

Is Los Angeles-Style Sprawl Desirable?

Reid Ewing

This article reviews the literature on characteristics, causes, and costs of alternative development patterns. In doing so it debunks arguments by Gordon and Richardson in favor of Los Angeles-style sprawl. Sprawl is not suburbanization generally, but rather forms of suburban development that lack accessibility and open space. Sprawl is not a natural response to market forces, but a product of subsidies and other market imperfections. The costs of sprawl are borne by all of us, not just those creating it, and include inflated public spending, loss of resource lands, and a waning sense of community. The only realistic cure for sprawl is active planning of the sort practiced almost everywhere except the United States (and beginning to appear here out of necessity).

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Peter Gordon and Harry Richardson (G & R) have made a cottage industry out of challenging, time and again, planners' steadfast belief in compact development (Gordon and Wong 1985; Gordon et al. 1986; Gordon et al. 1988; H. W. Richardson 1988; Gordon and Richardson 1989; Gordon et al. 1989a; Gordon et al. 1989b; Richardson and Gordon 1989; Richardson et al. 1990; Gordon et al. 1991; Gordon et al. 1992; Bae and Richardson 1993; Richardson and Gordon 1993; Gordon and Richardson 1994a; Gordon and Richardson 1994b; Gordon and Richardson 1996a; Gordon and Richardson 1996b; Gordon and Richardson 1997). Their articles tend to counterbalance inflated claims by some on the other side of the issue. Their arguments are thought-provoking and, at least superficially, credible.

Yet, like most planners, I remain convinced that sprawl is undesirable. As background to the drafting of Florida's anti-sprawl rule (part of Florida's growth management apparatus), I wrote an article some time ago titled "Characteristics, Causes, and Effects of Sprawl" (Ewing 1994). It was all negative. Where did I go wrong, or where did Gordon and Richardson?

Asked to respond to G & R's latest, I have at last taken the time to compare our definitions, premises, logic, and empirical claims. Our differences become clearer when the alternative to compact cities is identified explicitly: Is Los Angeles-style sprawl desirable? This question would be purely rhetorical, of course, were G & R not promoting just that, Los Angeles-style sprawl. These two Los Angeles economists have got to get out more.

Characteristics of Sprawl

This discussion is divided into four parts, relating in turn to sprawl's characteristics, causes, costs, and cures. Both G & R and I use the term "compact" to describe one end of the development continuum. Depending on the context, G & R equate compact development to high density or monocentric development. This is a most unfortunate characterization of compactness. High density is not the preferred living arrangement for most Americans; and monocentric development is an

anachronism, as downtowns have become just one of many centers in large metropolitan areas.

My idea of “compact” development is more inclusive. Compact development requires some concentration of employment, some clustering of housing, and some mixing of land uses (but neither high density nor monocentric development).

G & R’s concept of sprawl also differs from my own. Even our reactions to the term “sprawl” differ. They avoid the term, thinking it pejorative, while I find it descriptive and useful. No term anchors the other end of the development continuum, opposite compact development, quite as well as does sprawl.

G & R’s concept of sprawl is a moving target, sometimes denoting “low density,” sometimes “dispersed,” sometimes “decentralized,” sometimes “polycentric,” sometimes “suburban” development. They lump the benign with the problematic, disarming would-be critics. This quote is illustrative: “. . . [t]hat suburbanization itself should be an object of attack is amazing, given the expressed preferences of a majority of Americans for suburban lifestyles and the supposed sanctity of the principle of consumer sovereignty.” It is not suburbanization *per se*, but the wasteful form it so often takes that most critics of sprawl attack. Even the most ardent New Urbanists, however, are drawing master plans for projects in the suburbs (Duany and Plater-Zyberk 1991; Calthorpe 1993; Katz 1994). They reason that if growth is going to the suburbs anyway, better it be in the form of compact development than sprawl.

The forms of development most often characterized as sprawl are: (1) leapfrog or scattered development, (2) commercial strip development, or (3) large expanses of low-density or single-use development (as in sprawling bedroom communities). (See table 1.) This list constitutes a definition of sprawl. It appears in Florida’s anti-sprawl rule, and certainly has more face-validity than G & R’s characterizations of sprawl. Yet it, too, oversimplifies.

Specifically, this definition fails to recognize that sprawl is a matter of degree. The line between scattered development, a type of sprawl, and multicentered development, a type of compact development by most people’s reckoning, is a fine one. “At what number of centers polycentrism ceases and sprawl begins is not clear” (Gordon and Wong 1985). Equally elusive is the line between leapfrog development and economically efficient “discontinuous development,” or between commercial strips and “activity corridors.”

Discontinuous development is a settlement pattern in which certain sites are bypassed initially to leave room for more intense uses later on. This pattern

TABLE 1. Characterizations of sprawl

	Low-Density Development	Strip Development	Scattered Development	Leapfrog Development
Whyte (1957)			X	X
Clawson (1962)			X	
Lessinger (1962)	X		X	
Harvey and Clark (1965)	X	X	X	X
Bahl (1968)				X
McKee and Smith (1972)	X	X	X	X
Archer (1973)			X	X
RERC (1974)			X	X
Ottensmann (1977)			X	
Popenoe (1979)	X	X	X	
Mills (1981)			X	X
Heikkila and Peiser (1992)	X		X	
Beaumont (1994)	X	X		X
Downs (1994)	X			
Barnett (1995)	X	X		
Fulton (1995)	X			X
Moe (1995)	X	X		X

cannot be considered sprawl if the amount of bypassed land is only that required for more intense uses (Ohls and Pines 1975; Peiser 1989; Heikkila and Peiser 1992). Activity corridors are linear developments along transportation routes. They cannot be considered sprawl if the corridors have the density and land-use mix required to support alternatives to the automobile (Lessinger 1962; Beimborn and Rabinowitz 1991; Ministry of Transportation et al. 1992).

Wherever one draws the line between sprawl and related forms of development may be challenged unless the choice is (1) quantifiable and (2) related to impacts: it is the impacts of development that render development patterns undesirable, not the patterns themselves.

Sprawl Indicators

It is for this reason that Florida's anti-sprawl rule include "indicators" of sprawl as well as definitions. The most important indicator is *poor accessibility*. Residences may be far from out-of-home activities, a state of poor *residential accessibility*. Or out-of-home activities may be far from one another, a state of poor *destination accessibility*. Both types of accessibility affect the efficiency of household travel patterns (Hanson and Schwab 1987; Williams 1989; Tarry 1992; Handy 1993; Ewing et al. 1994; Ewing 1995b; Handy 1995).

In scattered or leapfrog development, residents and service providers must pass vacant land on their way from one developed use to another. In classic strip development, the consumer must pass other commercial uses (usually on crowded arterials) on the way from one store to the next: the antithesis of one-stop shopping. Of course, in low-density, single-use development, everything is far apart as the result of large private land holdings and segregation of land uses.

The beauty of equating sprawl with poor accessibility is twofold. First, unlike simple archetypes, this indicator recognizes that real-world development patterns are a matter of degree (as discussed above). No real-world pattern will exactly match an archetype. By defining sprawl generically, we need not debate whether a given pattern is enough like "leapfrog development" or some other archetype to constitute sprawl.

Second, this indicator is readily operationalized. A host of accessibility measures are found in the literature (Ingram 1971; Morris et al. 1979; Pirie 1979; Koenig 1980; Richardson and Young 1982; Handy 1993; Ewing 1995b; Handy 1995; Kitamura et al. 1995; Cervero and Kockelman 1996). Simple measures of accessibility, such as average trip length or average travel time, can be obtained from household travel surveys.

More sophisticated measures can be derived with any conventional travel demand modeling system. The Florida Standard Urban Transportation Model Structure (typical of its ilk) calculates and reports vehicle miles of travel (VMT), vehicle hours of travel (VHT), and even "accessibility indices" for individual traffic zones, using travel time, cost, or distance between zones as the measure of accessibility.

Another indicator is *lack of functional open space*. "It is physically impossible to preserve large open spaces in reasonable proximity to people when millions of people are spread out in uniform low densities. The barrack-like development of land leaves people with the monotony of urban space and form at the scale of the street and private yard" (Schneider 1970).

Strip development presents a solid wall of commercial uses. Low-density suburban development subdivides land until every developable acre is spoken for; although, if you count people's yards, there is abundant open space, it is all in private hands or in holdings too small for community uses. The ultimate caricature of this situation is the walled and gated subdivision, where no land at all (not even street rights-of-way) is public.

Even leapfrog development, which leaves large areas undeveloped, fails to provide functional open space. The leftover lands are no longer farmed and yet, being in private hands, are unavailable for public uses. Open land in metropolitan areas, if not used for urban purposes, typically is not used at all. It has been estimated that there is about as much idle land in and around cities as there is land used (in any meaningful sense) for urban purposes (Clawson 1962).

The term "functional" applied to open space simply means that the space performs some useful public function. Permanent and public open space may be used to contain development, link neighborhoods, or buffer incompatible uses (Whyte 1964; Ewing 1991; Jarvis 1993; Yaro et al. 1993; Girling and Helpband 1994). If left natural, it helps control floods, purify runoff, recharge groundwater, support wildlife, and afford scenic views valued by residents (Spirn 1984; Shaw et al. 1985; McHarg 1992; Adams 1994). If bounded and amenitized, open space provides gathering places for casual social interaction, recreation, and civic functions. Without such public spaces, there can be no authentic public life in a community (Alexander et al. 1977; Gehl 1987; Whyte 1988; Crowhurst, Lennard, and Lennard 1995).

Open space can be used in the same way as accessibility, as an indicator to distinguish sprawl from other development patterns. It can be categorized, quantified, and assessed for functional value (Briggs and France

1980; Schroeder 1988; Kaplan and Kaplan 1989; Erwin 1990; Morrison et al. 1992, 221–62; Anderson and Gutzwiler 1994; Mertes and Hall 1995).

Graphic Illustration of Our Different Views

Three urban density functions are plotted in figure 1, corresponding to G & R's and my respective views of compact development and of sprawl. The first, G & R's compact pattern, is European in its very high central densities, high average densities, and abrupt urban-rural boundary. This is a straw man *par excellence*, since it is as yet unseen in the United States.

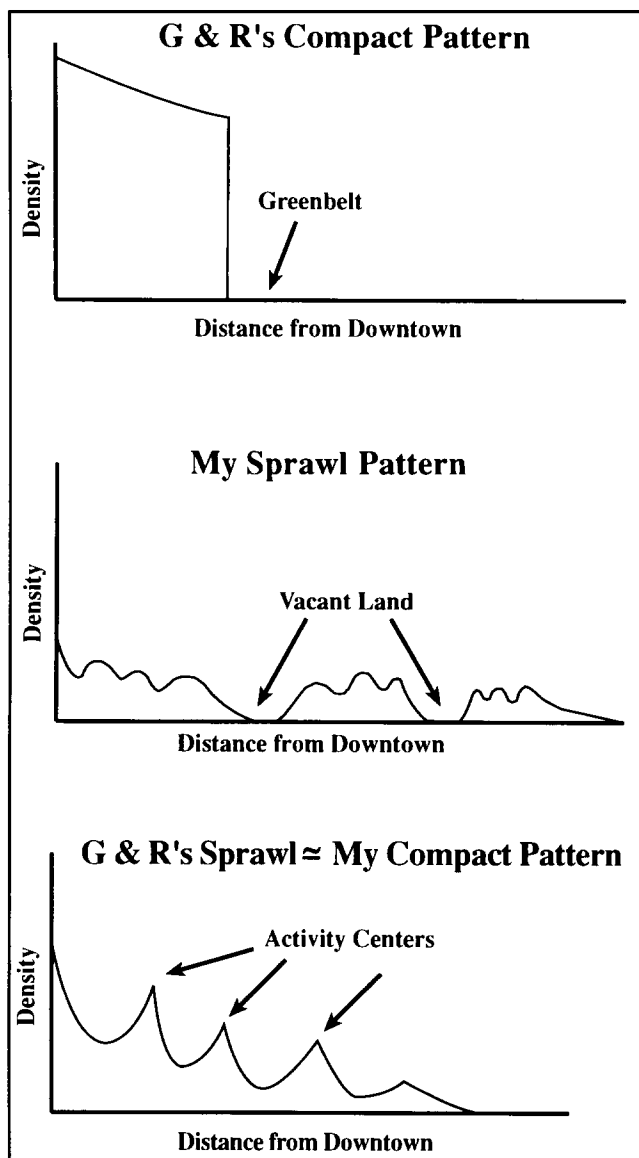


FIGURE 1. Three views of compact development and sprawl, in terms of urban density

The second pattern, my version of sprawl, has few significant centers, low average density, and wide gaps in the urban fabric due to leapfrogging. This is no straw man. It is a common urban form, and many planners and policy makers object to it.

The third figure serves reasonably well as either G & R's sprawl pattern or my compact pattern—a clear indication of how much our concepts of sprawl differ. This pattern is multicentered, has moderate average densities, and is continuous except for permanent open spaces, or vacant lands to be developed within the standard planning time frame.

Not Just Planners

For at least 25 years, the Urban Land Institute (representing large land developers) and the National Association of Home Builders have promoted mixed use and clustered development (Urban Land Institute 1961; Witherspoon et al. 1976; Priest et al. 1977; Council on Development Choices for the 80s 1981; David Jensen Associates 1985; National Association of Home Builders 1986a; Schwanke et al. 1987; Ewing 1991; Jarvis 1993; Bookout 1994; and Ewing 1996). They have done so because complementary land uses and permanent open spaces enhance the value of nearby residential properties and offer economies in site development. So it is not only the planning profession, with its tendency to “deny market processes,” that sees some advantage in compact development.

Causes of Sprawl

Conceiving sprawl differently, G & R and I cite different reasons for its proliferation. To G & R, it is the market at work, and the market works just fine (see, in particular, Richardson and Gordon 1993): Consumers and businesses prefer outlying locations where land is inexpensive and congestion moderate. Modern telecommunications make clustering of businesses unnecessary. The low cost of auto travel allows people to live far from their places of work, shopping, etc. The resulting decentralized settlement patterns are economically efficient, in G & R's view.

For them, the only sources of market failure—which might render settlement patterns inefficient—are subsidies for the automobile (encouraging long-distance driving) and local land use regulations (discouraging higher densities and mixed uses).

Unlike G & R, I view land markets as fraught with imperfections, imperfections that induce sprawl. Recall from Economics 101 that perfectly functioning markets require many buyers and sellers, good infor-

mation about prices and quality, homogeneous products in each market, no external costs or benefits, and so forth. Land markets meet none of these requirements. The rate of land appreciation is uncertain, causing land speculation and (where speculators guess wrong or land becomes legally encumbered) sprawl (Schmidt 1968; Lindeman 1976; Mills 1981; Fischel 1985, 265–6; Nelson 1990, 1992). Single-family housing is subsidized through the tax code, a public policy that benefits primarily suburban residents (Peterson 1980; Fischel 1982; Black 1996). Outlying development is subsidized through utility rate structures independent of distance from central facilities (Archer 1973; Sullivan 1985; OTA 1988; Frank 1989). The land market is rife with externalities (Clawson 1971; Lee 1979, 153–4). And government regulation may introduce additional market distortions (Moss 1977; Lee 1979, 159–60; Fischel 1985, 259–61; Fischel, 1990; Barnett 1995).

We now consider four possible causes of sprawl in more detail. Two are market-related and emphasized by G & R. The other two are related to market failure and were emphasized in my earlier article (Ewing 1994).

Consumer Preference

G & R are absolutely correct that, given the choice between low-density suburban living and high-density urban living, Americans overwhelmingly choose the former.¹ They are not correct when they suggest that compact alternatives to sprawl have only “boutique appeal.” Given a more complete set of choices than those posed by G & R, compact development can hold its own in the marketplace.

There is a strong consumer preference for new single-family detached housing—a housing type concentrated in the suburbs (Fannie Mae 1996). But most people could do without the rest of the suburban package. The suburbs rank low in residential preference surveys, well below small town, village, and rural settings (Center for Public Interest Polling 1988; Audirac et al. 1990; Constantine 1992; Duany and Plater-Zyberk 1992; Nelessen 1994, 81–96; American Lives 1995).

Given the choice between low and medium-to-high densities, home buyers split almost evenly. While they might prefer estate homes, many simply cannot afford them. Tony Downs defines low suburban densities as anything below 3–4 dwellings per net acre (Downs 1994, 142–53). By this definition, at least half of all *new detached homes* sold in the U.S. are at medium-to-high densities (Bureau of the Census 1995).

In high-priced housing markets, the most popular products are often zero-lot-line, courtyard, and other

small-lot houses (Becker 1996; also W. J. Richardson 1988; Kreager 1992; Bradford 1993; Bradford 1995). From surveys, residents are as satisfied with housing at six or seven units per acre as they are at three or four units per acre (Lansing et al. 1970; Flachsbart 1979; also see Nelessen 1994, 99–102). The National Association of Home Builders and Urban Land Institute have published entire volumes filled with examples of dense housing that affords privacy, quiet, and ample outdoor space (Jensen 1981; NAHB 1986b; Wentling and Bookout 1988).

Given the choice between mixed- and single-use areas, the public divides fairly evenly (Shlay 1986; Bookout 1992). As long as the proportion of land devoted to commercial uses remains low, and as long as commercial uses are separated from residential, the effect on residential property values is neutral-to-positive (Stull 1975; Grether and Mieszkowski 1980; Li and Brown 1980; Cao and Cory 1981). People are especially taken with the idea of neighborhoods clustered around a town or village center (American Lives 1995).

Given the choice between compact centers and commercial strips, consumers favor the centers by a wide margin (Howe and Rabiega 1992). Aesthetics are only part of the reason. In contrast to stores in a center, stores strung out along a strip are too far apart to permit one-stop shopping (Berry 1971; Boal and Johnson 1971; Jakle and Mattson 1981; Ewing 1996, 37–41). Strips can be difficult and dangerous to drive along, as cars constantly pull in and out of individual driveways (Stover et al. 1982; Smart 1991; Long et al. 1993; Levinson 1994). These same driveways and turn movements make strip development unpleasant and dangerous for pedestrians (Untermann 1984; Smith et al. 1987).

Technological Innovation

G & R state that agglomeration economies are now available throughout metropolitan regions (Gordon and Richardson 1996a). They suggest that modern telecommunications have rendered geography (read “centers” of any type) irrelevant.

G & R exaggerate. Agglomeration economies remain concentrated in metropolitan activity centers. While losing market share, downtowns still house five to ten times as much office space as do large suburban centers, in the five metropolitan areas studied by Gary Pivo (1990). Edge cities, suburban downtowns, suburban business centers, office clusters, and other concentrations (large and small) have captured disproportionate shares of suburban employment growth (Erickson 1986; Cervero 1989; Pivo 1990; Garreau

1991; Hartshorn and Muller 1992; Leinberger 1995; Cervero 1996a).

"... [S]uburban economic development does not take place evenly across the outlying area but rather is centered in key or magnet areas where economies of agglomeration arise, growth is rapid, and the export sector develops" (Stanback 1991, 81).

Telecommunications innovations have caused many activities to disperse (back-office processing and consumer services, for example). Others remain centralized (front-office decision-making and advanced business services) (Moss 1987a; Moss 1991; Stanback 1991, 69-76; O'hUallachain and Reid 1992; Schwartz 1992; Stanback 1995). While profoundly important, electronic communications are (and probably always will be) imperfect substitutes for the kind of rapid face-to-face communications made possible by cities. There is a texture and subtlety to face-to-face exchanges that cannot be reproduced electronically. Even where electronic communications can substitute for those face-to-face, the infrastructure for advanced telecommunications is not uniformly distributed, but concentrated in hub cities (Moss 1987b; Daniels 1991; Moss 1991).

Subsidies

Consumer preference and technological innovations help explain suburbanization and decentralization of activities within metropolitan areas. But they cannot explain the extent of dispersal, nor the absence of mixed land uses, nor the loss of valuable natural areas. We must look to market failures to explain these phenomena.

Raup (1975) and OTA (1995, 193-218) list all manner of subsidies for urban sprawl. The biggest are subsidies for the highway system. If motorists had to cover the full costs of auto use—including air pollution, parking, and other external costs—they would opt for residential, work, shopping, and other locations that require a fraction of their current travel. This is exactly what happens in Europe, where gasoline prices are about three times higher than in the United States (Pucher 1988, 1995a, 1995b; Davis 1995). In the United States, motorists bear only a fraction of the full costs (Hanson 1992; MacKenzie et al. 1992; Miller and Moffet 1993; Apogee Research, Inc. 1994; Moore and Thorsnes 1994; OTA 1994; Lee 1995; Litman 1995).

G & R dismiss such concerns with the comment that "the full auto subsidy adds up to little more than 22 cents per passenger mile and still falls short of the transit subsidy" (Gordon and Richardson 1997). They must not realize that at 22 cents per passenger mile, it

would require an additional gas tax of \$6.60 per gallon just to internalize air pollution, congestion, and parking costs.²

Without referring to the theory by name, G & R invoke the Theory of the Second Best when they suggest that large auto subsidies are somehow neutralized by large transit subsidies. Briefly, in this context, the theory holds that if one mode is underpriced relative to its marginal social costs, it may improve social welfare to artificially lower the price of another mode. G & R are using the same argument turned on its head, to justify auto subsidies.

Such pricing policies assume that the goods or services in question are substitutes for one another: subsidizing one leads to its overconsumption relative to the other. Thus economic efficiency is served by treating them equally. But if the goods or services in question are not substitutes—and G & R have argued repeatedly that transit is no substitute for the automobile—a subsidy for motorists simply results in a windfall (something economists first pointed out 30 years ago; see Meyer et al. 1965; Morgan 1974).

Public and Quasi-Public Goods

Home buyers purchase a whole bundle of attributes, some specific to the house itself and some to its environs. So-called residential and environmental amenities are part of the bundle. Most are public goods, in the sense that one resident's consumption does not affect another's, and no resident can be denied access to these goods. Public goods tend to be undersupplied by the private market because of the "free rider" problem, that is, the inability to charge beneficiaries for the value they receive (or even to ascertain what it is worth to them).

The best example is open space. Greenbelts and other open spaces, if designed for physical or visual access, can enhance the property values of nearby developable lands (Davies 1974; Correll et al. 1978; Lacy 1990; National Park Service 1990; King et al. 1991; Nelson 1992). Yet, as a public or quasi-public good, open space tends to be undersupplied, because land owners cannot capture the value to those around them. This is particularly true of small development sites, where most of the value of any preserved open space accrues off-site.

William Fischel, who sides with G & R on many issues, nonetheless sees the need for collective action to preserve open space. "The benefits of looking at farmland are perceived by many people, but each one may understate his individual willingness to pay for such benefits. A collective arrangement may be re-

quired to overcome this free rider problem when beneficiaries are numerous" (Fischel 1985, 287).

Costs of Sprawl

Like many economists, G & R are not concerned about resource consumption levels in the United States because real prices of oil, farmland, and other appropriable resources are still relatively low. They assume that technological prowess will allow indefinite economic growth. The paradigm to which they subscribe is sometimes called "empty world" economics. In that view, ours is a world of unlimited natural resources. The only constraint on development is the amount of man-made capital. Natural and man-made capital serve as substitutes for one another; a housing tract is a perfectly good substitute for a forest.

I subscribe to another world view, tied to the idea of sustainable development. Mine is not "full world" economics, but it is closer to that than to empty world economics. Natural capital is limited, and natural and man-made capital are complements rather than substitutes. More fishing boats will not substitute for depleted fish stocks. Mankind must learn to live on the annual "income" derived from our remaining stock of natural assets.

Sustainable development implies not only economic sustainability, but ecological sustainability (the continued productivity of ecosystems) and social sustainability (the maintenance of social values, traditions, and institutions). Such concerns do not even register with these two economists.

Our different world views cause us to assess the costs of sprawl very differently.

Vehicle Miles Traveled

The award for least defensible statement in a JAPA article goes to G & R, hands down:

"... [T]he link between high-density development and reduced VMT (vehicle miles of travel), and hence reduced energy consumption, is by no means clear." By way of evidence, G & R cite a simulation study showing a low transit market share even if suburbanites could somehow be persuaded to live in high-density "transit-oriented developments." G & R also cite statistics on average trip times for city versus suburban residents, statistics which suggest that longer suburban trip distances are offset by higher suburban travel speeds.³

G & R make the common mistake of emphasizing density over other land-use variables, and transit mode share over other travel variables. From an analysis of household travel patterns in a sprawling Florida

county, I found that households living in the most accessible locations spend about 40 minutes less per day traveling by vehicle than do households living in the least accessible locations (thus generating hundreds of fewer vehicle hours per year) (Ewing et al. 1994; Ewing 1995b). The savings are due almost entirely to shorter auto trips, not shifts to other modes. The land-use variable that proves significant is regional accessibility, not local density.

G & R make another mistake that is far less common—using macro travel statistics to draw inferences about micro travel behavior. There has been so much solid research lately using household-level travel data and neighborhood-level land use data, that G & R's continued reliance on highly aggregate data is hard to fathom. For reviews of household-level studies that reach conclusions different from G & R's, see Kitamura et al. 1995; Messinger and Ewing 1996).

Even on their own terms, G & R's macro comparisons are suspect. In one paper after another, they have argued that decentralization of firms and households raises average travel speeds enough to compensate for longer trips. Recent evidence suggests otherwise. Average commute times worsened during the 1980s in 35 of the 39 metropolitan areas with more than one million population (Rossetti and Eversole 1993, table 4-13). By the end of the decade, average commute times were significantly greater in the suburbs than in central cities (Pisarski 1992, table 4; Vincent et al. 1994, table 3-20).⁴

As for G & R's comment about density and VMT, every shred of evidence points to a strong link between the two. As densities rise, trips get shorter, transit and walk mode shares increase, and vehicle trip rates drop (Wilbur Smith and Associates 1968; Neels et al. 1977; Pushkarev and Zupan 1977; Hunt et al. 1986; Spillar and Rutherford 1990; Prevedouros 1991; Dunphy and Fisher 1994; Frank and Pivo 1994; Kitamura et al. 1995; Messinger and Ewing 1996). All of this translates into lower VMT (Harvey 1990; Holtzclaw 1991; Parsons Brinckerhoff Quade Douglas 1993; Dunphy and Fisher 1994; Holtzclaw 1994; Cervero and Kockelman 1996). By various estimates, doubling urban density results in a 25–30 percent reduction in VMT, or a slightly smaller reduction when the effects of other variables are controlled (Holtzclaw 1994, 6–8 and 21).

Energy Consumption and Air Pollution

G & R point to the "global energy glut," the weakness of the OPEC cartel, and the low real price of gasoline as evidence that energy impacts of sprawl are not worth worrying about. They are probably right.

But what if they are wrong? Conservatively, world-

wide demand for oil will grow by 30 million barrels a day between now and 2015, as Asia begins to catch up with the West in its standard of living (EIA 1996; for less conservative forecasts, see IEA 1995; PIRA 1995). This increment is greater than the current level of oil production in all OECD countries combined. During this period, Persian Gulf oil exports will surpass their previous high of two-thirds of the world's total, reached in the dark days of 1974. While the best case envisioned by G & R has the real price of gasoline holding steady, it is the worst case that worries others (Flavin and Lenssen 1994; Romm and Curtis 1996). "The fact that the most recent large-scale war fought was in the Persian Gulf is itself a testament to the risk of relying on the political stability of this region for a commodity so essential to economic activity" (The Roving Advocate 1996).

The relationship of energy consumption to urban form parallels that of travel to urban form. In energy studies, centralized development patterns consistently outperform low-density sprawl (Haines 1986; Newman and Kenworthy 1989). Though vehicles operate less fuel-efficiently in congested areas, per capita fuel consumption is much lower in central cities because people drive so much less (Newman and Kenworthy 1988).

Still, as urban areas grow, the central city becomes less and less accessible to development on the periphery. At some point, emergence of other centers is beneficial from the standpoint of transportation and energy. When energy studies include polycentric development as an alternative, that emerges as the preferred settlement pattern, even over monocentric development (Small 1980; Haines 1986). Thus, in large metropolitan areas, energy efficiency is served by concentrating development to some extent (but not to the extent of a single dominant center).⁵

Elsewhere, Richardson has argued that advances in vehicle emission control technology will solve our air quality problems (Bae and Richardson 1993). 128 million people, about half of all Americans, now live in urban areas that exceed one or more federal air quality standards for carbon monoxide, ozone, or nitrogen dioxide. Even with new emission controls mandated by the federal Clean Air Act, reductions in hydrocarbons (ozone precursors) will fall far short of what is required to meet federal air quality standards by the year 2010 (E.H. Pechan and Associates 1992; Kessler and Schroer 1995). The reason: Growth of VMT and vehicle trips will wipe out gains achieved through stricter vehicle emission controls.

Being unregulated, carbon dioxide emissions represent a bigger threat to national welfare than do regulated emissions. There is now a near-consensus within the scientific community that carbon dioxide build-up

in the atmosphere is causing global climate change, and that the long-term effects could be catastrophic (Intergovernmental Panel on Climate Change 1995). Worldwide emissions are expected to rise by one-third between now and 2015, this despite the United Nations Framework Convention on Climate Change. The United States produces more carbon dioxide than any other nation, and transportation accounts for a large and growing share of our total (USEPA 1993b; Marland et al. 1994; EIA 1994).

The findings reported above, relating energy consumption to urban form, apply to air quality as well. Like fuel consumption, vehicle emissions increase with VMT and decrease with average operating speed (up to about 50 mph for carbon monoxide and hydrocarbons, and to 35 mph for nitrogen oxides; carbon dioxide emissions track fuel use exactly). This gives compact development an edge over sprawl (figure 2;

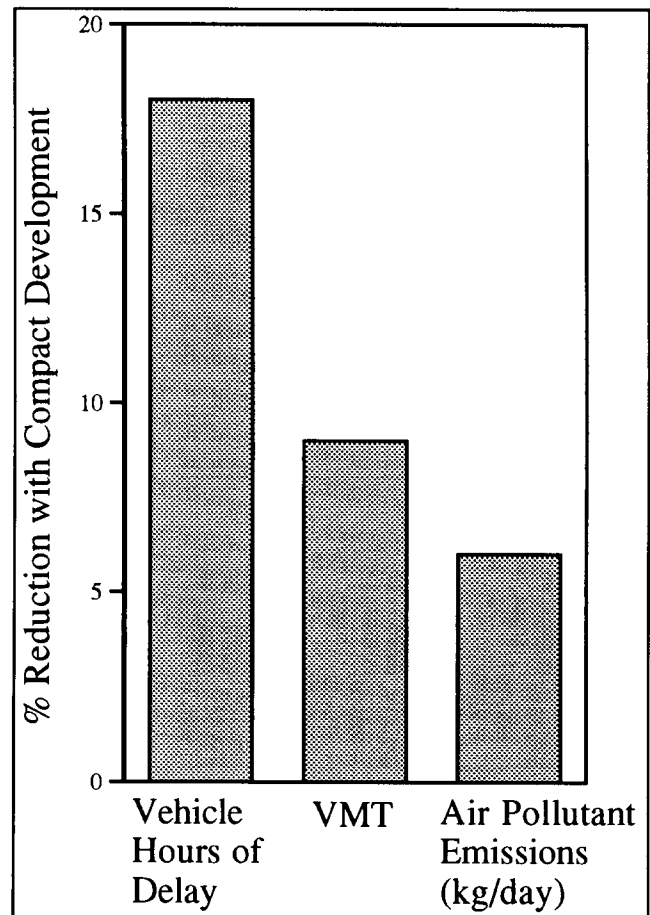


FIGURE 2. Sprawl versus compact development: performance measures. The figure compares a "Highways Only" alternative to the LUTRAQ alternative, which clusters jobs, houses, and shopping near transit lines.

Source: Cambridge Systematics et al. 1996, 21, 24-5.

also Scheuernstuhl and May 1979; San Diego Association of Governments 1991). But the edge is diminished by the fixed hydrocarbon emissions associated with “cold starts” and “hot soaks.” If an auto is used at all, even for a short trip to a transit line or a suburban activity center, such emissions are produced.

Infrastructure and Public Service Costs

Many studies report savings on infrastructure costs as densities rise (for literature reviews, see Priest et al. 1977; Frank 1989; Burchell and Listokin 1995). This makes sense. Infrastructure costs, some of which are fixed, are amortized over more units at higher densities. Economies of scale kick in.

G & R view such studies, even the most carefully crafted, as badly flawed. These studies adopt a “prospective view of the comparative costs of alternative types of development under sets of very precise assumptions.” This is G & R’s way of saying that such studies are purely hypothetical. As a more credible alternative, G & R cite a study of actual public spending per capita by Helen Ladd (Ladd 1992; also Bradbury et al. 1984; Ladd and Yinger 1989). Public spending dips initially, but quickly rises with density.

Why the difference in study results? For starters, the two types of studies focus on different costs—cost-of-sprawl studies focus on infrastructure costs, and public spending studies focus on public service costs. More importantly, the two types of studies relate to different types of government outputs—cost-of-sprawl studies to “intermediate outputs” and public spending studies to “final outputs” (using Ladd’s terminology). At higher densities, there are savings on intermediate outputs such as lane miles of street. But given the “harshness” of the environment (again, Ladd’s term), the cost of producing a unit of final output may be higher, enough to offset the savings on intermediate outputs. “. . . [I]ncreased density may require more traffic lights and traffic control officers to achieve a given level of traffic safety or traffic flow” (Ladd 1992).

So who is right about costs versus density? It all depends. Within the normal range of urban-suburban densities, per capita infrastructure costs almost certainly fall as densities rise. However, at the density extremes, there could be some surprises. At very low densities, the use of septic systems, open drainage, and rural street cross sections may cause the cost function to turn downward. At very high densities, the special needs of high-rise structures may cause the cost function to turn upward. Thus, the infrastructure cost function could assume the shape of an equivalence sign (~). Indeed, plotting the capital outlay equation from Ladd’s paper, this is approximately

the shape that emerges (except for one data point; see figure 3).

Whatever cost savings are realized as densities rise are almost certainly diminished by the “harshness” of the environment at higher densities (see above). Total public spending, including public service costs, may follow the curve suggested by Ladd, be more U-shaped, or assume some other form. Even the most careful studies to date—Ladd’s, Frank’s, and CUPR’s—have limitations that make the exact shape of the cost function anyone’s guess.

Having said this, it turns out that density may not be the most important land-use variable after all. Density largely pays for itself, in the sense that developers pay for on-site infrastructure and successive property owners pay for public services through their property taxes. Controlling for socioeconomic factors, there may be little cross subsidy (and hence inefficiency) in one density pattern versus another (Frank 1989, 41-2; Avin 1993, 5). The same cannot be said of leapfrog or strip commercial development.

Archer (1973) analyzed a case of leapfrog development in Lexington, Kentucky. By bypassing tracts of land well-suited for residential development, developers drove up private and public costs by hundreds of thousands of dollars per year. Some of the extra costs were incurred by residents of the outlying development in the form of higher travel costs; they presumably paid less for land and housing than they would have at a more accessible site, in keeping with efficient resource allocation. The remaining costs, however,

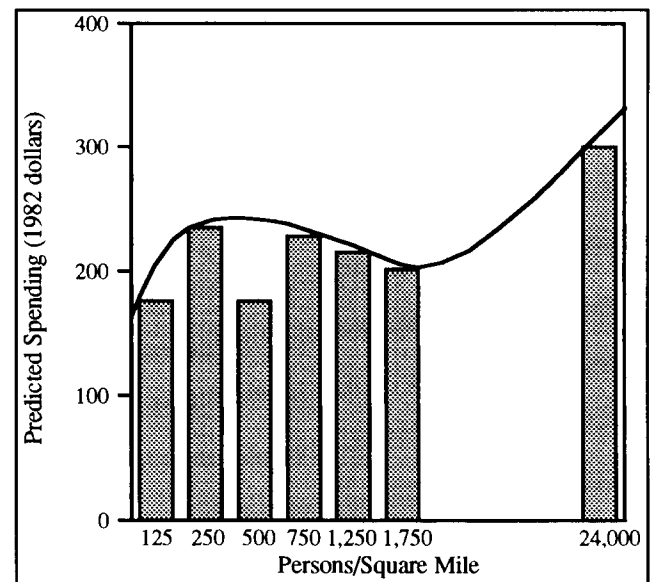


FIGURE 3. Capital outlays versus density

Source: Ladd 1992, table 8.

were defrayed by other consumers and taxpayers in the area, who ended up subsidizing sprawl.

Other studies comparing costs of leapfrog or scattered development to those of compact development include Dougharty et al. (1975), Downing and Gustely (1977), and Frank (1989, 39–41).

Loss of Resource Lands

As with concerns over wasteful energy use, G & R dismiss concerns over loss of farmlands and open spaces by citing statistics on the abundance of such lands. They also cite agricultural surpluses in the U.S. and an optimistic forecast of world carrying capacity (“The world is perfectly capable of feeding 12 billion people 100 years from now”).

Official forecasts of world food production tend to support G & R’s view. But a few voices of caution, led by the Worldwatch Institute, question the underlying premise of such forecasts: that agricultural yields will continue to rise at about the same rate they have historically. World agricultural production is running up against several constraints:

- Declining productivity of the world’s rangelands and fisheries, placing added pressure on croplands
- Failure of biotechnology to produce break-throughs in the yield potential of major crops, the easy gains having been made already
- Aquifer depletion in certain regions, putting an end to irrigated agriculture
- Failure of available crop varieties to respond to additional fertilizers.

Taking these constraints into account, U.S. grain surpluses may fall far short of world needs by the year 2030 (Brown and Kane 1994).

What if we stop playing breadbasket to the rest of the world? Is sprawl still a problem? The answer is “yes” if the loss of resource lands is (1) peculiar to sprawl-type development and (2) a result of market failure.

Sprawl consumes much more land in total than does compact development. An assessment of two development plans for the State of New Jersey, one a continuation of current sprawl and the other a more compact pattern, found that sprawl would consume two-and-one-half times as much land (CUPR 1992). The loss of environmentally sensitive land would be five times greater with sprawl, and the loss of prime farmland two-thirds greater.

Sprawl leaves little or no land in its natural (unimproved) state. In the landmark study, *The Costs of Sprawl*, a community prototype representing low-

density sprawl preserved no open space, while planned prototypes at the same gross densities (but much higher net densities) preserved anywhere from 18 percent to 57 percent of the total land area (RERC 1974, table 43). Studies of actual planned communities suggest that these hypothetical percentages are not far off the mark (Ewing 1991, 84–6; Ewing 1996, 21).

There are differing views on the extent to which rural-urban land conversion results from market imperfections, and on the corresponding need for public intervention to preserve farmlands. Arguing that the problem is illusory or at least overstated are Gardner (1977), Fischel (1982; 1985, 272–92), and Heimlich (1989). On the other side of the issue are Raup (1975), Volkman (1987), and Nelson (1990; 1992).

Market failure may result from:

- Urban spillover effects (externalities) that make nearby farming operations less profitable and cause farmers to disinvest; such effects may extend up to three miles from urban development (Nelson 1986; also Peterson and Yampolsky 1975; Andrews and Chetrick 1986; Lopez et al. 1988).
- The “impermanence syndrome” that causes farmers to abandon operations prematurely in anticipation of urban development; perhaps as much as one additional acre is idled for every acre converted to urban uses (Plaut 1976; also Berry 1978; Berry and Plaut 1978; Lopez et al. 1988).
- The substitution of marginally productive farmland for prime farmland lost to urbanization, with resulting increases in public subsidies and environmental costs (Peterson and Yampolsky 1975; Platt 1985; Nelson 1990). “The more prime farmland that is farmed the less there is need to raise productivity of marginal lands by brute force” (Nelson 1990).

As for the loss of natural areas, it is a classic case of public goods being undervalued by private property owners. The public goods in question are *stormwater management, groundwater recharge, water pollution control, habitat, and biodiversity*. There is little market value in any of them, and private property owners understandably discount public purposes as they make land-use decisions. But the loss to society as natural areas are paved over is quite real. (For an overview of natural resource valuation, see Lipton and Wellman 1995.) That is why our most valuable natural areas are now protected by environmental regulations.

Habitat fragmentation is a particularly good example of sprawl’s intangible costs. Because fragmented ecosystems cannot support the most imperiled species (species requiring large, undisturbed areas to accomplish their life cycles), scattered development

leaves habitat only for generalist species that are abundant to begin with (Harris 1984; Saunders et al. 1991; Morrison et al. 1992, 41–97; Florida Game and Fresh Water Fish Commission 1994). The loss of biodiversity is well-documented (IUCN 1980; Harris 1984; Kautz 1993).

Impacts on Central Cities and Downtowns

G & R dismiss central cities as economic losers in the competition for jobs. They denounce downtown renewal programs as wastes of public money. While they stop short of calling for the outright abandonment of central cities and their downtowns, G & R's wistful reference to "creative destruction" by market forces reveals their true feelings.

Some central cities are basket cases, per G & R's depiction. Others, however, have robust economies (Bradley and Berens 1993; Chinitz 1993; Rusk 1993, 14–5; Downs 1994, 68–9; Leinberger 1995; OTA 1995, 77–88). The economic winners are cities that have made the transition from industrial economies to advanced service economies or have piggybacked on high-tech industrial growth within their regions.

As for the losers, "creative destruction" might make economic sense (though never social sense, given the populations left behind), were suburbs and cities independent of one another. G & R treat them as such. But common sense suggests that cities and their suburbs are inextricably linked within the metropolitan economy, and that cities and their suburbs function not only as substitutes, but as complements to one another.

Again, G & R ignore external (spillover) effects of sprawl, in this case the effects of central city decline on the surrounding suburbs. There is a direct relationship between city population, employment, and income growth and parallel growth in the suburbs (Linneman and Summers 1991; Voith 1992, Ledebur and Barnes 1993; Rusk 1993; Savitch et al. 1993; Voith 1994; Ihlanfeldt 1995; also Downs 1994, 51–7; Adams et al. 1996). If cities and suburbs were close substitutes, we would expect an inverse relationship between their growth rates. Even controlling for state and regional growth patterns, a weak but direct relationship exists between city and suburban economic health (Voith 1992, 1994; Blair and Zhang 1994; but see the exchange between Hill, Wolman, and Ford 1995a and 1995b, and Savitch 1995).

Cities remain centers of culture, law, and other higher-order central place functions (Bradley and Berens 1993; OTA 1995, 87–8). They remain premier locations for finance, legal services, advertising, and other industries requiring rapid face-to-face contact

(Moss 1987a; Moss 1991; Persky et al. 1991; Warf and Wije 1991; Schwartz 1992; Sclar 1992; Ihlanfeldt 1995). They remain intake points for immigrants with entrepreneurial talent, who pump life into city economies before moving on (Cutler 1991).

As for downtown renewal programs, the national experience has been mixed. There are apparent failures like Los Angeles, the case cited by G & R. But many downtowns around the U.S. have made grand comebacks since their low ebb in the 1950s and 1960s, and now can claim lively, mixed-use environments. Their office, hotel, convention center, and neighborhood building booms are documented in *Downtown, Inc.—How America Rebuilds Cities* (Frieden and Sagalyn 1989; Frieden 1989). The booms were catalyzed in part by the same downtown renewal efforts so roundly criticized by G & R.

Psychic and Social Costs

G & R fail to acknowledge the psychic and social costs of sprawl. These costs are intangible, to be sure, but they are as real as travel costs and wetland losses. In utility theory and welfare economics, no distinction is made between intangibles and other goods.

In the article, "Urban Sprawl: Some Neglected Sociological Considerations," Popenoe (1979) identifies sprawl with two types of psychic costs: deprivation of access and environmental deprivation. Deprivation of access is straightforward. In a sprawling urban area, those who cannot drive have limited access to community facilities, services, and even employment. The negative impacts on the young, elderly, and poor are well-documented (Schaeffer and Sclar 1975; Popenoe 1977; Berg and Medrich 1980; Carp 1980; Millas 1980; Carp 1988; Rosenbloom 1988; Hillman et al. 1990; Hughes 1991; Kain 1992; Burchell and Schmeidler 1993; Newman 1996).

Environmental deprivation is subtler. Popenoe defines it as the absence of elements that provide activity and stimulation. The physical uniformity of sprawl is a source of environmental deprivation. So is the lack of neighborly interaction.

The modern metropolis has communities of interest by the thousands, that is, groups with common interests organized around work, recreation, church, etc. But strong communities of place, where neighbors interact, have a sense of belonging, and have a feeling of responsibility for one another, are harder to find. Communities of place are a casualty of sprawl. Whether they can be fully or partly replaced by communities of interest is, frankly, an unresolved issue (Heller 1989; Etzioni 1993, 121–3).

One study measured residents' sense of commu-

nity in a sprawling suburb versus that in a nearby master-planned community; the latter's clear boundaries, public space at its center, and pedestrian connections to the center fostered greater interaction, satisfaction, and sense of community (Glynn 1981). Another study compared sense of community across areas with single and with mixed land uses; residents of mixed-use areas had a greater sense of community, presumably because they interacted more (Nasar and Julian 1995).

For more on physical design and the sense of community, see Burby and Weiss (1976, 352-5), Etzioni (1993, 127-30), and Cochrun (1994).

Cures

The only policy intervention endorsed by G & R is the imposition of congestion charges and emissions fees as shadow prices for external costs of auto use, specifically for delay and air pollution imposed on others. This is a safe endorsement for sprawl lovers. While congestion pricing and emissions fees have been touted by economists for decades, those in political power have not exactly rushed to meter their constituents' travel (Orski 1992; Arrillaga 1993).

The first federal demonstration program on congestion pricing, 1973-1978, produced no demonstrations. The current Congestion Pricing Pilot Program, started five years ago, has produced one limited pilot project (and many planning studies) (FHA 1996). Millions of dollars of spending authority were recently rescinded. Most candidates for future congestion pricing are individual bridges or expressways that already charge tolls, but would charge a premium at peak hours. Areawide congestion pricing is a good idea whose time has apparently not come.

My answer to sprawl is active planning of the type practiced almost everywhere except the United States (and beginning to appear here out of necessity). What G & R refer to as "command-and-control" policies, or less charitably in an earlier point-counterpoint as "Maoist planning methods" (Gordon and Richardson 1989), is really just planning. The posture usually assumed by local governments in the U.S., waiting for property owners to come forward with rezoning requests, is not planning but reacting.

Planning initiatives should be supplemented by policies that reward good development and discourage bad. In the first wave of growth management nationally, the concern was how much growth would be allowed. In the second wave, the focus shifted to where and when growth would be permitted, and who would pay for it. The third wave is upon us, shifting the emphasis to what kind of growth is allowed or encouraged. Oregon's Transportation Rule, New Jersey's

State Plan, Florida's anti-sprawl rule, and Florida's *Best Development Practices* are examples of initiatives to upgrade the quality of development, wherever and whenever it should occur (Oregon Land Conservation and Development Commission 1991; New Jersey State Planning Commission 1992; Florida Department of Community Affairs 1994; Ewing 1996).

Lest my answer to sprawl appear hopelessly European or Canadian, I offer a current example from Orlando. City government has entered into a partnership with the owners of multiple tracts southeast of the city. Through a cost-sharing arrangement, the partnership has prepared a master plan and development standards for the 12,000-acre site.

The plan itself is neotraditional, featuring neighborhood, village, and town centers that are compact and walkable. It provides for jobs/housing balance—specifically, for 29,000 residential units, and millions of square feet of retail, office, and industrial space.⁶ It preserves more than 40 percent of the total land area as parks or natural open spaces in a clustered pattern.

Property owners have bought into the plan because it promises more dwelling units (at higher net densities) and more commercial space (at higher FARs) than would a standard suburban master plan. They have also come to realize that compact, mixed-use development, with quality features, will sell better than sprawl.

Here, a public-private partnership has taken the place of G & R's unfettered market. Here, a handshake has replaced the invisible hand so revered by G & R.

AUTHOR'S NOTE

Three individuals collaborated with me on the final draft: Uri Avin of LDR International, Inc.; Robert Cervero of Berkeley; and Ben Chinitz of the Lincoln Institute of Land Policy. Cervero's imprint is particularly evident. Two research associates at Florida International University, Bob Gross and Edith McClintock, helped acquire background materials. Additional reference materials were provided by Rick Bernhardt of the Orlando Planning & Development Department, Mitchell Moss of New York University, Arthur C. Nelson of Georgia Tech, Gary Pivo of the University of Washington, and Will Schroerer of the U.S. Environmental Protection Agency.

NOTES

1. There are two theories of suburbanization, both based on changing locational preferences (Mieszkowski and Mills 1993; Adams et al. 1996). The "natural evolution" theory explains decentralization of firms and households in terms of changes in demand for land, due in

turn to changes in technology and incomes. Consumers are attracted to cheap land in the suburbs. The "flight-from-blight" theory explains the same phenomenon in terms of residential amenities. Consumers are driven from cities by high taxes, low-quality schools, crime, and racial tensions.

2. This estimate assumes an average fuel efficiency of 20 mpg and average auto occupancy of 1.5 persons per vehicle. While G & R overestimated some of the external costs of auto use, they missed others. From the most careful studies conducted to date, unreimbursed accident costs amount to 4 cents per vehicle mile, highway patrol and other public safety costs to 2 cents per vehicle mile, and energy subsidies (including military expenditures to protect Persian Gulf oil supplies) to 3 cents per vehicle mile.
3. G & R make one additional point to buttress their position: that compact development has the potential to generate new vehicle trips by lowering the average cost per trip, thereby increasing overall VMT. The effect of accessibility on vehicle trip rates depends on the price elasticity of demand for activities outside the home and on the elasticity of substitution between vehicle and walk/bicycle travel. Most of the evidence to date, including my own study of household travel in two Florida metropolitan areas, suggests that activity demand is relatively inelastic, that total trip rates are independent of location, and that vehicle trip rates are either constant or decline with density (Ewing et al. 1996).
4. One issue is finessed here, mainly because I am so ambivalent about it myself. G & R's use of trip times as their bottom-line performance measure implies indifference between long-distance travel at high speeds and short-distance travel at low speeds; a 20-mile trip at 60 mph is equivalent to a 10-mile trip at 30 miles per hour, since both take 20 minutes. Clearly, the two are not exactly the same, because the social costs of auto travel depend on VMT as well as VHT. Yet, I agree that VHT is a good bottom-line performance measure, perhaps as good as VMT (Ewing 1995a). The Nationwide Personal Transportation Survey (NPTS) shows dramatic increases in average trip length and VMT between 1983 and 1990 (Pisarsky 1992, 11-4, 57-65; Vincent et al. 1994, Chapters 2 and 3). Comparing city and suburban averages, differences are equally dramatic (Pisarsky 1992, 62-3; Vincent et al. 1994, Table 3-9). By these travel measures, decentralization of firms and households has been a disaster.
5. Compact development also saves on residential space cooling and heating. Due to their common walls, multi-family and attached single-family dwellings have less surface area exposed to the elements than do single-family detached dwellings. This cuts down on heat gain and loss.
6. While G & R do not, in this particular article, attack the idea of jobs-housing balance, one can anticipate their reaction to Orlando's initiative. For reviews of the empirical evidence in favor of balance, see Ewing (1996, 19-20) and Cervero (1996b).

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