Evolution of the American Metropolis," in *The Geography of Urban Transportation*, by Muller, Hanson & Giuliano (eds.) The Guilford Press, NY (2004): Chapter 3.

ⁱⁱ *Urban Sprawl in Europe: The Ignored Challenge*, European Environment Agency Report, No. 10 Copenhagen (2006).

ⁱⁱⁱ *Influence of Transportation Infrastructure on Land Use*, Urban Land Institute Advisory Services Workshop Report, Washington, DC (2004).

^{iv} "Sprawl, Growth Boundaries and the Rehnquist Court," Lewyn, Michael, *Utah Law Review*, Vol. 1 (2002).

^v "Data Collection and Modeling Requirements for Assessing Transportation Impacts of Micro-Scale Design," report prepared for the Federal Highway Administration, Washington, DC (2000).

^{vi} *The Effects of Land Use and Travel Demand Management Strategies on Commuting Behavior*, Travel Model Improvement Program Report, Washington, DC (1994).

^{vii} "Internal capture" is defined as the percentage of total trips that are made internal to a development and do not use transportation facilities external to the area. See "Enhancing Internal Capture Estimation for Mixed-Use Developments, National Cooperative Highway Research Program Project No. 8-51, Phase I Report, (2006).

^{viii} *Toward a New Metropolis: The Opportunity to Rebuild America*, by Arthur C. Nelson, The Brookings Institution, Washington DC, December 2004.

**CONSOLIDATED COMMENTS FROM MEMBERS OF THE BLUE RIBBON PANEL OF
TRANSPORTATION EXPERTS - PAPER 4D-08**

One reviewer commented as follows:

This paper points out the quite limited prospects for overcoming reliance on ‘personal vehicles’ in the post-war metropolitan areas whose land-use patterns were developed in response to the wide availability of the automobile. It notes a wide range of economic and institutional constraints on effective coordination of transportation investment and land use policies in such areas. However, it may slight the potential for such approaches in revitalizing older cities, many of which have a legacy of transit systems and dense commercial and residential development. In such places, coordinated transportation and land use planning can channel growth toward development corridors defined by extended and upgraded transit services.