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# **Economic Growth in Urban Regions: Implications for Future Transportation**

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## 1. Economic Development of Metro Areas

A central tenet of urban economics is that households, businesses, and industries compete for urban sites that enjoy accessibility advantages – whether to jobs, labor markets, raw materials, or distributions centers. Transportation investments trigger economic growth by enhancing accessibility, particularly in fast-growing, congested cities. Scholarly work suggests the impacts are more *redistributive* than *generative* – that is, new highways, rail investments, and busways shift growth that would have happened regardless from particular corridors and subareas of a region to others as opposed to prompting firm relocations and new business investments in a region. Factors other than transportation, such as “quality of life”, are increasingly influencing location choices of middle-income households and firms that are footloose. Of course, transportation and quality of life are not unrelated – public opinion polls reveal that being stuck in traffic is often first on the list among factors that are blamed for a declining quality of urban living

A confluence of market forces and social transformations has altered America’s urban landscapes since the 1960s with profound implications for future transportation policy. The collapse and off-shoring of inner-city manufacturing matched by the expansion of service and knowledge-based industries and the globalization of economic production has strengthened the cores of cities like New York, Chicago, and Los Angeles. Globalization heightens the role of central cities as command-and-control posts in international networks of capital, services, and information trade and exchange, complemented by highly specialized labor markets (Hutton 2004). The easy access to resources such as labor, extensive business networks, and cutting-edge research performed at institutes of higher learning attracts both capital and entrepreneurs to urban areas. Consequently, metro areas are often at the center of the development of many new technologies, like biotechnology. Metro areas also offer new industries crucial amenities, including a diverse and ample supply of labor, financial and physical capital, access to national and international markets, and a local base of technical knowledge. Presently, their economies account for 86 of national output (Global Insights, 2006). Where economic activities gravitate, so do households. More than 93 percent of the U.S. population presently lives in metro areas.

As an industry matures, technological advances allow companies within that industry to move to non-urban locations. As a consequence, newer, faster growing industries tend to cluster within metro areas, while older, slower-growing industries are less tied to urban locations. The two key segments of the US economy – financial services and professional and business services – are almost entirely concentrated in metro areas. These sectors contain some of the most innovative and rapidly growing industries, like computer system design, management consulting, and biotechnology research.

The relationship between economic growth and transportation is often expressed in spatial terms – e.g., how the changing geomorphology of urban landscapes poses new challenges in building transport infrastructure; how road and transit investments shape urban growth; the changing role of ports and distribution networks in the global supply chain of in- and out-sourcing materials and products. Increasingly, however, the

relationship between economic growth and transportation are being expressed in temporal terms as well – e.g., the spread in time-of-day and day-of-week of travel; just-in-time inventorying and manufacturing; and the increasing unpredictability of when and where traffic congestion will occur. The new economy, and its spatial and temporal influences on transportation and cities, has profound implications for future transportation policy. Smart transportation policies and investments, I argue, are essential if America is to remain globally competitive. Past studies show that transportation is a linchpin to sustained economic growth. Accordingly, this paper aims to frame discussions about the role of future transportation in a global context and suggests pathways for promoting economic development of cities and regions in a sustainable context.

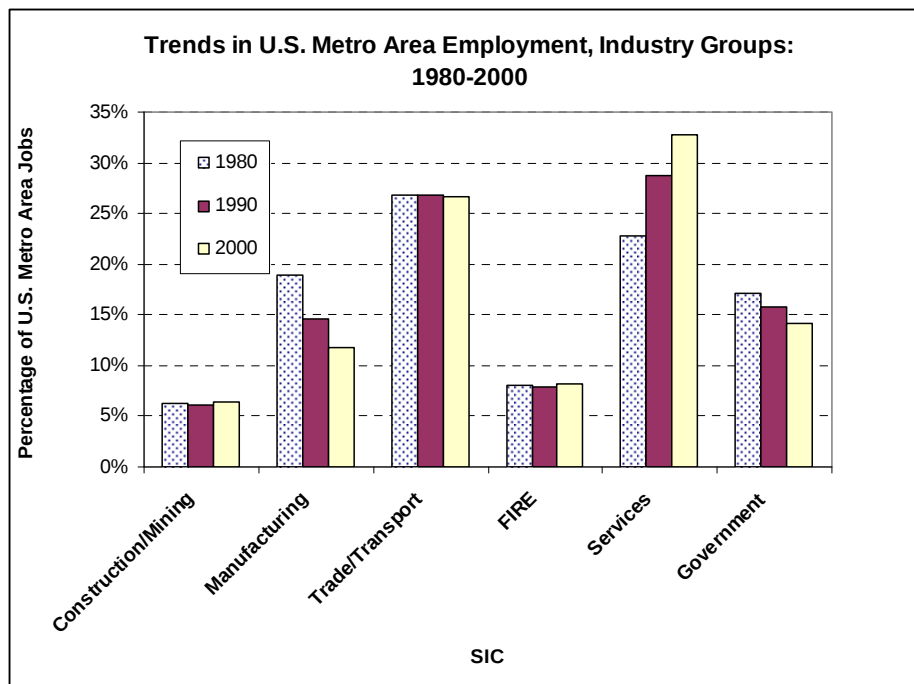
In what follows, changes in the economic make-up of U.S. cities are first discussed both for central and non-central areas. New types of employment clusters, like aerotropolises and telecommunities, are also examined. The new economy, I argue, demands new transportation approaches. The paper closes with discussions on the implications of new spatial-temporal arrangements for future highway and transit investments, and challenges policy-makers to pursue a program of sustainable mobility, urbanism, and finance.

## **2. Recent Economic Growth in U.S. Metro Areas**

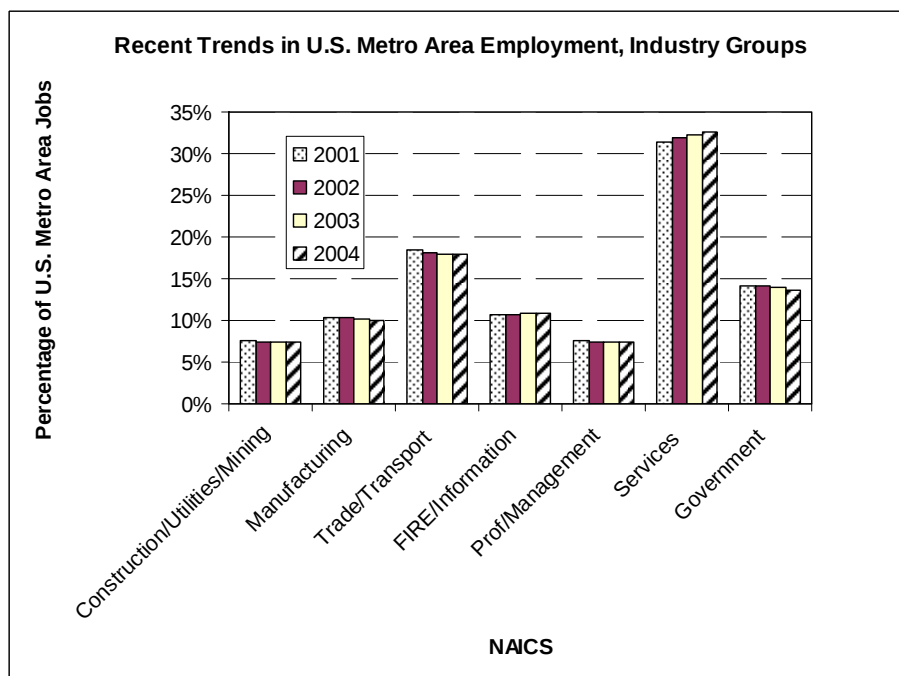
National statistics underscore the shifting nature of economic production and activities of U.S. metro areas over the past three to four decades. Most notable has been the decline in manufacturing matched by an increase in household and business services (Figure 1). During the 1990s, service-oriented cities outgrew manufacturing cities by a substantial margin (Glaeser and Shapiro, 2001). Since 2001 (when a slightly different industrial classification scheme was introduced by the U.S. Department of Labor), these patterns have continued, with expanding service-sector growth matched by a slight upswing in finance, insurance, real estate, and information industries (Figure 2).

The spatial implications of post-industrialization have been unequivocal. While in global cities, many headquarter functions have clustered in the financial and banking districts of central business districts (CBDs), in smaller U.S. cities that are far lower in the global hierarchy, most economic growth has decentralized to the suburbs and beyond. Even in global cities, economic activities are increasingly differentiated with front-office functions tending toward central locations and back-office and support functions spun off to outlying environs.

A combination of “push” and “pull” factors has been at play in influencing firm locations. Agglomeration diseconomies (e.g., congestion), crime and social problems, aging and obsolete infrastructure, among other factors, have “pushed” many firms to the periphery. The lures offered to companies to move outward include telecommunications advances, the attraction of lower property prices and taxes, proximity to labor markets and airports, newer infrastructure, municipal tax incentives, and quality of schools.



**Figure 1. Trends in U.S. Metro Area Employment by Industry Groups: 1980-2000.**  
Source: U.S. Department of Labor, Bureau of Labor Statistics;  
<http://www.bls.gov/oes/home.htm>



**Figure 2. Trends in U.S. Metro Area Employment by Industry Groups: 2000-2004.**  
Source: U.S. Department of Labor, Bureau of Labor Statistics;  
<http://www.bls.gov/oes/home.htm>

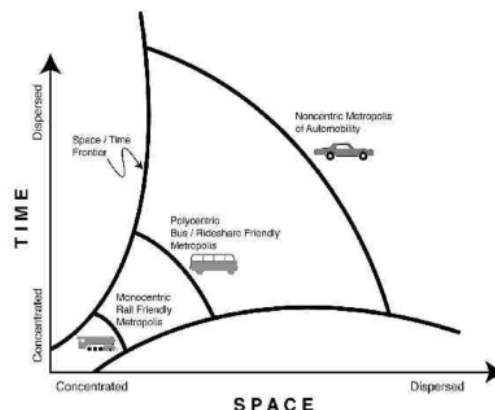
Telecommunication advances diminish the need for spatial proximity, hastening the pace of new growth on the metro edges and in far-flung rural townships (so-called micropolitan areas). As growth spreads in all directions, the mismatch widens between the geography of travel (e.g., tangential, cross-town, suburb-to-suburb) and the geometry of traditional transportation networks, which tend to be of a radial, hub-and-spoke design. Circuitous trip patterns and mounting traffic congestion, especially in the suburbs and exurbs and on orbital beltways, have resulted. The scatteration of travel has been well underway for decades, however notwithstanding smart-growth initiatives, market forces themselves presage no reversal of this trend.

Changing urban economies have formed new space-time arrangements, conspiring against most forms of movement other than the private car. Today, 92 percent of all U.S. trips to work and 86 percent of all trips are made by the private automobile (Pucher & Renne 2003). Figure 3 conveys the trend toward atomization in how Americans travel in a space-time context. The traditional monocentric city with concentrated activities (e.g., downtowns and 8-to-5 work schedules) supported point-to-point rail services reasonably well. As technology advances gave rise to polycentric settlements and less regular work schedules, more flexible forms of collective-passenger transport, like bus transit and carpools, prospered. As cities and the regions of the future become increasingly “non-centric” and “edgeless”, and time schedules less certain and predictable, the frontier of space-time possibilities continue to fan outward.

### 3. Changing Urban Economies within Metropolitan Areas

It is too simple to describe the changing economic and spatial-temporal make-up of cities as complex, atomized, and diffuse. Patterns vary by sizes, economic bases, and ages of U.S. cities as well as by locations within metropolitan regions themselves. This section focuses on shifting economic activities within specific sub-areas: central cities and CBDs; traditional suburbs; subcenters and edge cities; and exurban, “edgeless” settings.

SPACE / TIME CONTINUUM OF URBANIZATION AND TRAVEL



**Figure 3. Space-Time Diagram of Contemporary U.S. Mobility Demands.**

Source: Cervero, 2005.

### 3.1 Central Cities and CBDs

The central areas of many, though not all, U.S. cities have rebounded since 1990, fueled by the new economy and changing demographics and lifestyle preferences. Central cities enjoy a locational advantage in industries that value agglomeration: information technologies, producer services, arts and cultural productions, health care, and higher education. Since these activities are intimately tied to the global economy, the downtowns of America's "global cities" have generally weathered the economic times quite well; those that are not, have not.

Why are downtowns important in a global economy? Because knowledge-based activities rely upon spatial agglomerations to facilitate transactions and allow face-to-face contact. The mediation of information, because most of it is new and non-standardized, necessitates face-to-face interaction, crucial for learning, building trust, and reducing risks (Storper and Manville, 2006).

What does the increasing importance of agglomeration mean for transportation? Services and information brokering that gravitate to the city core are generally less land-consuming than traditional manufacturing. This makes them potentially viable loci for radial-based public transit services. High-end transit/high-speed trains can appeal to the market of time-sensitive, high-salaried central-city workers, particularly in the largest metro areas (where heavy rail services already exist). The potential receptivity of these workers to transit is tempered somewhat, however, by their high car ownership levels as well as the stochastic, unpredictable nature of daily work schedules in the information-age economy.

While CBDs remain pre-eminent centers of employment and for most large U.S. cities retail transactions, their economic standing within the regional landscape is generally slipping, even in global cities. Less than 22 percent of metropolitan employment lies within three miles of the center city of major U.S. metro areas (Glaeser, Kahn & Chu, 2001). Some observers note that city economies are not isolated from those of their suburbs, and that agglomeration economies are increasingly regional in scale in all except the largest central cities (Hill and Brennan, 2005). Except in the biggest cities, central areas are no longer regional employment incubators. Job growth in central cities depends, for the most part, on healthy regional employment growth.

In part because the regional economies of many traditional industrial cities continue to languish, downtown job growth in recent years has been uneven. Global cities like New York City, San Francisco, and Washington, D.C. have seen their downtowns prosper although in relative terms, the fastest growing central cities over the past decade have been smaller: Austin, Orlando, Raleigh, Billings, and Charlotte (Hill and Brennan, 2005). All metro areas in Pacific Census Division had central cities that gained jobs during the 1990s, though at a slower rate than their suburbs (Hill and Brennan, 2005). Population also grew the fastest in western cities during the 1990s. On the whole, however, the share of metropolitan employment located in central cities has declined. On the opposite

coast and in the Midwest, the central areas of most medium and large cities have stagnated or lost jobs.

### ***Changing Demographics and Attractions of the Core***

The recipe of “sun, skills and sprawl” as precursors to post-war urban growth, advanced by urban economists like Edward Glaeser, while mostly right, finds exceptions. Central city labor needs residences and while historically labor has opted for suburban domiciles, gentrification of the inner core is gaining steam in many settings. A number of large cities that are enjoying a resurgence, like New York and Boston, have higher levels of college-educated residents than their populations as a whole (Drennan, 2002). During the 1990s, population growth in cities with highly educated populations out-paced others (Glaeser and Shapiro, 2001). Why? One explanation is agglomeration economies: high-skilled people follow the firms that hire them. Another is amenities. Many older cities enjoy a cultural, aesthetic or consumerism advantage over others, helping them attract people with high levels of human capital. Richard Florida’s (2002) famously labeled such people the “creative class” and has argued that particular packages of amenities, like cafes, galleries, music and a generally bohemian, tolerant atmosphere, are strongly correlated with the presence of knowledge workers and growth (Storper and Manville, 2006). Increasingly, central cities are “chic” places to reside, offering loft living, artist quarters, convention centers, multicultural restaurant districts, creative professional-class neighbors, and shiny glass and steel towers of the post-industrial economy. Their appeal is thus to a niche market of mostly non-traditional households. More and more local officials from rustbelt cities are embracing the “ACE” (arts, culture, entertainment) model to grow their local economies. The governor of Michigan, after reading Florida’s *The Rise of the Creative Class*, urged her state’s mayors to form a “Cool Cities” advisory board.

The contrast of “new” versus “old” deserves further discussion. In “sunny and sprawling” cities like Orlando and Las Vegas, growth tends toward the fringes. In “cold and old” cities like Boston and New York, however, it is tilting inwards (Storper and Manville 2006). “Modern” cityscapes are passé and “oldness” is “in”. Since 1990, a majority of Northeastern and Midwestern cities over 500,000 – among them New York, Chicago, and Boston – grew in population and jobs (Glaeser and Shapiro, 2003). Their appeal is to a unique market niche. For lifestyle reasons, the creative class is drawn by the Jane-Jacobs-style cities of serendipity and diversity. Central cities offer colorful, neighborly, and traditional enclaves. They are also cherished for their diversity and durability in housing stock. As suburbs decline, they tend to be less amenable to redevelopment because they have mostly homogenous housing stocks and non-residential buildings of roughly the same age (Lucy and Phillips, 2006). Resurgence of big cities is also due to reductions in crime which itself is tied, in part, to increased social interaction (Jane Jacob’s notion of “natural surveillance” and “eyes on the street”) (Glaeser and Gottlieb, 2006).

While some “old cold” central cities gained population in the 1990s, the dominant trend of residential movement nonetheless remains towards the suburbs, even among sub-

groups such as immigrants. Many more people leave central cities than enter them (Storper and Manville 2006). Downtowns are unlikely to ever be big residential nodes. In 2000, they accounted for less than one percent of the nation's population (Birch, 2002). However who is coming in central cities "matters". Almost two-thirds of the households moving to center-city San Francisco between 1985 and 1990 were in the top two income quintiles, as were over 40 percent of Boston's immigrant households over the same period (Storper and Manville 2006).

Gentrification and the emergence of non-traditional neighborhoods and households in central cities could give rise to non-traditional transportation solutions. Older cities were designed in the pedestrian era, thus they are generally unpleasant places to drive and horrible places to park. High urban densities correlate with high traffic densities. Need this always be the case? At the extreme are settings like Manhattan where the majority of trips are by foot and just one in two households own cars. In Boston, San Francisco, Seattle, and Portland, carsharing has gained popularity as an alternative to full-blown car ownership. Abroad, London's mayor, Ken Livingstone, sought to reduce the "dis-amenity" of central-city traffic congestion through the bold step of introducing cordon tolls. Some U.S. cities have sought to tame auto travel through techniques like traffic calming, street diverters, and even the removal of elevated freeways. Portland, San Francisco, Boston, Milwaukee have torn down inner-city elevated freeways, replacing them with boulevards and enhancing waterfront access in hopes of regenerating urban districts and removing eyesores and barriers. Chattanooga recently removed several lanes from a wide thoroughfare that hugs its river banks, what some call "road dieting". Reducing the presence of cars helps restore central cities to their original designs as pedestrian-oriented places. Advocates of traffic calming aim to return cities back to the fabric of the traditional walking city. Moreover, freeway removals and road dieting suggest a re-ordering of urban priorities – less emphasis on swift movement and more on livability and quality-of-place. Central-cities are not about to become car-free, however. In core areas, suburban-style malls and supermarkets are opening to cater to the childless couples, empty-nesters, and Generation X'ers (e.g., Norfolk's MacArthur Mall). Even Wal-Mart wants to open a store in Manhattan.

While powerful economic and demographic megatrends mostly explain urban regeneration, public policies have also played a role. Take Philadelphia, for example. There, urban regeneration has been spurred by four policies: fiscal strategies (tax abatements for office/factor conversion, TIF), regulatory devices (zoning amendments, new school boundaries), capital improvements (cultural, tourist, public space upgrades), strengthening organizations (private consortia for amenities, open space conservancies) (Birch, 2006). Thanks to tax abatements offered for building conversions, over the past decade some 110 class-B office and factory buildings have been converted to more than 7000 residential units. Many refurbished buildings have ground-floor retail. Surveys reveal a high percentage of Philadelphia's residents walk to work.

### ***Working Class Rings***

While popular accounts of urban regeneration focus on downtowns and centuries-old

neighborhoods, traditional working class districts that ring some of the nation's biggest downtowns are also rebounding, such as Hoboken and Jersey City in northern New Jersey and Oakland on the other side of the San Francisco Bay. Inner-ring cities near CBDs of global renown enjoy a halo effect, reaping the benefits of proximity and offering lower land prices and rents. According to Puenes (2006), being in the center of their metro regions, central cities and first-tier suburbs are poised to absorb a large share of growth of the next 20 years.

Transportation investments could further spur urban renaissance – such as the opening of the Hudson-Bergen LRT line (Jersey City), Metrorail in Arlington County (Rosslyn-Ballson corridor), and the running of frequent ferry services (e.g., Manhattan to Hoboken). Between 1993 and 2001, Jersey City posted the nation's biggest increase in central-city market share of metro jobs: 9.9% (Hill and Brennan, 2005). The loss of some 12 million square feet of office space in southern Manhattan following 9/11 has further increased this number, in part because of Jersey City's good rail access and "direct line of sight" to the lower tip of Manhattan.

### **3.2 Suburbs**

Despite central-city gains in employment and sometimes population, on the whole, American cities continue to decentralize. In all but the largest and densest metropolitan areas, the locus of economy activity has migrated outward, forming a new geomorphology of economic production – sprawling corporate enclaves, business parks, power centers, and other "non-nodal" forms of "edgeless cities" (Lang, 2002). Today, all U.S. metropolitan areas (with the exception of New York and Chicago) have the majority of office space outside of traditional downtowns. While 38 percent of all office space in U.S. metro areas was located in primary downtowns in 1999, nearly the same amount (37 percent) was found in highly dispersed clusters with less than 5 million square feet of space (Lang, 2002).

The contrast between global and "other" U.S. cities is again worth noting. For the most part, employment decentralization in global cities has been in the form of back-office and support functions being spun off to office parks and corporate campuses where real estate prices are lower than downtown, tied to front offices via the world wide web. In the case of non-global cities, almost all private-sector activities involving economic production has migrated to the suburbs and beyond. There, downtowns are largely populated by institutional land uses, some mid-level retail, and occasionally sports venues and university campuses.

In both global and non-global cities, employment decentralization has followed the suburbanization of housing of earlier decades. In the aggregate, American central cities lost population every year between 1985 and 2000, while American suburbs grew in all those years and American rural areas grew in all but one (US Census Bureau 2004). The median resident today lives more than 9 miles from the center city. The median employee works 8 miles from the city center (Glaeser and Kahn, 2000). The trend toward decentralization is most pronounced in fast-growing sunbelt cities and least

pronounced in U.S. cities more than 200 years old.

America's population recently eclipsed the 300 million mark. Gains are due less to natural population replacement and more to immigration and appreciably higher birth rates of immigrant households. No longer are most immigrants bound for the central city, however. By 2000, slightly over half of immigrants in the U.S. lived in suburbs and their growth rates in suburbs exceed those in the central city (Singer 2004).

### **3.3 Exurbs and Beyond**

The fastest growth is occurring beyond the suburbs of the 1950s, 60s, and 70s. Today, around 6 percent of those living in large U.S. metro areas reside in exurbia, with far-fringe areas growing more than twice as fast as their respective metropolitan areas (Bebue et al., 2006). Many micropolitan areas beyond the traditional orbit of metropolitan areas are growing even faster. Since the early 1990's, California's fastest growing county has been Placer, stretching between Lake Tahoe on the Nevada border and the suburbs of Sacramento. With 306,000 inhabitants and a 5% annual growth rate, Placer County has morphed within a fairly short time from rural countryside to a micro-metropolis of bedroom communities, second homes, and telecommuters.

The trend to weekly time budgets partly explains the explosive growth of far-flung counties like Placer. In the traditional economy, workers chose residences so as to maintain an average commute of 30 minutes or so, referred to as time budgets. With more workers telecommuting two or three days per week, increasingly time budget expenditures are being viewed on a weekly basis. The idea of spending two or more hours getting to work is more and more acceptable if it has to be done only a few days per week.

In the biggest metropolitan areas, the lack of affordable housing has pushed growth even farther outward. The quest for affordable housing not only spreads the laborshed of cities but also leads to leapfrog growth. Meteoric rates of growth in places like Bakersfield and Las Vegas are largely a product of workers fleeing high housing costs in Southern California (Hill and Brennan, 2005).

The transport implications of exurban growth are unequivocal. As employment densities go down, drive-alone commuting goes up. With abundant free parking and sparse transit services, not surprisingly most office park workers drive alone. The atomization of employment partly explains growth in drive-alone commuting to 78% according to 2004 American Community Survey. Scatteration of jobs has also increased suburb-to-suburb commuting, which constituted 46% of all work trips in 2000 (Pisarski, 2006). For these trips, the private car is really the only game in town.

Not everyone is so rosy about the future of micropolitan development. Small, remote communities and regions dominated by single industries are increasingly unsuited to global competition, sometimes suffering from out-of-date infrastructure and undereducated workers. They are also criticized for their sterility and shortages of

cultural offerings. Architectural critics contend that adaptive reuse and infill of office is key to sustaining the viability of edgeless growth. In the book, *Suburban Nation*, Andres Duany and his co-authors write: “If suburbia is to thrive in the 21<sup>st</sup> century, a place must be created that captures the imagination of the young, educated ‘creative class’. No longer seduced by office parks with outdated marble lobbies, these workers are attracted to loft living and downtown intensity that reflects their self-image as ‘workers-as-artist’”. One notable example of an adaptive re-use of a standalone building is the Mockingbird Station, a mixed-use urban ‘chic’ project, on Dallas’s light-rail (DART) line. In 1997, developer Ken Hughes bought a seven-acre property with an abandoned Western Electric building and proceeded to convert it to a retail-entertainment-apartment complex, retaining the original brick walls and large jalousie windows. The commercial and residential units today enjoy 30% to 40% rent premiums over comparable suburban uses.

### 3.4 Subcenters

More concentrated forms of suburban employment growth, coined “edge cities” by Joel Garreau (1991), flourished between the mid 1980s and mid 1990s but have lost market shares to edgeless patterns of office park and stand-alone building growth over the past decade. Subcenters tend to cluster near suburban freeway interchanges and to a lesser extent, rail stations. They are sometimes schizophrenic in their site designs, on the one hand featuring mid- and even high-rise buildings yet on the other designed and parked for automobile access and circulation. Pedestrian amenities are often few and far between.

Edge cities are well positioned to rebound in coming years due to growing dissatisfaction with edgeless environments. A survey of nonresidential developers by the Urban Land Institute and Price WaterhouseCoopers (2004) asked in which of types of areas do they expect to invest over the next several years. Four of the top five factors influencing siting were: proximity to transit stations, in pedestrian-oriented suburban business districts, in inner ring suburbs, and in central business districts. At the bottom were such locations as suburban strip commercial centers, in suburban business parks, and exurbia.

Some edge cities are experiencing a second generation of development: a make-over of strategic infill, land-use diversification and often transit-orientation and pedestrian-friendly streetscape design. In *Transforming Suburban Business Districts* (ULI), Geoffrey Booth contends: “It’s all about quality of life. People and employers are looking for more vibrant, pedestrian-friendly, live-work-shop places” – what is called the “place-making dividend”. Atlanta’s Linbergh MARTA station area could be a bellwether. Some 1.3 million square feet of office space, retail shops, and a hotel, plus residential condominiums, are being built on an 11-acre MARTA park-and-ride lot. One of Atlanta’s largest companies, BellSouth, is the project’s anchor tenant. BellSouth’s move to the Lindbergh site reflected a corporate decision to relocate scattered suburban offices to a inner-suburban transit node in response to growing employee frustration over traffic congestion and a perceived eroding quality of life. The consolidation of its offices into three new centers over the next few years will mean 80% of company employees in metro Atlanta will work near a MARTA station, compared to 30% today.

Sub-centers like Lindbergh are building blocks for regional networks of high-quality, functional transit services. Besides employment, they are natural locales for transit oriented housing as well. According to the Center for Transit Oriented Development (CTOD, 2004), half of new housing needs in metro areas with rail could be met within a one-half mile walking distance of existing or planned fixed-rail stations. Chris Nelson (2006) argues that rising demand matched by a limited supply of transit-served, walkable locations will make them good places to invest.

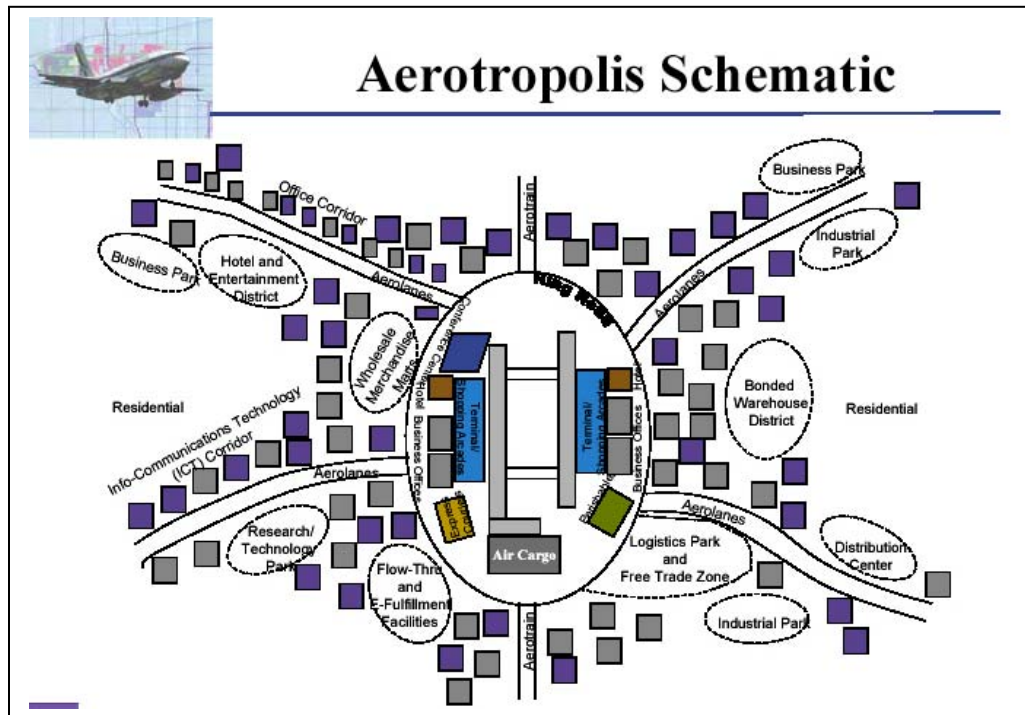
If planners have their way, Tysons Corner in northern Virginia, long a poster child of everything that can go wrong with car-oriented edge city development, could become a transit-oriented sub-center. Efforts are underway to extend Metro to Tysons complemented by a circulator system. FTA recently approved the \$4 billion 23-mile extension of Metrorail from West Falls Church to Dulles and Loudon County, to be funded by federal government, betterment assessments among benefiting land-owners, and Dulles Toll Road receipts.

#### **4. Airports: The New Employment Hubs**

Airports and their immediate environs are increasingly the economic hubs for the non-service components of the new economy. New economy products such as microelectronics, pharmaceuticals, aerospace components, medical devices, and other high value-to-weight, time-sensitive products account for more than 80 percent of international air cargo. Presently, 2.8 million jobs, or 2.5% of the nation's total, are located within a 2 ½ mile radius of the main terminals of the 25 busiest airports (Appold and Kasarda, 2006). Within a 5 mile radius, the share is 16.5% of all jobs.

Airports increasingly guide the growth of both edge and edgeless cities. Over 60,000 are employed on-site at Atlanta's Hartsfield-Jackson airport, exceeding the U.S. census definition of a metropolitan area central city. Twenty-five of America's largest airports average 29,000 employees. The daily population traveling through Atlanta's Hartsfield-Jackson Airport, the world's business, is over 227,000 (Appold and Kasarda, 2006).

One model, advanced by John Kasarda (2001), for organizing the various ancillary activities in and around airports is the "aerotropolis" (Figure 4). In the global supply chain of economic production, airports are natural logistics points for assembling and distributing products. Today's most competitive manufacturers use advanced information technology and high-speed transportation to provide fast and flexible responses to customers' unique needs. Such firms build agile production systems that quickly connect them to their suppliers and customers, allowing them to source parts and ship assembled products as needed. A manufacturer's ability to meet customer demand depends on the existence of a comprehensive ground-to-air shipping network of air cargo carriers, trucking companies, freight forwarders, and logistics providers. This network has been strengthened as demand for time-sensitive manufacturing and distribution grows. Made possible primarily by proximity to an airport, a ground-to-air shipping



**Figure 4. Aerotropolis: Global Sourcing Subcenters.**

Source: J. Kasarda, Kenan Institute of Private Enterprise, University of North Carolina.

network allows manufacturers to minimize their inventories, shorten production-cycle times, and quickly access novel inputs for custom products that create additional value (Kasarda, 2006).

Increasingly, knowledge-based activities are also congregating around airports. Firms specializing in information and communications technology and other high-tech industries consider air accessibility especially crucial. High-tech professionals travel by air at least 60 percent more frequently than other professionals, giving rise to the term “nerd birds” for commercial aircraft connecting “techie” capitals such as Austin, Boston, Raleigh-Durham, and San Jose (Kasarda, 2006). Many tech firms are locating along major airport corridors, such as those along the Dulles Airport access corridor in Northern Virginia and the expressways leading to Chicago’s O’Hare International. In this sense, knowledge networks and air travel networks increasingly reinforce each other.

Areas around airports are also increasingly attractive to hotels, restaurants, shopping, conference halls, fitness centers, and entertainment facilities. Airport areas are even developing their own “brand” image—“the DFW Area” and “the O’Hare Area,” for instance. In the case of DFW, a 6 million square foot building, Infomart, was recently built near the airport to allow buyers, sellers, and brokers of fashions and durable goods like home furnishings and appliances to assemble from around the world to comparatively shop among product lines. Thus, airports are even becoming the new “garment districts” for comparative shopping.

Kasarda's aerotropolises are 21<sup>st</sup> century edge cities and in some settings, the second downtowns. Chicago's O'Hare Airport, 14 miles from the loop, has over a half million jobs within 5 miles. Las Colinas, a 12,000 acre master-planned airport-linked city just east of DFW has 25,00 residents, hosts more than 98,000 employees in 21.4 million square feet of office space (including world headquarters of ExxonMobil), and 8.5 million square feet of light industrial and distribution space (Kasarda, 2006).

As more and more activities converge on airports, so does traffic congestion. This poses a threat to just-in-time production and delivery systems that rely on agility and predictability. Truck-only tollroads have been proposed for the Hartsfield-Jackson airport area of Atlanta as well as the congested central city. Fixed-guideway transit serves a number of U.S. airports, though critics note they generate relatively few riders and are very expensive to build (De Neufville, 2006). While many professional-class rely on private cars to reach airports, high-quality demand-responsive shuttles could appeal to some business-persons if a network of HOV and HOT lanes provided travel-time advantages.

## **5. Telecommunities**

The number of Americans working at home doubled over the 1980-2000 period, increasing by 2 million. With the atomization of America's workforce – i.e., post-Fordist trends toward contingent labor, subcontracting, part-time workers, sole proprietors, cottage industries, independent software programmers and other cyber-workers – nearly 4% of U.S. workers now work at home. In *Commuting in America III*, Alan Pisarski (2006) calls this a "quiet revolution".

As telecommunications and IT continue to liberate companies and their workers from the need for spatial proximity, communities are being built that cater to the needs of those who often work at home. Telecommunities, designed and marketed to software programmers and other IT workers, are changing traditional time-budget theory as we know it. For example, the city of Montgomery far north of Toronto has been designed (e.g, laced with fiber optic cable and broad-band width buildings) and marketed as a mixed-use community suited to telecommuters who only need to make the 100-km long trek to their main office in central Toronto once or twice a week.

Another vision of the telecommunity is a satellite location that is E-connected to a main office. La Plata, Maryland in rural Maryland is one example. La Plata is being designed as a telecommunity, comprised of a workforce serving head-offices in metropolitan Washington D.C. via the internet from home offices and neighborhood telework centers. The town, built according to New Urbanist principles and slated as the back office home for the U.S. Department of Homeland Security, is to be populated 24 hours a day, 7 days a week

## 6. Transportation Initiatives for the Future

Investment in transportation infrastructure is critical to sustained economic growth. Mobility, studies show, is absolutely essential to economic productivity and thus remaining competitive in the global economy. An international study found every 10 percent increase in travel speeds, labor market expands 15 percent and productivity by 3 percent (Banister and Berechman, 2000). In a San Francisco Bay Area study, every 10 percent increase in commuting speed increased work output by 1 percent (Cervero 2001). The larger the labor marketshed, research shows, the higher the labor productivity.

Since most people and goods move in private rubber-tire vehicles, highway advocates argue that new investments in high-speed, high-capacity limited-access facilities is woefully needed (see the Reason Foundation's *Mobility Project*: <http://www.reason.org/mobility/index.shtml>). Proponents point to the recent work of Shirley and Winston (2004) that showed during the 1970s, highway investments generated rates of return of 15% or more by helping businesses reduce logistics costs and enabling firms to adopt just-in-time manufacturing. Highway spending raises productivity by lowering assembly and distribution costs and increasing the speed and reliability of highway transportation.

While some authors suggest road investments redistribute rather than induce new growth, Boarnet (1998) argues that highway capital improvements are not a zero sum game, in which the entire output enhancement in the vicinity of the improvement is simply shifted from somewhere else. His evidence suggests that firms that move to benefit from highway improvements expand at the new site so that total output rises. The most persuasive evidence of benefits comes from studies on production costs. Bhatta and Drennan (2003) find from a literature review that the estimated cost elasticities (production costs as a function of transportation infrastructure investment) range from -0.05 to -0.21.

### 6.1 Road Expansion and Construction

One-third of the nation's population – 98 million Americans – live in metro areas where the average person spends 40 hours – one entire work week – “stuck in traffic” (Downs, 2004). Worsening congestion combined with increases in complex travel patterns and suburb-to-suburb commuting has prompted calls for an accelerated program of road construction. Stanley (2006, p. 23) envisages a web-based transportation network of the future – “a new tier of roadway is needed to accommodate the complex traffic environment of the contemporary urban area”. According to David Hartgen and Gregory Fields (2006), 42,000 lane miles need to be added in 403 urban areas over the next 25 years to eliminate all LOS F. Value-pricing tollways are viewed as the most expedient and cost-effective means of financing such outlays. In the case of traffic-snarled Atlanta, a recent Reason Foundation analysis calls for a network of express toll lanes added to the entire freeway system, several bypass tunnels, and a separate toll truckway system at a total price tag of \$25 billion (Poole, 2006). If history tells us anything, however, it is that in congested settings and in the absence of strong regional land-use controls, new road

capacity will induce new growth and alter travel demand, and within a few years, a good share of added capacity gets consumed (Cervero 2003). Clearly, road expansion and land-use management need to go hand in hand – an important element of smart growth.

Many regions have turned to HOV (high occupancy vehicle) facilities over the past two decades to promote efficiency in travel. Despite investing hundreds of millions of dollars in HOV lanes during 1990s, carpooling's market share of commutes has been steadily eroding. The share of commuters pooling to work declined from a nationwide average of 13 percent in 1990 to 11.4 percent in 2000 (Poole and Orski, 2003). Between 1980 and 2000, carpooling's share of commute trips declined by 7.5 percentage points. Most are today made up of two-person family members, prompting Pisarski (2006) to call them "fam-pools". In metropolitan Washington, D.C., traditionally one of America's strongest vanpooling markets, ridesharing noticeably fell over the past decade, rooted in the shift from predominantly government to increasingly high-technology employment. Many of the region's software engineers and Internet-industry workers keep irregular hours and rely on their cars during the midday, making it nearly impossible to share a ride to work. In light of these trends, some call for HOT (high occupancy toll) lanes in lieu of HOV lanes. The proposed network of value-priced toll lanes in Atlanta would replace the currently planned (but only partially funded) set of HOV Lanes (Poole, 2006).

## **6.2 Transit Investments**

Urban rail investments have been credited with strengthening urban centers and supporting polycentric patterns of suburban development (Cervero, 1998). By one estimate, some 50,000 predominantly white-collar office jobs were able to locate in downtown San Francisco than could have otherwise been accommodated as a consequence of investing in the BART radial heavy-rail system because of bridge capacity limitations (Cervero and Landis, 1997). Not only did downtown San Francisco prosper but so did the entire Bay Area economy from the resulting increases in agglomeration that enabled San Francisco to compete as a knowledge-based global city. Rail investments, however, have come at a high financial cost, consistently exceeding estimated construction costs and falling well short of ridership expectations.

While in most small to medium size areas, public transit carries fewer than 5% of commute trips and only 1% to 2% of all trips, metro areas with worsening congestion have witnessed some growth in transit. In 2000, 19% of commute trips in metro areas with 1-5 million inhabitants were by public transport (Pisarski, 2006).

Might the new economy and its unfolding spatial arrangement present new opportunities for public transit investments? To the degree growth continues to disperse to lower density settings, bus-based transit is best suited to serving the many-to-many nature of travel. To the degree that transit oriented development (TOD) can be achieved, producing many-to-few travel patterns, dedicated busway facilities might be justified.

We must be reminded of the importance of tying urban transportation investments to smart public policy – that is, making sure the appropriate policy "software" accompanies

investment “hardware”. An example is the flexing of parking and mortgage-qualification standards for housing near new rail investments. Studies, for example, show that around 30 percent of households residing within a half-mile of California rail stations do not own cars (Lund et al., 2004). Lowering the standard requirement of two spaces per unit to one or 1 ½ spaces per unit can reducing housing expenses by as much as \$40,000 per unit in the case of tuck-under, podium parking. This frees up income for housing purchases, a factor that should be weighed in qualifying TOD households for home mortgages. Policies like flexible parking standards and location-efficient mortgages acknowledge that outlays for transportation and housing – among the biggest concerns in large metro areas according to public opinion polls – are “bundled”. Integrating the bundled good of housing and transit can yield real economic gains. In Portland, Oregon, arguably the best example of housing and transit integration among medium-size U.S. cities, the two commodities consume 51% of the typical household’s earnings; in more car-oriented Atlanta and Miami, the figure is in the 55% to 58% range (Dunphy, 2004).

### ***Circulator Systems***

The second-generation infill of edge cities and retrofit of campus-style office parks present opportunities for on-site transit circulator systems. Several edge cities are proposing automated group transit (AGT) and people-mover investments to cope with the “last mile” problem – the reality that in most suburban settings, public transport does not connect workers from their drop-off stations to their final destination (often a good mile or more away). The prospect of waiting 20 minutes for a shuttle bus, particularly when parking is free, is an unacceptable proposition to most suburban workers.

AGT and other forms of high-performance, grade-separated circulator connectors are presently being closely studied for both aerotropolises (e.g., Heathrow and Dubai) and edge cities and office parks from the 1980s – Stanford Business Park and Hacienda Business Park in the San Francisco Bay Area, Denver Tech Center and Greenwood Plaza in metropolitan Denver, Redmond WA (Microsoft campus), and Tysons Corner in northern Virginia. In the case of Stanford Business Park, one analysis shows that a seamless interface between the CalTrains commuter rail system and an AGT system would increase the 1000 feet walkable distance of a TOD twenty-fold (called “extended transit villages” by the CITIES21 organization, transforming “mega office parks” into “mega TODs”): “Extended TOD blanket much larger areas with a very high quality feeder/distribution system, connecting with the train and bus systems”, replacing portions of expansive surface parking lots (Raney, 2006). As Anthony Downs (2004) and others argue, TOD is a 2% solution – they are too small in geographic coverage to have a discernable effect on traffic, the environment, and housing supply. Extended TODs are a middle ground between TOD and AOD (auto-oriented development). It is easy to dismiss PRT/business-park TOD concepts as too expensive or radical to be practical, however let us be reminded that new oil deposits are not being discovered fast enough to replace what is being pumped out today and rising concerns about global warming presages a future of carbon taxes that could substantially bump up prices at the pump.

Might circulators also have a place in compact residential settings? Singapore operates AGT circulators at two new towns – Bukit Panjang and Sengkak – as part of a three-tier hierarchy of rail transit. Heavy-rail subways serve the core along radial lines, light-rail transit provides orbital connections between radial lines, and at heavy-rail/light-rail intercept points, AGT circulators have been built or are planned. This configuration not only confers high regional accessibility and connectivity but also defines development axes and the “green wedge” open spaces that separate them.

### ***Strengthening Downtowns with Streetcars and Commuter Rail***

Traditional streetcar services are staging a comeback (Ohland and Poticha, 2006). The recent introduction of traditional streetcar services, along with a host of other pro-city programs, has been credited with the conversion of once-dormant warehouse buildings to lively loft space in Portland’s Pearl District. In Atlanta, a traditional streetcar is being considered to help stitch together different points in the mid-town area (Buckhead to CBD), running along Peachtree Street. By enhancing central-city circulation and having a cachet that appeals to the central city’s creative class, traditional streetcars are poised to further strengthen the role of downtowns in the urban hierarchy.

At the other end of the rail spectrum are commuter rail lines, with more track miles having been added over the past decade than all other forms of rail transit put together. Commuter rail lines substantially expand the laborsheds of downtown districts. As radial based services, downtowns reap most of the economic benefits associated with commuter-rail service expansion. However, expanded laborsheds also mean increased suburban and exurban sprawl. The Altamont Commuter Express (ACE), which connects the San Joaquin and Stanislaus Counties to the Silicon Valley, is effectively a conduit to affordable housing. In greater Washington-Baltimore, the former civil-war battlefields of northern Virginia and Amish towns of southern Pennsylvania are being converted to tract subdivisions for professional class workers. True, commuters are taking energy-efficient trains to and from work, however the work trip accounts for less than a quarter of the total miles logged weekly by the average U.S. wage-earner. The other three-quarters are spent chauffeuring kids, running errands, and driving to Safeway, Target, and the other big-box retailers that dot America’s suburban and exurban landscapes.

In California, sprawl could increase several orders of magnitude if high-speed train services come to the Central Valley, connecting Bakersfield to LA and Fresno to San Francisco. The state is poised to mimic what’s happening in Japan, where legions of commuters regularly take Shinkansen bullet trains 100-plus miles each way to jobs in Tokyo and Osaka. Expansion of inter-metropolitan and inter-state rail services speaks to the need for proactive state land-use planning and management if the unintended sprawl-inducing consequences of these investments are to be avoided.

To the degree that expensive rail investments are pursued in coming years, value capture forms of financing should be turned to. Even in Hong Kong, the railway investment is not financially viable on its own. Property development has been the only source of return to the private railway corporation, MTR, to meet investors’ equity demands.

Through its “rail+property” program, MTR enjoys premiums between US\$12 and US\$36 per square foot gross floor area for housing estates built atop or adjacent to its metro stations, making it the most profitable public-transport operation worldwide. In Hong Kong, public-private partnerships (PPPs) are not about off-loading the costs of building rail systems to the private sector. Rather, they are about “co-development” – each sector bringing a natural advantage to the table (e.g., land acquisition powers in the case of the public sector; access to equity capital in the case of the private sector). The resulting “win-win” situation not only leads to financially viable investments, but also an intimate connection between rail systems and nearby real-estate development that attracts tenants, new investors, and transit riders.

Privatization of public-transport infrastructure and ancillary land development occurred with inter-urban streetcar investments a century ago in most U.S. cities and is presently practiced by Japanese railway corporations. In Japan, regional governments set design, routing, and service strictures in franchise awards to railway consortia to ensure new-town development complies with regional growth visions and objectives. Given America’s past century of experiences where public investment in transit and private investment in real estate have not been well coordinated or spatially integrated to the degree that they should have been, privatization of railway investments should not be overlooked in promising corridors.

## **7. Setting a Future Policy Agenda**

America’s transportation system suffers from too much uniformity and standardization. It does not match the changing composition of America’s economy, demographics, and lifestyle preferences. More plurality and diversity is called for. America has always been a melting pot of different cultures, heritages, and ideas. Our transportation systems need to match this richness and diversity.

What might post-modern transport in America look like – tollways, small-vehicle jitney-like services, electronic hitchhiking, tele-travel? If given an opportunity, the marketplace is apt to produce a richer assortment of mobility options in response to recent economic and demographic megatrends. One of the chief challenges will be to break down the many institutional and regulatory barriers that prevent transportation systems and services from being market-responsive.

Take paratransit, for example. Many recent immigrants from Latin America, the Caribbean, eastern Africa, southeast Asia, and the Indian subcontinent bring with them a culture predisposition and heritage that is more accepting of small-scale, demand-responsive forms of paratransit, like jitneys, private vans, and micro-buses, even if it means sometimes crowded seating conditions and not the newest of vehicles. Fixed-route, fixed-schedule buses that run on 30-minute headways are not necessarily competitive modal options to the many-to-many, on-call, flexible service attributes of the private car in the minds of many recent immigrants (not to mention middle-class Americans). Similarly, those coming from areas with a rich tradition and spectrum of

transit and paratransit offerings might be more receptive to TOD living. For paratransit to gain a foothold, the monopolistic stranglehold that many U.S. public transit agencies and taxi franchises have over the mass transportation marketplace needs to be relaxed through deregulation of shared-ride services and greater market competition.

### ***Variety and Choice in Transport Options***

The principle of variety and choice is practiced in nearly all forms of consumerism in contemporary America. There is no reason it should not be applied in the transport sector as well as in make-up of built environments. Given that more than 90% of all trips are by private car and a comparable share of suburban housing options are single-family detached units in single-use neighborhoods, considerable headway remains to be made in diversifying travel, living, and working environments.

At its core, New Urbanism, traditional neighborhood designs (TDN), and TOD aim to create more variety and choice in environments for living, working, shopping, and recreating. While such urban-design strategies also aim to reduce car dependency, promote sustainability, increase social interaction, and build social capital, not everyone embraces such neo-progressive ideals. However, most everyone agrees that increasing variety and choice is a good thing.

Even the highway sector would benefit from variety and choice. Express tollways are meant to provide parallel options to motorists: slower moving freeways or faster moving tolled facilities. Denver recently opened express toll lanes on a stretch of I-25 running north-south through the CBD. This two-lane facility was converted from lanes formerly reserved for HOV. Usage is trending upward. In July this year, the toll facility generated \$63,000 in revenue. Texas, Virginia, and Oregon are pursuing partnerships with private companies to build new toll roads or add new toll lanes, using mostly private funds. In exchange, private companies obtain the right to operate the facilities and collect tolls over long periods of time. To further spur private interest, consideration might be given to assisting them with land acquisition at key interchanges to allow value capture.

In freight-intensive corridors, truck-only-toll (TOT) lanes are being considered to provide premium-level service to shippers and freight carriers. In Chicago, a private roadway, the Chicago Land Bridge, is being built to connect materials from international origins to the metro Chicago area for distribution to the Midwest region of the U.S. The half-mile long private roadway can be used to transport “heavy” containers (ones weighing more than allowed on U.S. public roadways), allowing the shipment of large, heavy containers to distribution centers (without deconsolidation at port of entry).

### ***New Technologies and Niche Services***

Future policy should strike a balance between supply- and demand-side strategies. For example, a marriage of ITS (e.g., cellular, WiFi, web, and automated telephony) and TDM could give rise to “automated hitch-hiking”. Some envisage a “wireless carpool assistant” wherein GPS-enabled cell phones communicate with application servers for

tracking the whereabouts of carpool participants, and special software optimizes ridematching and vehicle routing. While substantially higher fuel prices and stringent regulations might be needed to create a market for such services, increasing complexity in travel patterns and schedules could create opportunities for particular niche markets, such as college campuses. A wireless carpool assistant could also promote ridesharing to edge cities by providing a security blanket for those whose schedules get thrown off.

Another growing niche market is carsharing. While car co-ops have been around for several decades in Europe, only over the past few years have they gained a foothold in American cities, most notably Boston, Seattle, and San Francisco. Besides having fairly high densities and mixed land-use characters, what these cities most share in common with their European counterparts are limited and expensive car parking. In a recent evaluation of San Francisco's City CarShare program, I found that four years into the program, around one-third of participants shed private cars and weekly vehicle miles traveled (VMT), adjusted for vehicle occupancies, fell 15 percentage points more than that of a control group of otherwise comparable residents (Cervero et al., 2006).

### ***Sustainable Technologies, Urbanism, and Finance***

An overarching principle of future transportation policy must be sustainability, broadly defined. In their report "Mobility 2030: Meeting the Challenges to Sustainable Mobility", the World Business Council for Sustainable Development (a coalition of 170 international companies, including major automobile manufacturers, from 35 countries) estimate transport-related greenhouse gas (CO<sub>2</sub>) emissions are likely to more than double worldwide by 2050, which, it concludes, would be "clearly unsustainable". There can be no question that future transport policy must increasingly seek to lower future per capita carbon-emissions. This will require finding a policy balance between "sustainable automobility" (e.g. clean-fuel private vehicles, including hybrid-electrics, fuel cells, hydrogen-burning ICE, new-generation diesels) and "sustainable urbanism" (e.g., TOD). To bring both about, "sustainable financing" is also needed (e.g., carbon taxes; congestion tolls and variable road pricing).

Externality pricing, in the form of congestion charges, are particularly important if large agglomeration diseconomies are to be avoided in America's global cities. Pricing traffic congestion so as to create more attractive pedestrian environments is apt to appeal to the "creative class" that many cities are actively courting. Presently, the San Francisco County Transportation Authority is studying the feasibility of a London-style congestion-charging zone for downtown San Francisco.

When it comes to sustainable finance, the city-state of Singapore stands as a paragon. There, transportation pricing and finance is viewed from an economic development perspective – a tool for holding the population of private cars in check so as to maintain economic productivity and a high quality of urban living. Presently, Singapore comes closer to passing on the full social cost of car ownership and usage than anywhere. It has done so through a 3-tier scheme: (a) *Fixed "subscription" fees on vehicles*: import duties; registration fee (tied to engine size) plus add-on; a quota scheme that auctions a

controlled stock of certificates to purchase vehicles; island entry/exit fees; and a fuel topping tax (to discourage purchase of cheaper gasoline in Malaysia); (b) *Use-related fees*: fuel taxes and parking surcharges; and (c) *Externality fees*: congestion tolls through electronic road pricing and annual road tax (pegged to engine size).

Two enabling factors partly explain Singapore's success. One is the circularity between efficient pricing and public transport. A world-class transit service made full-cost pricing politically feasible; and revenues channeled to a fungible central fund financed superlative transit services. Second, a well-managed unitary authority existed that linked financing to tangible and measurable objectives. For example, the number of Certificates of Entitlements (CoE) for registering new cars put out for bid in any one year is tied to achieving roadway level-of-service targets the previous year.

Bold initiatives like expanded rail services and AGT circulators cost money, sometimes massive sums. However if for no other reason than to pass on inter-generational benefits, they deserve serious attention in any forum devoted to future transportation policy. There is no shortage of contrarians to bold new ideas in the transport field. However, as underscored in *The Aquarian Conspiracy*, innovations in the public realm will never take form unless networks of dedicated people seek to advance noble ideas and causes, even in the midst of apathy and disillusionment (Ferguson, 1987). Planting a few seeds can bloom a hillside of flowers. There are more than 200 large-scale employment centers with six-million-plus workers in the U.S. Getting the top brass of a heavy-weight organization, like Microsoft or Google, to embrace sustainable transport and urbanism can be the spark to massive change, the so-called "tipping points" (Raney, 2006; Galdwell, 2000). Writes Peter Muller: "the first electric trolley line opened in Richmond in 1888, was adopted by two dozen other cities within a year, and by the early 1990's was the dominant mode of intraurban transit. The rapidity of the diffusion of this innovation was enhanced by the immediate recognition of its ability to mitigate the transportation problems of the day" (Raney, 2006). Our collective challenge is to seek out tipping points that usher in a new era of transport policies and programs that advance sustainable futures while also keeping America highly competitive, if not a leader, in the global marketplace.

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