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Cars and Drivers in the New Suburbs

Linking Access to Travel in Neotraditional Planning

Randall Crane

Various "new suburb" landuse designs have recently been proposed to address a number of social and environmental problems, including the dominance of automobile travel. Transportation benefits are expected from reducing the surface street distance between locations, mixing land uses, "calming" traffic, and promoting walking, bicycling, and transit via redesigned streets and streetscapes. That auto travel will fall is a largely unchallenged premise of these designs. Yet little evidence exists as is either weak or contrary; this paper presents a simple behavioral argument to explain why. Generally speaking, driving is both discouraged and facilitated in the new suburbs with the net effect being an empirical matter. In particular, the number of both automobile trips and vehicle-miles traveled can actually rise with an increase in access, such as a move to a more grid-like land-use pattern. Whatever the merits of neotraditional and transit-oriented designs, and there are many, their transportation benefits have been oversold. Each development must be evaluated as a separate case to determine whether its net impact on auto use is positive or negative.

Planning practitioners and traffic engineers are increasingly enamored of a new and little-studied school of urban design. Often lumped together under the umbrella label of Neotraditional Town Planning, these ambitious efforts have accepted the challenge of rethinking the relationships among form, scale, and movement in modern suburban environments. The most visible proponents have been architects, especially the Miami team of Andres Duany and Elizabeth Plater-Zyberk (1991, 1992), best known for their work on the community of Seaside, Florida, and Peter Calthorpe (1993), who is based in San Francisco and is the author of the "pedestrian pocket" concept. While the proposals and projects differ in many respects, they share an emphasis on establishing the sense of community that often is missing in newly developed neighborhoods, to be accomplished largely by mixing land uses and getting people out of their cars and onto the street. The street pattern has played a central role in many of these designs and discussions; a growing number of policy documents embrace a grid layout as a direct means of reducing automobile travel. The grid has thus undergone a rebirth of sorts, in part because it is perhaps the single "new suburb" feature most compatible with both standard subdivision regulations and traditional practice (Reps 1965; Ryan and McNally 1995). The problem for planners and residents alike is that transportation problems may worsen rather than improve as a result. This paper argues that while it is likely that many elements of the new designs do discourage driving for some kinds of trips, the aggregate effect is uncertain.

It is easy for neotraditional complaints about cars and neighbor-
hood form to get our attention. Cars do pollute the air and eat up our time, whatever their overall value in a mobile society. They likewise tend to monopolize the “public space” of the street, which had always been a key element of the social fabric (Appleyard 1981; Lynch 1981; Kostof 1992). Thus even freshly built neighborhoods seem to lack charm, and perhaps in certain respects they lack functionality as well. In place of the friendly front porch of older times, for example, the main exterior feature of new residential developments is most often the garage door (Southworth and Owens 1993). It would be difficult to maintain that many of the new developments form true neighborhoods in the social sense, as there is little in their physical surroundings to link their residents privately or publicly, aside from broad streets and the common architectural theme of their homes.³

The neotraditional proposals are also quite amiable. They are easy on the eyes, for one thing, and self-consciously familiar. The designers realized that to coax people to walk more, neighborhoods must be more pleasant to walk through and destinations must be closer. A major contribution of the path-breaking work in this field was to recognize that the prototypical New England or Southern small town fits the bill quite well.³ Some survey evidence suggests that many suburbanites prefer to live in such towns, or at least in communities resembling them (Inman 1993), and that effect is more or less what neotraditional plans try to deliver: a physical environment inviting neighborhood interaction, rather than obstructing it, and land-use and street patterns permitting more travel by foot, all in a manner and appearance consistent with our collective sense of the traditional small town.⁴ In principle, the new designs thus confirm, rather than challenge, how many people feel about where and how they would like to live.

The impacts of such thinking on professional practice have, roughly speaking, followed two lines. One is principally “architectural” in the sense that design and scale elements dominate. The community of Seaside (illustration 1), for example, is justly noted for the clapboard beauty of its homes, its white picket fences, and its weathered old-town feel, though it is barely ten years old (Dunlop 1989; Mahoney and Easterling 1991). The look is sensitive to local context, however. The newer and larger Duany/Plater-Zyberk project of Kentlands, in Gaithersburg, Maryland, is based on the mid-Atlantic look and feel of Annapolis and Georgetown. In his writing and, to a lesser extent, in designs such as Laguna West, a development in the Sacramento, California area, Calthorpe (1993) has stressed the importance of bringing human scale not only to individual housing tracts, but also to the linkages between residential and commercial activities (illustration 2). The renewed emphasis on front porches, sidewalks, and common community areas as spatial focal points, as well as the half-mile-wide “village scale” of each community, are the most visible examples of such links. The last feature is strongly reminiscent of the “neighborhood unit” approach to planning first popularized in the 1920s and 1930s (Perry 1939; Dahir 1947; Banerjee and Baer 1984).

The second major area in which these designs have found popular acceptance is transportation policy. Public complaints about automobile congestion and air quality have left planners intensely receptive to new ways of reducing car use; yet their options are limited. The cost of mass transit is ballooning, and conventional transportation planning strategies have not changed the affliction most people continue to feel for their cars (Giuliano 1989; Deakin 1991; Wachs 1993a, 1993b). Fundamental change in land-use patterns is seen as a potentially more promising tool, and this idea has found its way into an increasing number of public planning and policy documents aimed at improving air quality by means of land-use/transportation linkages (e.g., San Diego 1992, Los Angeles 1993, and San Bernardino 1993). Perhaps the most typical transportation feature of this new design trend has been a grid street layout, in contrast to the conventional looped cul-de-sac pattern, as seen in figure 1. The main intent is to shorten trip lengths for pedestrians as well as to increase community legibility.⁵ The conclusion that auto travel will decrease in more compact and grid-like land-use developments is so appealing that it has been reported as a virtual fact in almost all discussions of neotraditional design principles.⁶ The strong appeal of neotraditional planning, then, is that in some respects it promises to kill two birds with one very attractive stone.

This paper examines the conventional neotraditional wisdom that a return to a grid circulation pattern has unambiguous transportation benefits. The popularity and the growing influence of this planning theory on community transportation and land-use policy justify the attention, especially since what little evidence we have about the transportation benefits of the grid pattern is weak at best, and contradictory at worst. As shown in the following section, the most consistent empirical finding has been that a change in land use increasing “access,” measured any number of ways, invariably leads to shorter trips—a result following essentially by definition. A measurable effect of access on induced behavior, such as trip frequency, mode split, or total travel, has proven more elusive. In some
cases, trip frequency has risen with improved access, rather than fallen. In other instances, variation in access has had no measurable effect on travel patterns other than average trip length.

The discussion and analysis below offer both an explanation for these somewhat contrary results and a framework for consistently evaluating the net travel impacts of changing land-use patterns such as the new suburban designs. Generally speaking, neotraditional designs both promote and discourage auto use, with the net effect being mixed. The analysis suggests that the generic transportation benefits of neotraditional and transit-oriented designs have been oversold, and that each development must be carefully evaluated as a separate case to determine whether its net effect on auto use is positive or negative.

Note that the argument presented here is not that neotraditional or transit-based urban and suburban designs are wrong-headed. On the contrary, it is easy to be enthusiastic about the thoughtful and imagina-

tive ways such designs provoke planners to rethink the physical and aesthetic organization of both residential and mixed-use space. Neither does this article imply that these plans necessarily lack transportation benefits. Rather, it demonstrates that such benefits are not self-evident, depending as they do on the particular mix of features in each development. The primary purpose of this study is to identify the source of the misunderstanding and to suggest a framework for evaluating the various design features by measuring their net benefits more reliably.

The next section reviews the literature on the transportation benefits of neotraditional designs, concluding that past work is either incomplete or problematic: while these designs are typically promoted as having transportation benefits in every element, the evidence is mixed at best. The following section then clarifies how street patterns affect travel behavior, and the implications for efforts to measure the transportation benefits of new suburbs.
ILLUSTRATION 2. Laguna West, California (Photo by and courtesy of Calthorpe Associates)

FIGURE 1. Pedestrian pocket versus more standard and “discouraged” development design (from City of San Diego, Transit Oriented Development Guidelines, prepared by Calthorpe Associates (1992), 18)
Streets, Travel and Access: The Literature

The promise of nearly all new suburban design strategies has included a reduction in automobile use (e.g., Duany and Plater-Zyberk 1992; Calthorpe 1993). This is to be accomplished by reducing the surface street distance between locations, mixing land uses, and supporting alternative transportation modes such as walking, bicycling, and transit. Many such designs also narrow streets and change the streetscape to reduce auto access and build at a more human scale. The intent is to increase the interaction of residents by increasing pedestrian traffic, as well as to reduce air pollution and traffic congestion. Neotraditional designs thus often feature elements of both transit-based and grid-like circulation patterns, which make more efficient use of neighborhood streets and improve overall neighborhood access.

A principal goal in each case is to move many trip destinations within walking distance of homes. The higher densities and increased mixing of land uses accomplishing this also allow individuals to accomplish more with each local trip. The thinking is that these elements, alone and in tandem, will encourage people to walk more and so enjoy their neighborhoods more. (See figures 2 and 3 and illustration 3, showing the circulation patterns in Seaside.) In some cases, these features are expected to encourage increased use of transit for commuting, which involves pedestrian travel to and from transit stops and stations as well. In either instance, it is typically assumed that residents will both take fewer trips and drive fewer miles overall (Duany and Plater-Zyberk 1992; Calthorpe 1993).

The available evidence on these questions is difficult to synthesize, as the literature commonly addresses aesthetic, social, and transportation issues simultaneously. In addition, the various design types grouped under the rubric of neotraditional town planning differ in fundamental respects, so that generalizations about the style as a whole are often inappropriate. As our interest is with transportation issues, the following discussion focuses on those design attributes meant to influence travel. At the risk, then, of ignoring some distinguishing traits and overemphasizing others, we characterize "new suburb" designs as those attempting to influence travel behavior in at least three ways:

- Land uses will be better integrated, thus reducing the number of trips;
- The effective travel distance between any two points will lessen; and
- Pedestrian- and transit-oriented features will be promoted over car-oriented features.

The success of the first of these will clearly depend on a number of factors, including the compatibility of both land uses and trip purposes. This "mixed-use" argument is not directly addressed here.8

Rather, the paper sorts out the behavioral effects of the last two features in terms of how the changes in circulation patterns affect travel patterns. Two problems with these arguments are immediately apparent: Available supportive evidence is scanty; moreover, most studies are grounded on either questionable assumptions or comparisons of dissimilar communities. Studies of actual neotraditional developments have not been published, as few developments are fully built out at this time. Hence, even careful quantitative evaluations tend to be based on either hypothetical situations, as in the case of engineering simulations, or data obtained from older traditional communities sharing some characteristics with proposed neotraditional communities. The three methodological approaches used thus far are simulation studies, descriptive studies, and analytical studies based on observed behavior. Those studies supportive of the proposition "grid patterns reduce car use" tend to have serious flaws, such as assuming that trip frequencies do not vary from one design to another, or failing to isolate the independent influence of the street pattern on travel behavior. This group of studies is briefly reviewed below.

Simulation Studies

Peter Calthorpe's (1993) assertions about the transportation benefits of his suburban designs depend heavily on a finding in a simulation study by Kulas, Anglin, and Marks (1990) that traditional grid circulation patterns reduce vehicle miles traveled (VMT) by 57 percent as compared to VMT in more conventional networks. The usefulness of this result is limited, however, because the authors assume trip frequencies are fixed. They also assume average travel speeds are slower in a grid-based network, which in turn requires nonstandard street design standards. Calthorpe (1993) and Duany and Plater-Zyberk (1992) often mention their desire to slow cars down by using narrower streets and less parking, but not all designs do—especially where they must comply with conventional traffic engineering standards.

The more elaborate simulation studies of McNally and Ryan (1993) similarly report less driving in a rectilinear grid street system, yet they also assume trip frequencies are unchanged. As a consequence, the result more or less follows directly from the statement of the problem: As you move trip origins and destinations closer together, which the grid system does, trip lengths must decrease. The unanswered question is
whether the number of trips is also affected by the change in trip length. The lack of a transparent behavioral framework, a problem shared by most engineering simulations, and the neglect of trip generation issues make the conclusions of both sets of studies difficult to assess.

**Descriptive Studies**

Another study often used to document the transportation merits of traditional or neotraditional street patterns is the descriptive work of Friedman, Gordon, and Peers (1992). While their work is not analytical, it does have the dual advantage of addressing the question of trip generation and being based on actual behavior rather than simulations. Working from household travel surveys in the San Francisco Bay area, the authors categorized the observations into either Standard Suburban or Traditional, depending on whether each area possessed a hierarchy of roads and highly segregated land uses (the former) or had more of a street grid and mixed uses (the latter). They then compared travel behavior in the two groups. Average auto trip rates were about 60 percent higher in the Standard Suburban zones for all trips, and about 30 percent higher for home-based nonwork trips. It is impossible to separate out the relative importance of the many differences between the two groups of communities, however, and thus to identify how much of the observed behavior is influenced by the street configuration alone. The Traditional areas include those with employment and commercial centers, and with close proximity to transit networks servicing major employment centers such as downtown San Francisco and Oakland.

In a qualitatively similar kind of comparison, but one restricted to residential neighborhoods of similar ages and other characteristics, Handy (1992b, 1992c) found survey evidence that the more grid-like communities in the San Francisco Bay Area generated more local automobile trips rather than fewer. She also provides limited evidence, but without much explanation, that VMT are greater in traditional areas for certain types of trips. In addition, while the number of walking trips per survey respondent was highest in neotraditional-type communities, “it could not be determined whether these walking trips replace or are in addition to driving trips” (Handy 1992c, 266). The relationship between different types of trips remains unclear in these simple comparisons of average trips per day per person, by mode, across communities.
broadly characterized as traditional or modern. (Handy also estimated models of pedestrian behavior for her sample, but with little success.)

**Analytical Studies**

Holtzclaw (1994) recently examined the issue somewhat more directly, by measuring the influence of neighborhood characteristics on auto use and transportation costs generally. The neighborhood characteristics used in the study are residential density, household income, household size, and three constructed indices: transit accessibility, pedestrian accessibility, and neighborhood shopping. These are in turn used to explain the pattern of two measures of auto use: the number of cars per household, and total VMT per household. The data are from the 1990 U.S. Census of Population and Housing for 28 California communities. The reported regression coefficient on density in each case is ~0.25, suggesting that doubling the density will reduce both the number of cars per household and the VMT per household by about 25 percent. The results also argue that a doubling of transit accessibility, defined as the number of bus and rail seats per hour weighted by the share of the population within a quarter-mile of the transit stop, will reduce the number of autos per household and the VMT per household by nearly eight percent. However, changes in the degree of pedestrian access—based on street patterns, topography, and traffic—or neighborhood shopping had no significant effect on the dependent variables in this sample. The street configuration is only one component of the pedestrian access measure, so this result does not in itself imply that a more grid-like pattern has no impact on VMT or number of autos.

A 1993 study of Portland, Oregon is similar in approach to the Holtzclaw report, but has the advantage of using household-level survey data (1000 Friends of Oregon 1993). This analysis also attempts to explain the pattern of VMT, as well as the number of vehicle trips, using household size, household income, the number of cars in the household, the number of workers in the household, and constructed measures of the pedestrian environment, auto access, and transit access. The auto and transit access variables were defined as simple measures of the number of jobs available within a given commute time: 20 minutes by car and 30 minutes by transit. As an example, an increase in 20,000 jobs within a 20-minute commute by car is estimated to reduce daily household VMT by half a mile.
while increasing the number of daily auto trips by one-tenth of a trip. The same increase in jobs within a 30-minute commute by transit reduces daily VMT a bit more, to six-tenths of a mile, and reduces the number of daily car trips by one-tenth of a trip.

The pedestrian access variable is more complex, based on an equal weighting of subjective evaluations of four characteristics in each of 400 zones in Portland: ease of street crossings, sidewalk continuity, whether local streets are primarily grids or cul-de-sacs, and topography. The final score for each zone ranges from a low of 4 to a high of 12, with 12 being the most pedestrian-friendly. The regression model reported that an increase of one step in this index, from 4 to 5, say, decreases the daily household VMT by 0.7 miles, and decreases the daily car trips by 0.4 trips. These point estimates are used to predict the effects of changes in the independent variables, such as access to employment by transit, on the dependent variables. Although this result is consistent with the theory that more pedestrian-friendly and transit-oriented development reduces both car trip frequency and overall auto travel, it does not directly measure the effects of street patterns. The difficulty is that the effects of a grid as compared with an alternative street pattern are not separated out from the sidewalk, street crossing, and topography variables.

In a related look at how access affects trip generation within urban areas, Hanson and Schwab (1987) present evidence that in Sweden better access, measured as more retail and service establishments within a specified distance, reduces the proportion of trips made by automobile. However, they found little or no influence of access on overall trip frequency, and hence on VMT. Another set of studies looks at the impact on transit ridership of residential densities and development near transit stations. These are summarized in Cervero (1993, 1994) and Holtzclaw (1994), and mainly conclude that people are more likely to make use of transit the closer stations are to their homes and where they work. Thus, transit ridership is positively related to the density of both residential developments and employment sites near stations.

In sum, the studies measuring both trip frequency and VMT in grid communities have found that auto use is either higher than or no different from what it is
in comparable nongrid settings (Hanson and Schwab 1987; Handy 1992b, 1992c). Most other work has assumed that trip frequencies fall or do not change, or else their data are insufficiently disaggregated. Virtually every case lacks a straightforward framework for sorting out the independent effects of each component of neighborhood design on travel behavior. All three groups of studies have lumped several design and travel characteristics together, making conclusions about the travel properties of individual street and neighborhood design features impossible to isolate. The clearest pitfall is the failure to separate out the effects of a grid circulation pattern, which in principle increases access for both cars and pedestrians, from the effects of street width and streetscape features explicitly intended to slow cars and reduce traffic. The next section clarifies this point, that more access can lead to more travel in all modes. In so doing, the discussion identifies the main behavioral parameters that designers should account for in their plans.

Measuring the Travel Impacts of Improved Access

This study offers both an explanation for the somewhat contrary results in the literature and a framework for consistently evaluating the net travel impacts of changing land-use patterns, such as the new suburban designs. The main result is simple, and well known to transportation analysts in other contexts (e.g., Domencich and McFadden 1975; Wachs 1993b), yet has inexplicably been overlooked in past evaluations of the transportation benefits of neotraditional plans: Any neighborhood configuration of land uses and street patterns improving local access will also increase trip frequencies, perhaps enough to increase overall travel. The consequence is that a change in land use that improves community access, even if transit- and pedestrian-oriented access improve the most, may not reduce auto travel. In contrast to the conventional wisdom, it may well increase it. Moreover, even if travel by car falls with the improvements in access, ignoring the higher trip frequency associated with more open circulation patterns misleads by overstating the potential transportation benefits of the design.

The literature on the transportation effects of neotraditional design has yet to employ a strong conceptual framework when investigating these issues, leaving both supportive and contrary empirical results difficult to interpret. In particular, an analysis of trip frequency and mode choice requires a discussion of the demand for trips, but land-use studies, at even a superficial level, often lack that. That approach would permit us to explore the behavioral question, for example, of how a change in trip distance influences the individuals desire and ability to take trips by each mode. The tools of microeconomics provide perhaps the most straightforward framework for such a discussion, by emphasizing how overall resource constraints enforce tradeoffs among available alternatives, such as travel modes, and how the relative attractiveness of each alternative in turn depends on relative costs, such as trip times (e.g., Domencich and McFadden 1975).

The discussion below abstracts from the many other aspects of this topic to address the effect of improved access on travel distance, trip frequency, and mode split. Three sets of assumptions focus the analysis on the questions at hand:

- "Access" is interpreted solely as a price or cost characteristic, related to trip length.10
- Travel behavior is described by a standard microeconomic model of individual demand.
- New suburban designs are assumed to reduce the distance required to make any local trip.

In a sense, the last assumption characterizes these designs as a compression of existing land-use patterns that, most particularly, shrinks the effective travel distances between potential nodes. Compared to an alternative design, this improvement in access has three somewhat countervailing effects. It reduces the absolute cost of a trip in each mode; it may change the relative cost of each mode; and it increases the purchasing power of any individual making that trip by freeing up time and money resources. Although the literature on neotraditional design has tended to suggest otherwise, the first and third of these effects will typically increase the demand for trips in all modes, rather than reduce it.11 The second may or may not. The presumption would be that pedestrian travel could become more attractive in comparison with driving than it had been, through the design of better pathways and so on.

As benchmarks, the potential effects of the price changes on mode choice are illustrated in figures 4, 5 and 6 for trips by car and by foot.12 For any given trip frequency these plots the cost of a trip, for some unspecified purpose, against trip length. This cost summarizes all the relevant features of the trip, including the aesthetic aspects so critical to the neotraditional planners. The purpose of the trip has obvious implications for the relative merits of walking and driving, and for how those merits vary with the length of the trip. As is often noted, people rarely walk to the grocery store when they can drive. Each chart assumes that the marginal cost of travel is everywhere rising;
both the total trip cost and the marginal cost of walking are initially lower than for driving, and the cost of walking rises more quickly than that for driving does. Hence people will tend to walk for short trips and drive for longer trips, all things considered. These idealizations are intended only to clarify how access can influence the means of travel.

Figure 4 presents an initial situation, wildly simplified for the sake of legibility. For short trips, walking is the preferred mode. When the cost (including the time required as well as out-of-pocket expenses) for the trip gets to a certain point, however, this person prefers to drive. In the example, that cost is labeled α and corresponds to a trip of length δ. For trips of distance δ or more, say one-quarter of a mile, it costs less overall to drive, and the car becomes the best mode. The lower envelope of the two total cost curves is the mode demand curve at any distance. Hence, any change in land-use patterns that reduces trip length from above δ to below δ will substitute pedestrian traffic for automobile traffic, for that trip.

Characterizing the change in land-use patterns as a decrease in the cost of a trip to a certain distance makes the relative attractiveness of driving versus walking dependent on the relative change in the cost of each. Figures 5 and 6 illustrate two such cases. The cost of traveling any given distance decreases for both modes in each example. An asterisk denotes the post-

**FIGURE 5.** The new suburb. The grid street pattern lowers trip costs for both modes in comparison to conventional designs. Walking costs fall from w to w*, and automobile trip costs fall from α to α*. In this example, auto travel costs fall less than walking costs, so maximum walking trip length rises from δ to δ*.}

**FIGURE 6.** The same comparison as in figure 5, but for an example where per-mile auto costs decrease more than walking costs, so maximum walking trip length falls from δ to δ*.}

improvement trip cost, so that walking trips to any distance have fallen from a cost of w to w*. In figure 5, the pedestrian cost falls the most at any distance, so that the trip length where modes change (δ) becomes longer; that is, δ<δ*. For any given number of trips, the mode split now features more trips by walking and fewer by car than before. This is consistent with the work on pedestrian travel by Untermann (1984), Guy
and Wrigley (1987), and 1000 Friends of Oregon (1993), all of whom show that walking trips rise with an improvement in pedestrian access.

This is not the only possible outcome, however. New suburban designs also promise to improve circulation and reduce congestion for automobile travel, and designers have rarely if ever explicitly evaluated how these improvements compare with the value of the community's pedestrian-oriented features. It is possible that the grid circulation pattern characteristic of many neotraditional designs could generate the result shown in figure 6, where a reduction in street congestion along with other changes lowers per-mile auto travel costs the most. In some instances the change in automobile circulation is the focus of the design.

The other implication of new suburban design that can be suggested by these simple diagrams is that the length of a particular trip—for example, to the bookstore or the park—will decrease, regardless of which mode is used and how trip length is measured. Better access leads to shorter trips in each mode.

While many of the travel-oriented components of neotraditional neighborhood designs are aimed at encouraging pedestrian and transit travel, they often also include changes in street patterns that will reduce the distances required to drive between locations. Will this lead to more walking and less driving, as promised? The charts above suggest that the net impact on mode choice is ambiguous, except where the (time and money) cost of nonauto modes are reduced the most.

What cannot be easily answered with these figures is the impact of improved access on total trip generation, and thus on the total amount of travel by mode. Depending on how relative access changes, more trips are likely to be generated in certain modes, including possibly car travel. Even in those cases where better access translates to a shift from cars to pedestrian travel for preexisting trips, new trips by car may result in response to the lower cost per trip. Whether total car travel—trip frequency times trip length—rises or falls therefore depends on how these two components compare. If the number of automobile trips increases by more than the average trip length declines, a result opposite to the neotraditional promise is obtained.

Crane (1995) presents a formal argument identifying the basic tradeoffs that make the impact of neotraditional street patterns on auto use ambiguous. That analysis examines the effect of a change in trip cost, among other design features, on automobile trips, on walking trips, on miles traveled by automobile, on miles traveled walking, and on aggregate travel. The main idea can be presented somewhat more plainly, however, as follows: A change in the time required for a trip by any particular mode may affect the number of trips desired in all modes. It does this in two ways, by affecting the relative cost of a trip in each mode and by affecting the remaining time and money available for travel. A reduction in the time and convenience required for a trip on foot will both increase the attraction of walking versus other modes—the substitution effect—and also increase the amount of time available for travel by all modes. As it becomes easier to walk, owing to a better system of walkways, shorter distances, better landscaping, etc., we thus expect people to substitute walking trips for car trips. Put another way, we usually expect the demand curve for travel by any given mode to be downward sloping. Indeed, this possibility is often mentioned as the predicted outcome of the grid land-use patterns associated with neotraditional neighborhood design.

The conventional assessment ignores a critical part of the story, however. Perhaps the main point of this article is that the same argument applies to travel by car. The increase in access associated with neotraditional neighborhood design typically reduces the cost of travel for all modes. A move to a grid street pattern will shorten the driving distances between any two locations, thus reducing the time and effort required for each trip by car. As neotraditional planners have pointed out, this will reduce the length of each trip. However, it follows from our characterization of travel demand that people, in the aggregate, will also take more trips by car. That part of the result is unambiguous, even if auto access improves only a bit. The indeterminate part of the story is whether people will take enough new trips to more than offset the shorter trip length, resulting in more travel overall. This outcome depends on how individuals assess the importance of trip length and of overall access, for trip frequency. Not only will this evaluation differ from one individual to another, but it will also depend critically on other characteristics of the land use and circulation environment. In short, a change in land-use that improves community access overall may or may not reduce auto travel.

For example, some designs incorporate significant traffic-calming features, such as narrow streets and intersections, intended to slow cars down or otherwise explicitly discourage their use (Appleyard 1981; Duany and Plater-Zyberk 1992). These features should generally reduce auto access and thus the demand for auto trips, all things being equal. All things are not held equal, however, if the design also reduces driving distances, relative to an alternative street layout. Again, the net effect on vehicle miles traveled can be either positive or negative as compared to that in a conventional suburban layout. It is worth repeating, moreover,
that many neotraditional designs neglect traffic calming features altogether (Friedman, Gordon, and Peers 1992; McNally and Ryan 1993).

Within the evaluative framework of neotraditional planning, the impact of a time savings on car trip demand is thus theoretically uncertain. An increase in accessibility both encourages and discourages automobile travel in part, leaving the net effect impossible to determine a priori. As shown by Crane (1995), the number of trips by car will rise with increased access as long as the substitution effect remains sufficiently small. The substance of this article is that the magnitude of these effects will depend on local circumstances, such as the availability of close substitutes for either pedestrian or car travel, and so cannot be stated generally.

Conclusion

The increase in access associated with neotraditional neighborhood design typically reduces the cost of travel for all modes. All things considered, people will be likely to take more trips. They could take enough new trips to more than offset the shorter trip length, resulting in more travel overall. A direct consequence is that a change in land use and street configuration that improves community access, even if transit- and pedestrian-oriented access are improved the most, may or may not reduce auto travel. It may well increase it, particularly if the demand for auto travel is relatively price-elastic and/or income-elastic. Even if car travel falls with access, ignoring the higher trip frequency associated with more open circulation patterns is misleading, and thus overstates the potential transportation benefits of the design.

Careful empirical study of these issues is surprisingly rare. It is tempting to conclude that many urban designers and transportation planners have taken the neotraditional argument at face value, at least with respect to travel impacts. If so, the assessment is premature, as available analyses offer little conclusive evidence that “new suburban” planning influences travel behavior in any way other than shortening the average trip. In some instances behavior toward trip frequencies and mode split appears to be relatively inelastic with respect to access, although these relationships have been analyzed for statistical significance in only a few cases. In the most thorough study done to date, Handy (1992b) presents evidence that trip frequencies usually increase with access; the net effect on total travel is much less clear.

In fairness, it must be said that although neotraditional designers are likely to have been overly entusiastic in their arguments that such designs have auto travel benefits, they are generally careful to emphasize the many needed complementary elements of such strategies. It is mainly traffic engineers and land-use planners who have focused on the traffic advantages of the grid without considering its impact on trip frequency, and without emphasizing the attendant need to make pedestrian travel more pleasant and social (e.g., Kulash, Anglin, and Marks 1990; Friedman, Gordon, and Peers 1992; McNally and Ryan 1993). Although most neotraditional developments probably have traffic benefits, these are more likely to be due to features that “calm traffic” and cluster destinations within walking distance than to the collateral benefits of a grid-like subdivision form. These benefits are also less likely to affect commuting and major shopping than to affect other kinds of trips. In the end it seems evident that the relationship between a legible street pattern and car versus pedestrian travel is one that simply has not been deeply examined.

In the face of incomplete knowledge, planners have begun to experiment with “contingency standards,” which are themselves dependent on the actual behavior generated by a development rather than on design promises. San Diego County has designed a contingency transportation plan for the 23,000-acre, neotraditional Otay Ranch development, eventually to contain as many as 80,000 residents. If the development does generate fewer than the standard number of auto trips per household, as its designers intend but cannot guarantee, traffic engineers have agreed to convert some of the lanes on arterials to open space (Calvita 1993). In the interim, however, streets must conform to existing codes.

It is worth repeating that the purpose of this article is not to disagree with what neotraditional and pedestrian-oriented planners have in mind. Their approach to the modern suburb is substantially more thoughtful and functional than that characterizing the typical suburban development. In most respects, moreover, the new suburban model appears to satisfy its design objectives. At the same time, the results developed here suggest that the transportation benefits of neotraditional design are likely to be overstated. The main problem with the claim for these benefits is that in nearly all instances, they are expected to follow from each and every feature of a neotraditional traffic plan. Thus much attention has been devoted to what is perhaps the easiest element to implement, a rectilinear grid street plan, often to the exclusion of other, more promising features. The fact that a grid, by itself, may well cause more traffic problems than it solves has slipped between the cracks.
AUTHOR’S NOTE

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NOTES


2. The mixed views the architectural profession has held toward the suburbs, ranging from disdain to merely aesthetic, are perhaps part of the story. See the discussion in Boles (1989).

3. Except that, as Calthorpe (1993) emphasizes, traditional small towns tend to lack the densities required to support transit. Fink (1993) also argues that the neotraditional model, based in many ways on the prototypical Eastern small town, does not apply well to the more decentralized character of the western U.S.

4. Interestingly, Duany (1989) emphasizes that these communities are not typically permitted under standard building and planning codes. A central feature of his firm’s town plans has been their codes, which provide both for more flexibility in some respects, such as allowing narrower streets, and for less in others, such as prescribing design guidelines for individual structures. Clear descriptions of how a neighborhood and a planning department might change street codes to benefit existing neighborhoods are found, respectively, in Appleyard (1981) and Fernandez (1994).

5. Alternative views of the street “grid” as a design element representing spatial attitudes as well as form, in theory and historical practice, are found in Nitschke (1966), Groth (1981), and Kostof (1991).


7. Many of the broader issues concerning the linkages between land uses and transportation behavior are discussed in, for example, Cervero (1989), Deakin (1991), Giuliano (1989), and Handy (1992a).

8. Crane (1985) explicitly considers how mixing uses and increasing densities, as well as “calming” traffic, affect the demand for car trips and VMT. See Middlesex Somerset Mercer Regional Council (1992) for a survey and recent evidence that greater densities and mixed uses can significantly reduce both VMT and auto trips per person. Wachs (1993a, 1994b) points out, however, that these are likely to increase per square mile, worsening congestion and perhaps pollution.

9. Holtzclaw defines “pedestrian access” as (fraction of through streets) x (fraction of roadway below 5 percent grade) x (0.33)/(fraction of blocks with walks) + (building entry setback) + (fraction of streets with controlled traffic).

10. Access has been measured in many ways, but is often used to capture scale as well as distance (Handy 1992b, 1992c). The number and diversity of potential destinations within some specified distance, such as the number of grocery stores and restaurants, is a typical measure (Hanson and Schwab 1987). In practice, node composition as well as the spatial distribution of nodes thus both matter. To keep the basic story straightforward, this article abstracts from all aspects of access but linear distance. However, although increasing the diversity of destinations clearly affects the attractiveness of any travel mode for any given travel distance, it does not qualitatively affect the logic of the argument.

11. Handy (1992b) and Crane (1995) are the ones who I am aware of that explicitly note this consequence of reducing trip length.

12. Extending the story to allow for more travel modes, such as transit and bicycling, would complicate the narrative and analytics without changing the qualitative nature of the results.

13. I employ the term “demand curve” somewhat differently from its usual usage, as it gives the preferred mode corresponding to the total cost of an entire trip, not the number of trips or the trip length per unit cost.

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