CITIES AND ACCESSIBILITY: THE POTENTIAL FOR CARBON REDUCTIONS AND THE NEED FOR NATIONAL LEADERSHIP

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Abstract

This article begins by outlining the elements that should be included in the framework for understanding how people interact with their built environments. Part II describes how the framework might be made operational through the use of an emerging technique called land-use transportation scenario planning. Part III assesses how well land-use transportation scenario planning fits within the dictates and limits of U.S. transportation law. The analysis ultimately reveals that it holds substantial promise as a tool that could lead to meaningful cuts in carbon emissions.

KEYWORDS: Gree-TEA, Carbon reduction, transportation infrastructure, induced development, triple convergence
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Keith Bartholomew∗

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INTRODUCTION

U.S. cities are a major contributor to greenhouse gas emissions. Collectively, the commercial and residential buildings that make up our urban areas contribute 38% of the nation’s human-generated carbon dioxide emissions and urban-related car and truck travel another 21%. And yet, American cities are a significant source of hope in the battle to reduce climate change impacts. True, American culture, policy, and affluence have created some of the most resource consumptive landscapes in the world, but the picture is not uniformly dismal. In carbon emissions, as in real-estate, not all urban development is equal.

In fact, there is substantial variation in the resource consumption and carbon emission capacity of differing development patterns. Manhattan, for example, has been labeled one of the nation’s “greenest” places, in part because of its record of energy efficiency in transportation, while Raleigh-Durham has been identified as one of the most resource consumptive. While it is tempting to label these variations as just another dimension of the city-suburb continuum, that would be too simplistic and conclusory. Moreover, it would not offer much in the way of guidance for future action. Instead, what is needed is a framework that first provides some understanding of how people interact with their built environments and then offers constructive direction for policy development.

This Article attempts to construct that framework. Part I begins by outlining the elements that should be included in the framework, using the concept of accessibility as the primary organizing structure. Part II describes how the framework might be made operational through the use of an emerging technique called land use–transportation scenario planning, and offers some indication of what deployment of that technique might mean for reductions in carbon emission rates. Part III then assesses how well land use–transportation scenario planning fits within the dictates and limits of U.S. environmental and transportation law.

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The analysis reveals that accessibility-based land use–transportation scenario planning holds substantial promise as a decision-making tool that could lead to meaningful cuts in carbon emissions. While the technique is accommodated by several important federal environmental and transportation statutes, the fit is awkward. Moreover, the degree to which federal law mandates use of the technique is limited, indicating that its wide-scale deployment will likely also be limited. Given this outcome, the Article concludes that national leadership is needed for the development of statutory revisions, principally in the federal transportation planning and funding law, which is scheduled for renewal by Congress in 2009.5

I. MOBILITY & ACCESSIBILITY: FOUR POLICY LEVERS

Patterns of land use and transportation investment that are carbon profligate can be differentiated from those that are carbon efficient by whether the pattern was designed and built to prioritize mobility, on the one hand, or accessibility, on the other. Strictly speaking, mobility focuses on the movement of vehicles in time and space.6 Accessibility, by contrast, focuses on the ease and convenience by which a person (or an increment of freight) can gain access to a needed activity.7 While the two concepts are related, they are not mutually dependent.8 In many circumstances increased mobility can increase a person’s level of accessibility to daily destinations.9 Assuming a constant geographic arrangement of destinations and low levels of traffic congestion, the number of places one can access in a car is frequently much greater than the number accessible by walking.10

5. This Article focuses on transportation-related energy and carbon issues, but the framework proposed here has many possible co-benefits, including farmland and open space preservation, protection of water quality, improvements in public health, and energy security. See EWING ET AL., supra note 1, at 10.


7. See id.; Harvey J. Miller, Place-Based Versus People-Based Accessibility, in ACCESS TO DESTINATIONS 63, 63 (David M. Levinson & Kevin J. Krizek eds., 2005) (“Accessibility is a multi-faceted concept that ultimately centers on an individual ability to conduct activities within a given environment.”).

8. See Susan Handy, Planning for Accessibility: In Theory and in Practice, in ACCESS TO DESTINATIONS, supra note 7, at 131 (“[M]obility and accessibility are distinct concepts with vastly different implications for planning.”).


10. Id. This is not always the case, however. Consider the central portions of many of the world’s large cities (mid-town Manhattan, for example) where driving a car can actually provide for less accessibility than walking.
Accessibility, however, is not dependent on mobility. For example, a person’s access to grocery shopping can be increased by the construction of a new store within walking distance of that person’s home or place of work. This would result in a net increase in the person’s accessibility in a way that is independent of mobility. In fact, the person’s expressed amount of mobility would likely decrease. Assuming households in Manhattan and Raleigh-Durham have roughly equivalent needs for access to basic daily activities, Manhattanites accomplish the same tasks with substantially less mobility than those living in Raleigh-Durham.

Given the environmental and climate impacts associated with increased levels of mobility, it would seem that the focus of land use and transportation planning, policy, and investment should be on accessibility. This, sadly, is not the case. Instead, for the past half-century, those efforts have been directed, almost exclusively, at reducing impediments to, and thereby increasing, mobility. The operative principles that lie behind this seeming obsession with mobility can be grouped into four basic policy “levers”: transportation infrastructure, transportation pricing, transportation education, and land use. These policy levers, which individually and synergistically influence individual travel choices and community level transportation patterns, have been pointed, almost uniformly, toward mobility-based outcomes since the mid-twentieth century. Hence, moving toward an accessibility-focused, and more carbon-efficient, land use and transportation planning framework will require substantial readjustment to each one of the levers.

11. See Handy, supra note 8, at 133 ("Good mobility is neither a sufficient nor a necessary condition for good accessibility.").
12. See Reid Ewing & Robert Cervero, Travel and the Built Environment—Synthesis, 1780 TRANSP. RES. REC. 87, 88 (2001) (showing that the number of total trips per household by all modes (i.e., "person trips") varies little across different development patterns).
13. See Reid Ewing et al., Measuring Sprawl and Its Impact app. 3 (2002) (showing average metropolitan levels of driving per person per day for New York and Raleigh-Durham of 15.4 and 31 miles, respectively).
14. There are many sources that catalog environmental resources implicated in transportation systems. For a general summary of the issue, see F. Kaid Benfield et al., Once There Were Greenfields: How Urban Sprawl Is Undermining America’s Environment, Economy and Social Fabric (1999).
A. Transportation Infrastructure

The impact of transportation infrastructure on travel demand is rooted in the physical requirements of public investment to facilitate movement—one cannot drive on a road that does not exist. The presence of transportation infrastructure does much more than facilitate trips, however. It can, in fact, influence the timing, length, destination, and mode of a trip, or whether a trip is made at all. Although for decades transportation planning has been based on the assumption that the amount of demand for travel is set predominantly by demographic forces, it is now understood that demand also responds to the amount and nature of the supply provided. According to “Down’s Law,” demand for travel expands to fill the capacity provided to it.17

When a new or expanded facility adds significant amounts of capacity to a transportation system that formerly was near or beyond its capacity, travel on the new/expanded facility is easier and quicker compared to other travel options, at least initially. Because people, to a large degree, make travel choices that optimize for speed and convenience,18 they are apt to change their behaviors to take advantage of the new capacity. Those behavioral changes express themselves in short-term shifts in daily travel patterns, medium-term changes in trip frequencies and lengths, and longer-term structural changes in land development patterns. These three phenomena are referred to, respectively, as triple convergence, induced travel, and induced development.

As the name implies, triple convergence connotes three ways in which travelers take advantage of a new or expanded transportation facility: by changing their time of travel, their travel mode, or their travel route.19 All three describe responses to the new or expanded facility’s increase in relative speed and convenience, compared to other travel choices. The temporal shifts occur among travelers who formerly avoided rush-hour congestion by traveling at other times; the new/expanded facility allows these travelers to change to traveling during the peak period. Travelers who formerly used modes of travel other than the one improved by the capacity expansion are similarly induced to switch to the improved mode. Travelers using other, parallel routes will likewise be encouraged to switch to the im-

proved facility. Together, these three short-term adjustments to travel patterns converge to soak up substantial amounts of the new capacity offered by the new or expanded facility.

Induced travel describes the changes people make in trip frequency and length in response to transportation capacity increases. One might assume that as travel becomes faster, people would use the time saved toward some other productive activity, but this, largely, is not the case. Basic economics teaches that as a product becomes less costly, people tend to consume more of it. So it is with travel. When the cost of travel decreases, in this case as measured by time, people tend to do more of it. This occurs, despite the fact that travel is a “derived demand”—in other words, it is not a good in and of itself but a function that provides the means for obtaining goods or accomplishing tasks. It is now understood that people have a daily “travel time budget”—an amount of time that they are willing to devote to traveling each day. For most people, that budget is somewhere around seventy-five minutes, regardless of travel conditions. As average travel speeds increase or decrease, people make proportional changes to their trip-making behaviors to stay close to their travel time budget. Hence, as travel speeds increase due to a significant capacity expansion, many people respond by increasing their trip frequencies and lengths, particularly for discretionary trips such as shopping. For example, they begin making individual trips to stores they formerly visited as part of multi-destination tours—thereby increasing the rate at which they make trips—and they select stores further away than they did previously, adding to their average trip distances. These relationships are demonstrated graphically, and somewhat cynically, by the cover of the April 1966 edition of Asphalt magazine (see Figure 1).

20. A short-term example of route convergence occurs every time travelers respond to radio traffic reports by altering their travel routes to avoid congestion and vehicle crashes.
21. Downs, supra note 19, at 82-86.
24. Hanson, supra note 6, at 3-4. But cf. Patricia L. Mokhtarian et al., Understanding the Demand for Travel: It's Not Purely "Derived," 14 Innovation 355, 377 (2001) ("[W]e should begin to view travel not just as a disutility, but as a literal 'good' having both positive and negative characteristics.").
26. See id.; see also Transp. Res. Bd., supra note 19, at 145; Downs, supra note 19, at 104.
Figure 1. Cover of *Asphalt*, the quarterly publication of the Asphalt Institute (April 1966).

*Induced development* (sometimes called *induced growth*) refers to the long-term changes in land use patterns resulting from significant capacity expansions, reflecting shifts in the origins or destinations of trips.\(^27\) Consistent with the total travel time budget outlined above, average travel times for various trip purposes (for example, work, school, and shopping) have remained relatively stable for decades, perhaps even for centuries.\(^28\) This

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27. See Terry Moore & Paul Thorsnes, *The Transportation/Land Use Connection* 23 (1994) ("In the long run (from one to 10 years, or longer), land uses will respond to the lower overall cost of transportation on the system. Households and businesses currently located within the urban area will consider the lower transportation costs when they decide to relocate.").

28. See Peter O. Muller, *Transportation and Urban Form*, in *The Geography of Urban Transportation*, supra note 6, at 59, 61 ("The spatial extent of the continuously built-up urban area has, throughout history, exhibited a fairly constant time-distance radius of about 45 minutes' travel from the center . . . .").
has been especially true for commute trips. Throughout the last third of the twentieth century, average commute times remained steady at approximately twenty to thirty minutes. Yet, during the same period, travel speeds increased appreciably, reflecting increases in travel capacity. Obviously, this meant that travel distances also increased. While in some cases the increased commute distances reflected shifts in workplace location, they more often reflected shifts in housing location, with commuters choosing to trade the increased travel speeds for more distant, and frequently larger, residences.

Adding or expanding a transportation facility usually also means increasing the potential traffic flow in the vicinity of the improvement, thereby increasing the number of people who can access those places—in other words, more people can now travel to those locations within a given time frame. This increased access enhances the market attractiveness of those locations. For example, major retailers prefer highly accessible sites, as do businesses that rely on high levels of access to labor markets. The increased attractiveness, however, is relative: the locations served by the new or expanded facility have increased accessibility compared to other potential locations within a given market area. This means that the newly favored locations gain a competitive edge over the others. In time, this is likely to manifest itself through additional land development in the

29. See Hanson, supra note 6, at 21; see also Newman & Kenworthy, supra note 2, at 27 (“In the United Kingdom, a government study found that travel time for work trips had been stable for six centuries . . . .”).

30. See Hanson, supra note 6, at 21.

31. See Barry Zondag & Martis Pieters, Influence of Accessibility on Residential Location Choice, 1902 TRANSP. RES. REC. 63 (2005). Some observers have noted a recent reversal in this trend due, in part, to substantial increases in gasoline prices. See Joe Cortright, Driven to the Brink: How the Gas Price Spike Popped the Housing Bubble and Devalued the Suburbs (2008), http://www.ceosforcities.org/newsroom/pr/files/Driven%20to%20the%20Brink%20FINAL.pdf (charting how increased gas prices have resulted in significantly steeper declines in housing prices and increased home foreclosures in far-out suburbs compared to central cities and close-in suburbs); William H. Frey, Brookings Inst., Older Cities Hold on to More People, Census Shows (2008), http://www.brookings.edu/papers/2008/0710_census_frey.aspx (showing population increases in older central cities as a result of increasing gasoline prices and a slowdown in the housing market); see also Gas Prices Shift Housing Demand Toward Cities, NEW URB. NEWS, June 2008, at 3.

32. Note that the use of the word access has shifted slightly in this context. People-based accessibility, as outlined above on pages 161-62, refers to a person’s ease and convenience of being able to accomplish a needed task. Here, however, access refers to the ease of getting to a particular location. It is, hence, generally referred to as geographic- or place-based accessibility. See Miller, supra note 7, at 63-64.

33. Genevieve Giuliano, Land Use Impacts of Transportation Investments, in The Geography of Urban Transportation, supra note 6, at 237, 240-41.
areas surrounding the improved facility. The new or expanded facility does not create the demand for the new development, per se—in most cases the development would have occurred somewhere in the market area anyway. The new facility does, however, influence the location of the development, proximate to the expanded facility. This new development, of course, will have a certain amount of travel associated with it. Depending on the development’s size and type—commercial, residential, or industrial—the impacts of the added trips on surrounding transportation networks—including the newly expanded facility—could be substantial.

In the context of new or expanded highways, triple convergence, induced travel, and the travel generated by induced development conspire to swamp the additional capacity provided by a new or expanded facility. The extent to which these factors consume that capacity depends on a number of site-specific factors, particularly how congested the pre-existing roads were before the expansion. Studies estimate that the short-term effects could consume 40-50% of the new capacity: “the longer-term effect is likely to be greater, with a higher proportion (perhaps all) of the time saved being used for further travel.” In other words, depending on local


35. Id. The expanded facility could, additionally, influence the design of the induced development. For example, if the development attracted to an expanded suburban highway would have otherwise been located in more central, transit-served areas, it is likely that the design of the development at the suburban highway location would be more auto-oriented than at the alternative sites. See, e.g., Isadore Barmash, Sears Plans Move to Site Near Chicago, N.Y. TIMES, June 27, 1989, at D5 (“The company will move its merchandising group from the Sears Tower, the 110-story downtown headquarters it has put up for sale, to a campus-like setting on a 700-acre site Hoffman Estates, 20 miles northwest of Chicago.”). This would likely lead to more auto use overall than if the development happened at the more central sites. See HAGLER BAILLY, TRANSPORTATION AND ENVIRONMENTAL ANALYSIS OF THE ATLANTIC STEEL DEVELOPMENT PROPOSAL 21 (1999), available at http://www.epa.gov/ProjCtl/atlantic/as_51099.pdf (showing how siting a development proposed for central Atlanta at alternative suburban locations would result in increased vehicle travel of between 14.5% and 52.3%, depending on the location).

36. DOWNS, supra note 19, at 104 (“In the long run, road expansion could make congestion worse than it was initially.”).

37. See Robert Cervero, Are Induced-Travel Studies Inducing Bad Investments?, 22 ACCESS 26 (2003); see also ROBERT CERVERO & MARK HANSEN, ROAD SUPPLY-DEMAND RELATIONSHIPS: SORTING OUT CAUSAL LINKAGES (2000), http://www.uctc.net/papers/444.PDF.

conditions, approximately half of the new capacity could be consumed by triple convergence and much of the rest consumed by the impacts of induced travel and induced development.\textsuperscript{39}

Interestingly, these same relationships between supply and demand appear to apply to all transportation modes, not just to highways, although not to the same degree.\textsuperscript{40} For example, when the Utah Transit Authority added light rail service to its system for the first time in 1999, overall transit ridership increased 17\% in just one year; an additional 9\% increase occurred in the year after the agency opened its second line in 2001.\textsuperscript{41} Similar effects have been observed for non-motorized travel as well.\textsuperscript{42} The effects in non-automobile contexts arise from the same factors observed with respect to highways: the added capacity provided by new or expanded facilities makes travel by those modes more attractive because of actual or perceived increases in speed or convenience.

As outlined, the provision of transportation supply through investments in infrastructure can significantly affect the choices travelers make in how, when, where, how often, and how far they travel. Rather than being fixed and pre-determined solely by demographic influences, demand tends to follow supply to a certain degree, lending credence to those who argue that regions cannot successfully build their way out of congestion.\textsuperscript{43} In the end,

\textsuperscript{39} See Mark Hansen & Yuanlin Huang, \textit{Road Supply and Traffic in California Urban Areas}, 31 Transp. Res. Part A 205 (1997) (showing that a 1\% increase in highway capacity leads to a .9\% increase in vehicle miles traveled in five years); see also U.S. Envtl. Prot. Agency, \textit{Our Built and Natural Environments: A Technical Review of the Interactions between Land Use, Transportation, and Environmental Quality} 22 (2001) ("[I]nduced travel can occur and can absorb all new capacity."). \textit{But cf.} Transp. Res. Bd., \textit{supra} note 19, at 163 ("[O]nly part of the increased highway use can be attributed to the highway capacity addition.").

\textsuperscript{40} Fed. Highway Admin., U.S. Dep’t of Transp., Induced Travel: Frequently Asked Questions, http://www.fhwa.dot.gov/planning/ifaq.htm\#q5 (last visited Jan. 15, 2009) ("Improvements in any transportation system can lead to changes in travel behavior that will result in increased use of the system. A new bus route, rail transit line or commuter rail service is typically developed with the expressed purpose of acquiring new riders.").


\textsuperscript{43} See Downs, supra note 19, at 106.
people tend to make rational choices that maximize the time and convenience efficiencies of their travel. If public policy and investment decisions make traveling in a certain method superior to other options, people will gravitate to that method. Since the 1950s, U.S. policy and investment decisions have made automobile driving the superior method and people have responded by dramatically increasing their level of driving. The increase in driving has been attended, of course, by commensurate increases in carbon dioxide emissions.

The increased mobility that occurred as a result of these investment policies initially facilitated increased accessibility to a wide range of destinations. Over time, however, levels of accessibility steadily eroded. Through the effects of induced development, increased mobility has facilitated a steadily expanding development pattern. The saturation of automobile-related infrastructure and corresponding automobile dependency within dominant segments of American society have helped lead to a dispersion of destinations, thereby increasing the distances between where people are and where they need to go. In a self-fulfilling way, this has made access to many destinations increasingly dependent on high levels of mobility, frequently achievable only by the automobile. These mobility levels, however, are not shared across society and they are increasingly difficult to

44. See, e.g., Brian D. Taylor, The Geography of Urban Transportation Finance, in THE GEOGRAPHY OF URBAN TRANSPORTATION, supra note 6, at 294, 307 (indicating that more than 87% of government spending on transportation capital facilities in 2000 went to roads and highways).

45. See BRUCE KATZ & ROBERT PUENTES, TAKING THE HIGH ROAD: A METROPOLITAN AGENDA FOR TRANSPORTATION REFORM 55 (2005) (indicating an approximate 300% increase in vehicle miles traveled between 1960 and 2000, compared to a population increase of about 50%).

46. See EWING ET AL., supra note 1, at 22-23.

47. See NEWMAN & KENWORTHY, supra note 2, at 31-32. But cf. CORTRIGHT, supra note 31; Frey, supra note 31.

48. See Handy, supra note 8, at 133; Hanson, supra note 6, at 4.

49. According to the U.S. Census, in 2000 more than 60.2 million Americans (21.4% of the population) were too young to drive (age fifteen or younger); more than 25.4 million (9%) were seventy or older and may have limited or reduced ability to drive; more than 21.1 million (7.5%) reported a physical disability, which may impair driving abilities; and nearly 33.9 million (12.3%) had income below the poverty level, making the ownership and operation of an automobile financially prohibitive. U.S. CENSUS BUREAU, CENSUS 2000 SUMMARY FILE 1 & SUMMARY FILE 3 (2000), available at http://factfinder.census.gov. See generally AARP, BEYOND 50.03: A REPORT TO THE NATION ON INDEPENDENT LIVING AND DISABILITY 87 (2003), available at http://assets.aarp.org/rgcenter/il/beyond_50_il_3.pdf (“[A]s people move from their 70s into their 80s, the proportion of licensed drivers drops from more than 90 percent to just over 50 percent.”); Michael Cameron, Transportation Efficiency and Equity in Southern California: Are They Compatible?, in JUST TRANSPORTATION: DISMANTLING RACE AND CLASS BARRIERS TO MOBILITY 53, 59 (Robert D. Bullard & Glenn S. Johnson eds., 1997) (“[T]he 20 percent of the population in the lowest-income
To reverse these trends and move toward an accessibility focused planning process, the transportation infrastructure policy lever needs to shift substantially away from investments in highway expansion and toward non-highway investments that support a greater concentration of activities. Instead of obsessing on the need to ease or increase the flow of vehicles, transportation planning should refocus on facilitating accessibility to needed and desired activities. In other words, attention needs to shift from the needs of the machine to the needs of the operator.

### B. Transportation Pricing

People tend to make their travel choices in response to perceptions of cost—in transportation, as in other areas of life, people look for bargains.

50. By one estimate, it would require the construction of nearly 5000 lane miles annually, at a cost of $24 billion a year, just to maintain current congestion levels in the seventy most congested urban areas in the United States. See Surface Transp. Pol’y Project, Driven to Spend: Pumping Dollars out of Our Households and Communities (2005).


54. See Handy, supra note 8, at 134 (“To plan for accessibility is to focus on the ends rather than the means and to focus on the traveler rather than the system: do people have access to the activities that they need or want to participate in?”).

55. See Tommy Gärling & Reginald G. Golledge, Cognitive Mapping and Spatial Decision-Making, in Cognitive Mapping: Past, Present and Future 44, 51 (Rob Kitchin & Scott Freundschuh eds., 2000); see also Transp. Res. Bd., supra note 19, at 142 (“All else being equal, the lower the cost of highway travel, the greater the propensity to travel and the less priority residents and businesses will give to transportation relative to other preferences and costs of doing business.”); Kirk Johnson, Gasoline Prices, Still Rising, Alter the Habits of Many, but Far from All, N.Y. Times, Aug. 9, 2006, at A14.
It is not just the total cost of transportation that is influential, however, but also whether those costs are fixed or incremental. Fixed costs are those that do not vary with the amount of use. One either pays the cost—thereby gaining access to a particular travel option—or does not—resulting in the foreclosure of that option. Examples include the capital cost of buying a car or the cost of buying a monthly bus pass. In both cases, the amount of cost and the amount of use are unrelated, with neither affecting the other.

With incremental costs, on the other hand, costs and use are proportional: the more you use, the more you pay. Here, the best example is a bus fare. Every time someone boards the bus, they pay a fare (assuming they do not have a pass). Other examples include highway tolls, parking (at meters or pay lots), fuel, and the exertion of pedaling a bicycle. Time and convenience costs are incremental, as well: the time spent sitting in traffic congestion or trolling for an on-street parking spot are paid per instance.

The basic rule is that people seek to maximize the use of transportation modes that are based predominantly on fixed costs and minimize the use of incremental cost options. From a personal utility perspective, this makes sense. The fixed-cost option is already paid for; using it more will not cost more. In fact, increased use of a fixed-cost transportation option lowers the calculated amortized per use cost of that option, often to the point where continued use is perceived to be free. In contrast, an incrementally charged option will, by definition, always cost more with additional use. Hence, travelers that have comparable fixed cost and incre-


57. See Harold H. Kassarjian & Thomas S. Robertson, PERSPECTIVES IN CONSUMER BEHAVIOR xii (1981) (outlining the standard micro-economic theory that “[c]onsumers will behave in such a way as to maximize utility”).

58. Elizabeth Shay & Asad J. Khattak, Automobile Ownership and Use in Neotraditional and Conventional Neighborhoods, 1902 TRANSP. RES. REC. 18 (2005) (“[V]ehicles generally are treated by their owners as sunk costs.”).

59. See Edward Beimborn et al., INSIDE THE BLACKBOX: MAKING TRANSPORTATION MODELS WORK FOR LIVABLE COMMUNITIES 22 (Envl. Def. Fund ed.), available at http://www.environmentaldefense.org/documents/1859_InsideBlackBox.pdf (last visited Jan. 28, 2009) (outlining why travel forecasting models exclude the fixed costs of vehicle ownership and maintenance from calculations to estimate the number of trips made by automobile versus the number made by transit); CAMBRIDGE SYSTEMATICS, POTENTIAL PUBLIC POLICY IMPLICATIONS OF PAY-AS-YOU-DRIVE (PAYD) LEASING AND INSURANCE PRODUCTS 1-1 (2006), available at http://www.lrrb.org/pdf/200639C.pdf (“Since vehicles depreciate whether or not they are driven, people are often motivated to drive more so that they ‘get their money’s worth’ from their ownership investment in the car.”).
mental cost alternatives will almost always chose the former over the latter.\footnote{See, e.g., Brian E. McCollom & Richard H. Pratt, Transit Pricing and Fares, in TRAVELER RESPONSE TO TRANSPORTATION SYSTEM CHANGES, supra note 57, ch. 12-24 (explaining how the introduction of unlimited use passes in New York resulted in a 6.6% increase in ridership).}

On balance, most of the costs associated with car ownership and use are fixed. Of the $835.6 billion Americans spent on owning and operating private automobiles in 2001, 53% was spent on fixed costs—purchase price, financing, insurance, licensing, and registration—while only 20% was spent on incremental costs—fuel and tolls.\footnote{U.S. CENSUS BUREAU, STATISTICAL ABSTRACT OF THE UNITED STATES: 2006, at 694 (2005). The remaining 27% was spent on maintenance and parking. Maintenance has attributes of being both fixed and incremental, while parking could be either fixed or incremental depending on whether it is purchased through a permit (fixed) or by amount used (incremental). Of course, the recent increases in fuel costs are changing the balance.} Although some time and convenience costs associated with car use, such as those associated with traffic congestion, are paid incrementally, these costs are generally offset by the automobile’s many time and convenience benefits, which also accrue incrementally.

By contrast, many of the costs associated with transit use are imposed incrementally. As mentioned, with the exception of monthly passes, fares are generally charged on a per use basis, which is by definition an incremental cost. In addition, transit travel tends to be significantly slower than automobile travel,\footnote{See ALAN E. PISARSKI, COMMUTING IN AMERICA III: THE THIRD NATIONAL REPORT ON COMMUTING PATTERNS AND TRENDS 109 (2006) (noting the average travel time by solo car commuters was 24.06 minutes in 2000, compared with 45.88 for bus commuters).} with much less geographic and temporal flexibility. These time and convenience costs are also paid incrementally.

Given these conditions, a casual observer would have to conclude that U.S. transportation policy either favors driving or is indifferent: well over half of the costs of driving are paid through fixed-cost methods, whereas the costs of using non-automobile modes, in both out-of-pocket and time costs, are paid incrementally. Intentional or not, the current transportation pricing methods are partially, but significantly, responsible for America’s automobile dependency\footnote{See DOWNS, supra note 19, at 42-48.} and its resulting dispersal of destinations and decrease in accessibility.\footnote{The recent spikes in gasoline prices demonstrate this price/dispersal relationship, though in reverse. See CORTRIGHT, supra note 31; FREY, supra note 31.} The transportation pricing policy lever of a planning paradigm that is focused on accessibility would seek to reverse those conditions by shifting more of the costs of driving to incremental pricing.
methods, while charging more of the costs of using alternative modes through fixed-cost methods.

C. Transportation Education

In addition to transportation infrastructure and pricing, education plays an important role in influencing travel choices. People will consider only those travel options contained in a “choice set” comprised of alternatives they deem to be viable methods for meeting their needs. Because options not contained in a choice set will not be considered, understanding and influencing the cognitive processes behind the formation of choice sets is crucial to affecting ultimate travel decisions. Factors used in choice set formation processes include the physical availability of options, cultural and familial influences, and lifestyle preferences. Also relevant is the amount and quality of information a user has about various travel options; one cannot choose an option that is fully or partially unknown. Making rational travel choices, consequently, is dependent on having complete in-

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65. See, e.g., CAMBRIDGE SYSTEMATICS, supra note 59, at 3-5 (showing that households participating in a pay-as-you-drive auto insurance program drive 8% fewer miles than similar households that buy fixed-cost auto insurance); JAMES M. WHITTY, OREGON’S MILEAGE FEE CONCEPT AND ROAD USER FEE PILOT PROGRAM vi (2007) (showing a 22% decline in peak period driving in response to the imposition of a congestion-based mileage road user fee). See generally FED. HIGHWAY ADMIN., CONGESTION PRICING: A PRIMER (2006), available at http://ops.fhwa.dot.gov/publications/congestionpricing/index.htm.

66. See, e.g., Sungyop Kim & Gudmundur F. Ulfarsson, Curbing Automobile Use of Sustainable Transportation: Analysis of Mode Choice on Short Home-Based Trips, 35 TRANSP. 723, 735 (2008) (“[B]us pass holders have a higher propensity towards both bus and bike for short trips”); McCollom & Pratt, supra note 60, at 12-7; William Neuman, In Decade of Unlimited Rides, MetroCard Has Transformed How the City Travels, N.Y. TIMES, July 16, 2008, at B3 (describing how the introduction of unlimited ride transit passes resulted in steep ridership increases); Katie Zezima, With Free Bikes, Challenging Car Culture on Campus, N.Y. TIMES, Oct. 19, 2008, at A18.


68. See Katrin Dziekan, What Do People Know about Their Public Transport Options?, 35 TRANSP. 519, 520 (2008).

69. See id.

70. See KARLA KARASH ET AL., UNDERSTANDING HOW INDIVIDUALS MAKE TRAVEL AND LOCATION DECISIONS: IMPLICATIONS FOR PUBLIC TRANSPORTATION 3 (2008) (showing that survey respondents changed their attitudes about transit when more fully informed about the services available); Victoria Transp. Policy Inst., TDM Marketing, in ONLINE TDM ENCYCLOPEDIA (2009), http://www.vtpi.org/tdm/tdm23.htm (“Given adequate resources, marketing programs can significantly increase use of alternative modes and reduce automobile travel . . . .”).
formation about the choices available.\textsuperscript{71} Having incomplete information will artificially restrict formation of the choice set, leading to a skewed selection process.\textsuperscript{72}

The transportation information provided in modern America is dominated, almost universally, by information about automobiles. From parental and societal conditioning, to blanket advertising in the media, to drivers’ education courses in school, Americans are bombarded with information about how to use streets and highways to drive cars. Information about other travel choices is much harder to come by. Nevertheless, in those comparatively limited instances when marketing is attempted to promote non-auto modes, it has been effective in changing travel patterns.\textsuperscript{73}

The impact of transportation-related education on travel choices demonstrates its importance in creating an accessibility focused planning system. Under such a system, the transportation education policy lever would shift to aggressively promote non-auto modes and discourage driving, particularly solo driving.\textsuperscript{74}

\begin{thebibliography}{99}
\bibitem{71} Caspar G. Chorus et al., \textit{Information Impact on Quality of Multimodal Travel Choices: Conceptualizations and Empirical Analyses}, 34 TRANSPORTATION 625, 642 (2007).
\bibitem{72} See \textit{DEBORAH STONE, POLICY PARADOX: THE ART OF POLITICAL DECISION MAKING} 71 (2002) (“A . . . condition for a well-functioning market is that there must be full information about the available alternatives . . . .”).
\end{thebibliography}
D. Land Use

The built environment through which a transportation system traverses can have a substantial effect on transportation choices. Land use patterns can determine whether it is cost-effective to run a bus through a neighborhood, whether it is feasible to run mid-day errands without a car, and whether it is possible to safely and conveniently cross the street on foot. If transportation is about getting from here to there, land use defines the nature of here and there and in so doing defines the range of feasible transportation options. For convenience, land use issues are frequently subcategorized into five “Ds”: density, diversity, destination proximity, distance to transit, and design.

1. Density

Density is a representation of land use intensity that directly or indirectly measures the concentration of human activity. Persons living in higher density neighborhoods tend to be less automobile dependent, own fewer cars, drive them less often, and for shorter distances than persons living in lower density neighborhoods. Conversely, denser neighborhoods are generally associated with higher use levels of non-automotive modes. The relationship between density and travel patterns is rooted in accessibility. People living and working in denser neighborhoods usually have access to a much greater range of potential activities within close proximity.
than those in lower density neighborhoods.82 That increased accessibility makes lower rates of automobile use possible and use of alternative modes convenient, even preferable. People in higher density neighborhoods are not staying home more than those in low density neighborhoods; they make just about as many total trips as their low density cousins, but they rely much more on non-automobile modes and they travel substantially fewer miles.83

2. Diversity

Diversity refers to the mix of land uses within a small geographic area. The focus is not just on the traditional broad categories of residential, commercial, and industrial, but also on land use types within those categories. For example, the commercial component of a diverse environment might include small real estate offices, a large law firm, a couple of travel agencies, hair salons, tax accountant offices, health spas, music shops, a large department store, restaurants and cafes, and a book store. Suburban developments frequently have very little land use diversity; often they are comprised of a narrow range of land use types within a single category. Residential areas will not only be just residential, but will frequently contain only a limited number of product-types aimed at a rather narrow socio-economic market (for example, single-family detached houses within a set range of sizes and prices). By comparison, city or town centers may contain a wide variety of residential uses (for example, single-family detached houses, rental apartments, condos, and assisted living buildings) mixed in with a host of office, retail, manufacturing, cultural, educational, and entertainment organizations and businesses.

As with density, the amount of diversity correlates with a range of variation in travel patterns: as the amount of diversity increases, the amount of single-occupant automobile driving decreases and the use of other transportation modes increases.84 People living in more diverse neighborhoods tend to own fewer cars85 and drive them less frequently86 than those living

82. See G. S. Rutherford et al., Travel Impacts of Urban Form: Implications from an Analysis of Two Seattle Area Travel Diaries, in URBAN DESIGN, TELECOMMUTING AND TRAVEL FORECASTING CONFERENCE, WILLIAMSBURG, VA: SUMMARY, RECOMMENDATIONS AND COMPENDIUM OF PAPERS (L. Day ed., 1997).
85. See Hess & Ong, supra note 78, at 41 (“Households in neighborhoods with mixed land use are 31 percentage points more likely to be without an automobile than households in homogeneous neighborhoods.”).
in more homogenous environments. Those who commute to work sites located in diverse neighborhoods are more likely to travel by non-automobile modes than those working in single-use locations. As with density, having a wider choice of land uses in closer proximity means that it is more likely that daily activities will be more accessible with less travel. Although there is overlap among the two concepts, they are each based on different questions: density asks “how much stuff is there?”, while diversity asks “what kind of stuff is there?”

3. Destination Proximity

Destination proximity measures the degree to which a development pattern is centralized and compact. On average, people living in neighborhoods that are closer to a region’s center tend to drive less than those living in comparable neighborhoods located at the fringe. An analysis done for the Atlantic Steel redevelopment project in downtown Atlanta demonstrates this phenomenon. The study compared the relative transportation impacts of the proposed development at the downtown site with equivalent amounts of development at three suburban locations: a perimeter beltway site (Perimeter Center), a suburban site (Cobb/Fulton), and an exurban site (South Henry County). The analysis shows that the amount of driving associated with the development varies dramatically, depending on the location. At the Perimeter Center site, the development would generate 14.5%
more vehicle miles traveled ("VMT") than if it were located downtown; at the South Henry County site, the difference was 52.3% (see Table 1).

Table 1. Variations in Vehicle Miles Traveled ("VMT") between Alternative Sites for the Atlantic Steel Development Project

<table>
<thead>
<tr>
<th>location</th>
<th>VMT/day</th>
<th>% difference vs. Atlantic Steel site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlantic Steel</td>
<td>340,300</td>
<td>—</td>
</tr>
<tr>
<td>Perimeter Center</td>
<td>389,672</td>
<td>14.5%</td>
</tr>
<tr>
<td>Cobb/Fulton County</td>
<td>507,498</td>
<td>49.1%</td>
</tr>
<tr>
<td>South Henry County</td>
<td>518,197</td>
<td>52.3%</td>
</tr>
</tbody>
</table>

As with density and diversity, the issue with destination proximity is accessibility. Central locations are closer to a larger number and wider range of potential activities than fringe sites. This makes the use of non-automobile travel modes more feasible and reduces the length of most trips, regardless of mode.

4. Distance to Transit

Proximity to transit services is another important way land use influences travel patterns. The closer the origin or destination of a trip is to a station on a high-capacity transit network (usually rail-based), the more likely a person is to use transit for at least some trips. Similar to the other D variables, proximity translates as convenience. The closer one is to a transit station, the easier it is to walk to that station. As distance from the station increases, driving becomes relatively more convenient. Studies show that the major break-off point between being close enough and being too far appears to be around ¼ mile: within ¼ mile, transit ridership is ap-
proximately twice as high as it is between ¼ and ½ mile.98 After ½ mile, ridership rates fall even faster.99

5. Design

While all of the previous D variables are related in some way to physical proximity between trip origins and destinations, design is targeted at the specific ways in which origins and destinations are connected. Design, in this context, refers to a wide array of small-scale features in the built environment that make travel by one mode or another relatively easy and convenient or cumbersome and problematic. For example, a landscape designed for the convenience of car drivers might include multi-lane arterials, few intersections, large blocks, and ample parking lots located in front of buildings.100 Those same features, however, would likely make pedestrian travel unpleasant, indirect, and perhaps unsafe. Pedestrians tend to prefer narrow, slow-speed streets, frequent crosswalks, small blocks, ample sidewalks, street-fronting buildings, and various amenities that make walking pleasant (for example, street trees, street furniture, and visually interesting building facades).101 Logic suggests that such features can either facilitate or confound certain travel options.102 While the evidence is inconclusive, people appear to respond, at some level, to the indicated transportation design preference in a way that is consistent with that preference—for example, people accessing environments with high-quality pedestrian features


99. Dill, supra note 97, at 23.

100. See, e.g., JAMES HOWARD KUNSTLER, THE GEOGRAPHY OF NOWHERE 115 (1993) ("The suburban streets of almost all postwar housing developments were designed so that a car can comfortably maneuver at fifty miles per hour—no matter what the legal speed limit is."); MICHAEL SOUTHWORTH & ERAN BEN-JOSEPH, STREETS AND THE SHAPING OF TOWNS AND CITIES 4 (1997) ("Design of the residential street network is based on statistical information and research that is primarily oriented to facilitating vehicle movement on large-scale streets and highways."); Kuzmyak et al., supra note 76, ch. 15-58.


102. See Allan B. Jacobs & Donald Appleyard, Toward an Urban Design Manifesto, 53 J. AM. PLAN. ASS’N 112, 119 (1987) ("It is not enough to have high densities and an integration of activities to have cities.").
are more likely to travel by non-automobile modes than those accessing environments dominated by automobile design features. 103

The definition of what design features are important in determining mode orientation is not firmly set.104 Many studies focus on the layout of local streets: a street pattern containing smaller blocks arranged in a rectilinear orientation with a high density of four-way intersections is thought to be more conducive to pedestrian and bicycle movement than large block patterns with irregularly shaped blocks and few intersections. The rationale is that when people are traveling under their own power they are much more sensitive to travel distance, in general, and out-of-direction travel, in particular.105 A route that is more direct and, hence, shorter is more likely to induce someone to walk or bike than a route that is long and circuitous.106 A mid-1990s study attempting to measure the impacts of street connectivity in combination with other pedestrian design attributes—sidewalk connectivity, frequency of street crossings, and topography—found that households located in neighborhoods with a high level of these attributes had 10% fewer vehicle miles traveled than households in neighborhoods with only average levels.107 The location of parking at commercial buildings—in the front or side of the building versus in the back—also appears to be important in affecting travel choices.108

103. See U.S. ENVTL. PROT. AGENCY, supra note 92, 2-4 to 2-9 (showing that rearranging the proposed site plan for the Atlantic Steel redevelopment project to include a finer grain of streets and a more mixed land use pattern would reduce vehicle miles travel by 5.8%).

104. See Terri Pikora et al., Developing a Framework for Assessment of the Environmental Determinants of Walking and Cycling, 56 SOC. SCI. & MED. 1693, 1694 (2003) (“[I]t is unclear which specific features of the environment are important and how they influence physical activity.”).


106. Kuzmyak et al., supra note 76, ch. 15-93 (“If a destination is close enough, walking or bicycling in lieu of motorized travel becomes a viable option.”).

107. 1000 FRIENDS OF OR., supra note 42, at 32 (the results came from a multiple regression analysis that controlled for a variety of household demographic variables, as well as land use density and job accessibility); see MICHAEL REPLOGLE, INTEGRATING PEDESTRIAN AND BICYCLE FACTORS INTO REGIONAL TRANSPORTATION PLANNING MODELS: SUMMARY OF STATE-OF-THE-ART AND SUGGESTED STEPS FORWARD (1995); CAMBRIDGE SYSTEMATICS ET AL., SAN FRANCISCO TRAVEL DEMAND FORECASTING MODEL DEVELOPMENT: FINAL REPORT (2002). But cf. SUSAN HANDY ET AL., PLANNING FOR STREET CONNECTIVITY: GETTING FROM HERE TO THERE 16-17 (2003) (outlining controversy among studies, some showing that grid street patterns may increase trip making—including by car—while others showing grided streets resulting in less driving).

108. See Cervero & Kockelman, supra note 76, at 214 (“[S]omeone heading to a shop within their neighborhood is, on average, 56% more likely to drive alone if all buildings are surrounded by front- and side-lot parking vs. if all buildings have rear-lot parking.”); see also ANNE VERNIZ MOUDON, WASH. STATE TRANSP. CTR., EFFECTS OF SITE DESIGN ON PEDESTRIAN TRAVEL IN MIXED USE, MEDIUM-DENSITY ENVIRONMENTS (1996); 4B 1000
Identifying quantifiable travel responses with neighborhood-scale design elements is a relatively new research area, and many methodological issues have yet to be resolved. As a result, the degree of significance between specific design elements (for example, street furniture, sidewalk and intersection density, street widths) and variations in travel choice is not well defined, making a precise articulation of optimal design elements difficult. In the studies identified above, researchers were not able to discern whether the identified design features—street crossings, sidewalk networks, etc.—were solely responsible for the observed variations in travel patterns, or partly responsible in combination with other unidentified design elements, or whether the features acted merely as proxies for other characteristics. The difficulty in quantifying the transportation impacts of precise design components reflects, in part, the nature of neighborhood design issues and a mismatch of scales of analysis: travel patterns are assessed at a regional scale, while neighborhood design issues are articulated and addressed in very specific and localized contexts that vary greatly from neighborhood to neighborhood. In one neighborhood, increasing pedestrian-friendliness will require the construction of a new mid-block street crossing; in another, the widening of a sidewalk and planting of street trees; in still another, the narrowing of travel lanes on an arterial. Moreover, most design components considered important to travel choice processes usually appear in groups of attributes, not as single features, suggesting the possibility of overlapping and synergistic relationships. Regardless of the difficulty of identifying a precise list of components, the evidence indi-
cates that some combination of small scale design features is important in influencing transportation choice processes.114

Collectively, the five Ds distinguish built environments that facilitate access to desired activities and functions from those that frustrate such access. These spatially based elements are therefore at the root of accessibility.115 Unfortunately, for most of the last century, the five Ds in American land use patterns have been largely directed toward decreased levels of accessibility: low density, single use developments in isolated locations with poor access to transit, and auto-oriented design.116 An accessibility focused planning process would seek to reverse these trends and use the five Ds to promote built environments where potential origins and destinations are within close proximity and conveniently connected to each other.117

114. TRANS. RES. BD., DOES THE BUILT ENVIRONMENT INFLUENCE PHYSICAL ACTIVITY? EXAMINING THE EVIDENCE 158 (2005) (“[P]ositive perceptions about shade, scenery, traffic, people, safety, and walking incentive and comfort were positively correlated with numbers of walking trips to neighborhood commercial areas.”).

115. See Levinson et al., supra note 15, at 1 (“Like a house is a machine for living, cities are the machine for accessibility.”). But cf. Miller, supra note 7, at 63 (“A place-based approach to accessibility by itself is no longer viable in a world where transportation and [information and communication technologies] are drastically changing the relationships among place, space, and person.”).

116. See Henry Diamond & Patrick E. Noonan, Land Use in America 4 (1996) (showing increases in developed land between 1970 and 1990 of up to six times the rate of population increase); Downs, supra note 19, at 251 (indicating that less than 20% of the jobs in the eleven largest U.S. metropolitan areas are located within three miles of the regional center); Newman & Kenworthy, supra note 2, at 31-32 (outlining the increasing dominance of “Auto City” development patterns after 1945); Joseph J. Persky & Wim Wiewel, Introduction, in SUBURBAN SPRAWL: PRIVATE DECISIONS AND PUBLIC POLICY xiii-xiv (Wim Wiewel & Joseph J. Persky eds., 2002) (“[F]rom 1970 to 1990 the amount of urbanized land [in the Chicago region] grew by 46 percent, while the population increased by only 4 percent.”); see also U.S. ENVTL. PROT. AGENCY, supra note 39, at 4-8 (tracing land use trends in the second half of the twentieth century toward more dispersed, low density, and auto-oriented development patterns).

117. See Eliot Allen & F. Kaid Benfield, Environmental Characteristics of Smart-Growth Neighborhoods 17 (2003) (found that a neighborhood in Tennessee with modestly higher density, mix, and connectivity had 25% fewer per capita VMT than an otherwise comparable nearby neighborhood), available at http://www.nrdc.org/cities/smartGrowth/char/charnash.pdf; Asad J. Khattak & Daniel Rodriguez, Travel Behavior in Neo-Traditional Neighborhood Developments: A Case Study in USA, 39 TRANS. RES. PART A 481, 494 (2005) (finding that residents of a “New Urbanist” neighborhood in North Carolina generated 22.1% fewer automobile trips and made three times as many walking trips than residents of an otherwise similar neighborhood, even when controlling for demographic factors and preferences).
II. ACCESSIBILITY-BASED SCENARIO PLANNING

Having identified four policy levers that can be used to prioritize accessibility, how can those levers be made operational? One option is a technique known as scenario planning.

A. Asking “What If?”

Scenario planning asks a series of questions about the future that impliedly, if not literally, begin with what if. What if we arranged future land use development patterns a certain way and integrated them with transportation investments? What if we added a new parking pricing policy? What if gas prices double in the next decade or two? What if the climatic conditions changed drastically in our region? What would happen to our residents’ quality of life should any of these scenarios come to pass? Because all of these “what ifs” are about the future, we can never be certain that any of them will come to pass or, if they do, to what degree. Scenario planning is a way of thinking that can bound the range of these uncertainties and bracket the risks inherent in planning for a future that no one can predict.118

A scenario is “an internally consistent view of what the future might turn out to be . . . not a forecast, but one possible future structure.”119 Scenarios, fundamentally, are stories about the future, with beginnings, middles, and endings.120 In fact, the use of scenario in the planning context is derived from the term’s use in Hollywood screenwriting.121 Scenarios need not—and indeed cannot—be unerringly predictive. Rather, their job is to present a vision of the future that is internally coherent and plausible in light of known information.122

A process that uses scenarios to assess the future—a “scenario planning” process—employs a series of scenarios to define a range of possible future conditions. The scenarios are crafted around the key driving forces in local and macro environments that are both most important to the resulting decision and most uncertain.123 The expectation is that conceiving, crafting, and evaluating a series of scenarios, will identify an appropriate course, or

120. JAMES OGILVY, CREATING BETTER FUTURES: SCENARIO PLANNING AS A TOOL FOR A BETTER TOMORROW 11 (2002).
122. GILL RINGLAND, SCENARIOS IN PUBLIC POLICY 176 (2002).
series of courses, of action. Hence, through this process, the wide-open question of what the future might bring can be narrowed down to a more manageable set of possibilities.

The historic roots of scenario planning are based in military contexts and are reflected in writings that date back as far as Sun Tzu’s fourth century BCE treatise *The Art of War*. In the 1950s, scenario planning was used by the RAND Corporation to assess a range of potential nuclear conflict situations. In the early 1970s, the technique migrated to corporate strategic planning circles, where it was used to analyze economic conditions. Undoubtedly, the most famous application of the technique from that period was Royal Dutch/Shell’s study that effectively anticipated the 1973 OPEC oil embargo.

**B. Land Use–Transportation Scenario Planning**

During the 1990s, a form of scenario planning emerged that essentially grafted the military/business practice onto the more customary transportation planning structures of the metropolitan transportation planning process required by the Federal-Aid Highway Act of 1962 and the alternative analysis requirements of the National Environmental Policy Act of 1969 (“NEPA”). The resulting hybrid infuses the more traditional alternatives analysis procedures with a new set of variables drawn from land use and transportation demand management fields.

The motivation behind the merger was a growing dissatisfaction with the traditional practice of using a single geographic allocation of future household and employment growth for transportation modeling and forecasting. That practice ignored well-established knowledge about the interac-

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125. GEORGANTZAS & ACAR, supra note 118, at 138.
126. See SUN TZU ON THE ART OF WAR: THE OLDEST MILITARY TREATISE IN THE WORLD 56 (Lionel Giles trans., 1910) (analogizing military strategy to the properties of water, the writer praises the captain who can “modify his tactics in relation to his opponent”); cf. UTE VON REIBNITZ, SCENARIO TECHNIQUES 11 (1988) (“The earliest traces of a method for viewing or knowing the future are to be found in the writings of Seneca.”).
127. RINGLAND, supra note 126, at 12; see RINGLAND, supra note 121, at 17.
128. REIBNITZ, supra note 126, at 12; see RINGLAND, supra note 121, at 17.
129. SCHWARTZ, supra note 123, at 7-10.
tive relationship between transportation investments and land use patterns,134 outlined in the previous section. To incorporate those relationships, several leading transportation studies in the late 1980s and early 1990s employed a range of growth allocations, essentially using future land use as an input variable instead of as a static assumption.135 Although earlier academic studies pioneered the use of this approach,136 the later projects formalized the method and brought it into public planning and decision-making contexts. Assisted by substantially expanded computing capacity and methods, the practice mushroomed over the following two decades, becoming common enough to be considered part of the state-of-the-practice.137

The typical land use–transportation scenario planning process compares a “trend” scenario to one or more alternative future “planning” scenarios. In the trend scenario, urban development and transportation investment patterns of the recent past are assumed to continue through the planning horizon (twenty to fifty years in the future). The trend scenario—usually some version of urban sprawl—is assessed for its impacts on transportation measures and other regional outcomes.138

This is followed by the formulation of one or more planning scenarios that differ from the trend scenario with respect to transportation infrastruc-

134. See generally Reid Ewing, Transportation & Land Use Innovations: When You Can’t Build Your Way Out of Congestion (1997); Ewing et al., supra note 1, at 55-89; Gerrit-Jan Knaap & Yan Song, The Transportation–Land Use Policy Connection, in Access to Destinations, supra note 7, at 91 (tracing understanding about land use–transportation connections to the Dutch purchase of Manhattan from Native American inhabitants in the seventeenth century).


ture and land use—the first and fourth accessibility policy levers described in the previous section. Compared to the trend scenario, the planning scenarios usually contain higher gross densities, mix land uses to a greater extent, and have pedestrian and transit-oriented design features, more development in urban centers, and a variety of alternative transportation infrastructure investments. Some studies also include transportation pricing policies—the second policy lever. These planning scenarios are then assessed for their impacts using the same travel forecasting models and set of outcome measures as were used for analysis of the trend scenario. Vehicle miles of travel ("VMT") is almost always among the outcomes forecasted. The resulting comparison of scenarios provides a basis for rational urban policy development.139

A 2004 nationwide survey identified eighty land use-transportation scenario planning projects, all of which were completed between 1989 and 2003.140 These projects are concentrated in large metropolitan areas along the east and west coasts (Figure 2). They are also concentrated toward the end of the period studied (Figure 3), suggesting a trend toward greater use of scenario planning techniques. Most of the studies test three or four scenarios (including a trend scenario) that vary in density, mix, and arrangement of future land uses. Half of the studies also test alternative transportation infrastructure investments. Twelve incorporate a transportation pricing element. Three quarters of the studies evaluate scenarios for transportation impacts; over half for impacts on open space and resource lands; thirty-three for impacts on air quality; eighteen for impacts on fuel use; and ten for greenhouse gas emissions.141

139. Id.
140. Bartholomew, supra note 132. An annotated bibliography of the projects is available at http://content.lib.utah.edu/u?/ir-main,101. Many of the original project reports that were used as source data are available at http://www.lib.utah.edu/digital/collections/highways/.
141. Bartholomew, supra note 132, at 402.
Figure 2. Location of land use–transportation scenario planning projects, 1989-2003. These projects tend to cluster in the larger metropolitan areas on the east and west coast.

Figure 3. Completion dates by year of land use–transportation scenario planning projects, 1989-2003, suggesting a potential increase in the use of scenario planning techniques over time.
A study by Bartholomew and Ewing used twenty-three of these projects to analyze relationships between land use, transportation, and carbon emissions. Together, these studies include a total of eighty-five scenarios—one trend scenario per study, plus sixty-two planning scenarios, which are represented by the bars in Figure 4. For each bar, the value shown is the percentage difference in VMT between that scenario and the study’s trend scenario. As indicated, there is a wide variation in values across scenarios, from +5.2% to -31.7%. The variation in scenario density is similarly spread across a wide range (from -14.8% to +64.3%) and inverse in direction from VMT (see Figure 5), suggesting a possible inverse correlation between the density of a planning scenario and VMT (see Figure 6). This suggests that greater scenario density would lead to lower vehicle miles travelled.

Figure 4. Percentage difference in vehicle miles traveled between planning and trend scenarios.

Figure 5. Percentage difference in density between planning and trend scenarios.

Figure 6. Scatterplot of percentage differences in density and vehicle miles traveled between planning and trend scenarios.

One prediction that emerges from an inverse correlation between planning scenario density and VMT is that a reduction in carbon emissions
would be associated with increased planning scenario density, given the reduction in VMT. The authors thus sought to determine the possible transportation and carbon emission effects that could accrue if scenarios of the type and nature assessed in the study were implemented in metropolitan areas nationwide. A multivariate analysis using a hierarchical model revealed three significant influences on VMT: population growth increment, centralized development, and mixed land use. The analysis also showed that increasing average density by 50% and emphasizing infill development, mixed land uses, and coordinated transportation investments would, by 2050, result in 17% fewer VMT than under projected trend conditions. Accounting for “cold start” effects and possible engine efficiency reductions, this number translates into a CO₂ emissions reduction of 15.3%.

Although 15.3% is, admittedly, not a large number, it is very likely a conservative estimate for two reasons. First, limitations in the models and methods used to generate the data for the analysis likely underestimated the travel reduction effects of the land use strategies included in many of the scenarios. Second, all of the scenarios assumed the continuation of trend national and global economic and environmental conditions. It is very possible that these conditions will change in ways that would make continued

143. A density increase of 50%, which is within the density range of the scenarios depicted in Figure 5, is probably conservative, given the major demographic shifts anticipated through the first half of the twenty-first century. See Ewing et al., supra note 1, at 23-27; Arthur C. Nelson, Leadership in a New Era, 72 J. Am. Plan. Ass’n 393 (2006).
144. Bartholomew & Ewing, supra note 142.
147. Bartholomew & Ewing, supra note 138.
reliance on personal vehicle travel less tenable, suggesting that the difference between the planning and trend scenarios would be even greater.\textsuperscript{149}

### III. Federal Transportation and Environmental Mandates

Overall, these results are encouraging. They demonstrate that an effective planning method exists—and is growing in popularity—for redirecting at least two of the four policy levers (transportation infrastructure and land use) toward an accessibility based approach to land use and transportation planning, and that this approach could lead to decreased travel and carbon emissions. Still unresolved, however, is how an accessibility based scenario planning approach might be integrated into processes mandated by federal transportation planning and environmental laws. A cursory analysis suggests that such an approach could be employed at two levels of planning—long-range transportation systems planning and project-level planning—that utilize at least three different statutory regimes.

#### A. Long-Range Systems Planning

1. **Transportation Planning Statutes**

Although planning for metropolitan-wide transportation systems began in the 1950s, the practice came of age with passage of the Federal Aid Highway Act of 1962,\textsuperscript{150} which required metropolitan transportation system planning as a condition for receiving federal transportation funds.\textsuperscript{151} To qualify, the planning process needed to be continuing, comprehensive, and cooperative (the “3Cs”)—meaning that planning had to be ongoing, not just a single event, to incorporate a broad range of subjects and values, and to be carried out with the cooperation of state and local government agencies.\textsuperscript{152} Although the Bureau of Public Roads\textsuperscript{153} implementing regulations required consideration of land use and zoning in the 3C planning process,\textsuperscript{154} they did not require the consideration of alternative development

149. See ICF INT’L, INTEGRATING CLIMATE CHANGE INTO THE TRANSPORTATION PLANNING PROCESS 31 (2008); Bartholomew & Ewing, supra note 142.


151. Id. § 9, 76 Stat. at 1148.

152. Id.

153. The Bureau was the predecessor to today’s Federal Highway Administration.

patterns. Moreover, the purpose of the planning process was to achieve increased mobility, not improved accessibility.\textsuperscript{155}

Transportation systems planning has changed markedly since the 1962 Act, with the most significant changes coming from the Intermodal Surface Transportation Efficiency Act of 1991 (“ISTEA”).\textsuperscript{156} ISTEA revolutionized systems planning, principally by allowing for greater flexibility in how federal transportation funds could be used, and by providing a more expansive list of considerations that had to be incorporated into systems planning, including the possible effects of transportation investments on development patterns and the consistency of transportation plans with land use and development plans.\textsuperscript{157} Many of ISTEA’s innovations were carried forward, first into the Transportation Equity Act for the 21st Century (“TEA-21”)\textsuperscript{158} and then into the current transportation statute—the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (“SAFETEA-LU”).\textsuperscript{159}

Together, the innovations from ISTEA, plus several provisions originating with SAFETEA-LU, could provide a basis for an accessibility based systems planning process. According to the policy statement that introduces the metropolitan planning requirement section, it is in the national interest to promote “transportation systems that will serve the mobility needs of people and freight and foster economic growth and development within and between States and urbanized areas, while minimizing transportation-related fuel consumption and air pollution.”\textsuperscript{160} The planning factors for systems planning processes reflect this purpose statement, requiring consideration of projects and strategies that will “increase the accessibility and mobility of people and for freight” and “protect and enhance the environment, promote energy conservation, improve the quality of life, and

\begin{footnotesize}
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\item[157.] Id. § 1024(a), 105 Stat. at 1957-58.
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\end{footnotesize}
promote consistency between transportation improvements and State and local planned growth and economic development patterns.” \(^{161}\)

These provisions have facilitated and encouraged several metropolitan planning organizations (“MPOs”) \(^{162}\) to prioritize accessibility in their transportation systems planning processes. A leading example comes from the Sacramento Area Council of Governments (“SACOG”), the MPO for the Sacramento, California region. In its landmark study, the Sacramento Region Blueprint Transportation–Land Use Study, SACOG crafted a future growth strategy for the region by developing a series of neighborhood, county, and regional scenarios that assume different growth rates, land use mixes, housing types, densities, and infill/redevelopment proportions. \(^{163}\) These scenarios were analyzed for their land use and transportation impacts, leading to the adoption of a Preferred Blueprint Scenario, which has a substantially smaller urban footprint and 26% fewer VMT than the trend scenario (see Figure 7 & Table 2). The Preferred Blueprint Scenario is now being implemented through amendments to local government land use plans and through the region’s new long-range transportation systems plan. \(^{164}\) Similarly structured planning processes have also occurred in the San Francisco Bay, Salt Lake City, Utah, and Portland, Oregon regions. \(^{165}\)

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161. Id. § 134(h)(1)(D), (E).
162. Metropolitan planning organizations, first required by Section 112 of the Federal-Aid Highway Act of 1973, 87 Stat. 250, 257, are the entities through which federal funds for metropolitan area transportation projects must be planned and programmed. 23 U.S.C. § 134(d)(1) (2000) (“To carry out the transportation planning process required by this section, a metropolitan planning organization shall be designated for each urbanized area with a population of more than 50,000 individuals . . . .”).
Figure 7. Comparison of Basecase and Preferred scenarios from the Sacramento Region Blueprint Transportation–Land Use Study.
Table 2. Selected Data from the Sacramento Region Blueprint Transportation–Land Use Study

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>Ratio single to multi-family housing</th>
<th>% infill housing growth</th>
<th>% trips auto</th>
<th>% trips transit</th>
<th>% trips walk/bike</th>
<th>Daily VMT per household</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: Business as usual (trend)</td>
<td>75:25</td>
<td>27.0</td>
<td>93.7</td>
<td>0.8</td>
<td>5.5</td>
<td>47.2</td>
</tr>
<tr>
<td>B: Higher housing densities than A, with growth focused at the urban fringe</td>
<td>67:33</td>
<td>39.0</td>
<td>83.2</td>
<td>4.0</td>
<td>12.7</td>
<td>37.6</td>
</tr>
<tr>
<td>C: Higher housing densities than A, with growth focused on central infill sites</td>
<td>65:35</td>
<td>38.3</td>
<td>81.8</td>
<td>4.8</td>
<td>13.4</td>
<td>36.7</td>
</tr>
<tr>
<td>D: Higher housing and employment densities, with growth focused on central infill sites</td>
<td>64:36</td>
<td>44.0</td>
<td>79.9</td>
<td>4.8</td>
<td>15.3</td>
<td>35.7</td>
</tr>
<tr>
<td>Preferred Scenario</td>
<td>65:35</td>
<td>41.0</td>
<td>83.9</td>
<td>3.3</td>
<td>12.9</td>
<td>34.9</td>
</tr>
</tbody>
</table>

As encouraging as these examples are, they represent fewer than 1% of the nation’s 385 MPOs. For all its purported advances in systems planning processes, the planning provisions in SAFETEA-LU are advisory only—they require only consideration of accessibility related factors. Even that permissive standard is unenforceable: failure to consider any of the planning factors cannot be challenged in court and the resulting systems plans are not reviewable under NEPA. For this and other reasons, some commentators have suggested that the promise behind the innovations of ISTEA and its progeny, while significant, have not been realized in practice.

2. Transportation–Air Quality Conformity

While SAFETEA-LU’s planning requirements might provide a weak reed to base a change to accessibility based planning, the transportation–air

168. Id. § 134(h)(2).
169. Id. § 134(p).
quality conformity requirements of the Clean Air Act Amendments of 1990 ("CAAAs") offer a firmer basis for such an evolution, though the scope of change to date has been limited. The Clean Air Act Amendments of 1977, the predecessor to the CAAA, prohibited direct inconsistencies between long-range transportation system plans and state air quality plans, but provided little guidance on how this was to be determined and the mandate was largely ignored. Frustrated by perceived bureaucratic disregard of the standard, Congress beefed up the requirement in the CAAA, mandating that transportation system plans in air quality nonattainment or maintenance areas conform to an air quality plan’s “purpose of eliminating or reducing the severity and number of violations of the national ambient air quality standards and achieving expeditious attainment of such standards.” Instead of merely avoiding direct conflicts between transportation and air quality plans, the new conformity provisions created an affirmative duty for transportation planners to create plans that would work to achieve the aims of providing citizens with healthy air.

Though not specifically targeted at the tension between mobility and accessibility, the CAAA conformity provisions and their implementing regulations give at least some impetus for engaging those issues. The most direct, and obvious, point for this engagement would be the selection of transportation projects to be included in long-range system plans. A 1999 EPA-sponsored study, however, shows that in only a handful of high-

173. See Mark Garrett & Martin Wachs, Transportation Planning on Trial: The Clean Air Act and Travel Forecasting 112 (1996).
174. See id.
176. See id. §7505(a).
177. The National Ambient Air Quality Standards ("NAAQS") set maximum ambient concentration levels for seven “criteria” pollutants: ozone (O₃), carbon monoxide (CO), nitrogen dioxide (NO₂), sulfur dioxide (SO₂), lead (Pb), and particulate material at both 10 microns (PM₁₀) and 2.5 microns (PM₂.₅). See 42 U.S.C. § 7409 (2006); U.S. Envtl. Prot. Agency, National Ambient Air Quality Standards (2008), http://www.epa.gov/air/criteria.html; Weiner, supra note 136, at 170.
179. See id. §7506(c)(2).
181. See Arnold M. Howitt & Elizabeth M. Moore, Linking Transportation and Air Quality Planning: Implementation of the Transportation Conformity Regulations in 15 Nonattainment Areas 80 (1999) (noting expectations that the conformity requirements would result in less highway expansion and more investment in transit even though “these results were not specifically prescribed goals of the Clean Air Act’s conformity provision, nor of the 1993 regulations”).
growth metropolitan areas has the conformity process led to the scaling back or elimination of proposed highway projects and the promotion of transit investments. Aside from Atlanta’s high-profile conformity lapse settlement agreement, conformity’s impact on project selection has been difficult to detect. A later study by the Congressional Research Service shows that while sixty-three nonattainment or maintenance areas experienced conformity lapses between 1997 and 2004, “[m]ost of these areas . . . returned to conformity quickly without major effects on their transportation programs: . . . only 5 areas had to change transportation plans in order to resolve a conformity lapse.”

As with project selection, conformity’s influence on land use policy, while notable, has not been widespread. Although the Clean Air Act specifically disavows any “infringement on the existing authority of counties and cities to plan or control land use,” many had hoped that the CAAA’s restrictive conformity requirements would lead to “tighter coordination of land use and transportation planning to promote development patterns that require less travel.” The EPA has finessed the tension between statutory prohibition and popular expectation by sponsoring research and providing specific guidance on how land use policies might fit into air quality planning and conformity analyses, but the agency stresses that its efforts are

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182. Id. at 77, 81 (noting the scaling back of highway projects in Charlotte, Atlanta, and Houston, and promotion of transit projects in Denver and Portland).


184. Howitt & Moore, supra note 181, at 75.

185. McCarthy, supra note 183, at i.


Government agencies in several metropolitan areas have, in fact, used EPA’s research and guidance to take air-quality credit for land use initiatives; leading examples include the Atlantic Steel redevelopment project in Atlanta, Portland, Oregon’s metropolitan growth management policies, and the Chicago region’s reassessment of infill development potential. Probably the most dramatic change credited to the influence of the conformity process, at least on land use institutions if not directly on land use policies, was the creation, in 1999, of the Georgia Regional Transportation Authority (“GRTA”), which has substantial veto power over land use and transportation decisions in the Atlanta region.

In addition to these voluntary actions, the conformity-implementing regulations contain mandatory regional emissions analysis standards that, indirectly, influence land use policies. In nonattainment and maintenance areas classified as serious or worse for ozone or carbon monoxide and that are greater than 200,000 in population, agencies preparing long-range transportation system plans must ensure that future land use development assumptions are consistent with the transportation system alternatives under consideration. In other words, planners must account for the induced development effects that might be associated with different investment decisions. This, in essence, requires the consideration of integrated, inter-

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190. Bailly, supra note 35.
191. Howitt & Moore, supra note 181, at 86.
192. U.S. ENVTL. PROTECT. AGENCY, supra note 188, at 35.
nally consistent land use–transportation scenarios. Consideration of changes in land use policies to increase accessibility, however, is not required. Nevertheless, at least some acknowledgement of the potential sprawl-inducing effects of transportation investments is mandated.196

B. Project-Level Planning

Generally, individual transportation projects need to be drawn from system-level plans that comply with the planning and conformity requirements outlined above, particularly if they are to be federally funded.197 Hence, opportunities to look at transportation from an accessibility perspective will have already occurred at the systems stage by the time a project moves to final decision-making and possible construction. Nevertheless, several important points remain at the project decision stage for consideration of the accessibility policy levers.

I. Alternatives Analysis

Depending on the circumstances, several federal environmental laws may require agency consideration of alternative courses of action before proceeding with a proposed project. In addition to NEPA,198 the dredge and fill provisions of the Clean Water Act199 and Section 4(f) of the Department of Transportation Act of 1966200 may also require alternatives analysis if wetlands, historic resources, or parklands are involved. Because of the predominance of NEPA in transportation project decision-making, however, this discussion will focus on the requirements of that Act, acknowledging that the different standards of the other statutes could lead to different conclusions.201

Alternatives analysis has long been recognized as the “heart” of NEPA.202 The underlying purpose for engaging in an alternatives analysis is to address the general question of whether the stated purpose and need

196. See Johnston, supra note 148.
201. See id. § 303(c)(1) (requiring consideration of “prudent and feasible” alternatives); 40 C.F.R. § 230.10(a) (requiring consideration of “practicable” alternatives).
for the proposed project can be met by means that have lower environmental costs, including those options that would make the proposed project unnecessary.\textsuperscript{203} To address this question, NEPA requires consideration of a “no action” alternative, plus all other “reasonable” alternatives.\textsuperscript{204}

Determining which alternatives are reasonable and, hence, appropriate for inclusion in NEPA analyses has been controversial.\textsuperscript{205} With very little guidance from the Council on Environmental Quality (“CEQ”) regulations that implement NEPA, the term \textit{reasonable} has eluded precise definition, leading to an unsettled body of jurisprudence, not unlike that which surrounds regulatory takings under the Fifth Amendment.\textsuperscript{206} As a consequence, reasonableness has primarily been defined in the negative.\textsuperscript{207}

Alternatives that do not accomplish the need or purpose of the proposed action are unreasonable per se.\textsuperscript{208} This conclusion, however, merely begs the question of how an agency has defined the purpose and need for the project. In theory, stating the need more broadly will allow for a wider range of alternative methods to meet that need, while a more narrow definition will tend to restrict the universe of alternatives.\textsuperscript{209} For example, in an environmental impact statement (“EIS”) for proposed transportation improvements, the need to “provide greater personal and commercial accessibility for the residents and businesses of southwest Acme City” will lead to consideration of a greater range of alternatives than the need to “build a highway from Acme City to West Hinsdale.” Although courts will occasionally reject a statement drawn so narrowly that only the proposed action will accomplish it,\textsuperscript{210} deference is usually given to an agency’s judgment

\textsuperscript{203} 40 C.F.R. § 1502.1 (2008).
\textsuperscript{204} Id. § 1500.2(e).
\textsuperscript{205} See City of Alexandria v. Slater, 198 F.3d 862, 867 (D.C. Cir. 1999).
\textsuperscript{206} See Lingle v. Chevron, 544 U.S. 528, 537-38 (2005) (“In Justice Holmes’ storied but cryptic formulation, ‘while property may be regulated to a certain extent, if regulation goes too far it will be recognized as a taking.’ The rub, of course, has been—and remains—how to discern how far is ‘too far.’”) (citations omitted).
\textsuperscript{208} Colo. Envtl. Coal. v. Dombeck, 185 F.3d 1162, 1174-76 (10th Cir. 1999).
\textsuperscript{209} O.L. Schmidt, \textit{The Statement of Underlying Need Determines the Range of Alternatives in an Environmental Document, in \textit{Environmental Analysis: The NEPA Experience} 42, 49 (Stephen G. Hildebrand & Johnnie B. Cannon eds., 1993) (“When an agency defines the underlying need very narrowly, it wins. And when it defines the need very broadly (or not at all), it loses.”).
with regard to a statement of purpose and need. The literature is full of instances where courts have refused to invalidate a statement of purpose and need that a facility or service must be increased, enlarged, or expanded.

Also beyond the “rule of reason” are alternatives that are remote, speculative, uncommon, or unknown at the time an action is proposed. This standard, however, implies a definition of what is reasonable and what is not based on context. What was unreasonable in the past may become reasonable over time due to changes in technology, science, society, economics, and professional practice: “the concept of alternatives is an evolving one, requiring the agency to explore more or fewer alternatives as they become better known and understood.”

A primary example of this evolution comes from the area of energy conservation. In 1972, challengers to a proposed off-shore oil lease sale were unsuccessful in attacking the sale’s underlying EIS for failure to include a conservation alternative. The D.C. Circuit held that such alternatives fell outside the rule of reason. Shortly after that decision, however, the CEQ and a number of other federal agencies began promoting energy conservation research and policy development in response to the 1973 OPEC oil embargo. The effect of the change in global economic and environmental conditions, and the consequential governmental responses, brought the topic of conservation into the mainstream. Reflecting these changes, the D.C. Circuit held, just four years after its ruling in the off-shore oil case, that the EIS for a proposed nuclear power facility was deficient because it had not included an energy conservation alternative. Although the Supreme Court reversed that ruling, the basis of the high court’s holding reflected more on the plaintiffs’ failure to adequately articulate the proposed conservation alternative than on the reasonableness of the concept of con-

211. See Lee v. U.S. Air Force, 354 F.3d 1229, 1238 (10th Cir. 2004); Dinah Bear, Alternatives and the Scope of Analysis, C981 ALI-ABA Course of Study 353, 360 (Feb. 15, 1995).


216. Aeschliman v. U.S. Nuclear Regulatory Comm’n, 547 F.2d 622, 629 (D.C. Cir. 1976) (“Energy conservation was clearly a colorable alternative relevant to the goals of the project”), rev’d, 435 U.S. 519.
Energy conservation’s transition from “remote and speculative” to “reasonable” is implicit in the Supreme Court’s decision, and subsequent cases treat it as such.\(^{218}\)

Have alternatives based on changes in land use policy as well as transportation infrastructure similarly crossed over the boundary from being remote and speculative to being reasonable? There is evidence to suggest that they have. As outlined above, in the mid-1980s, analyses investigating alternative land use patterns were rare and pursued mainly by academics.\(^{219}\) Then, in the late 1980s, two ground-breaking studies brought integrated land use—transportation alternatives analysis to both systems- and project-level planning contexts.

At the systems level, Montgomery County, Maryland—an established leader in progressive land use planning practices—\(^{220}\) developed its 1989 Comprehensive Growth Policy Study based on an analysis of alternative arrangements of future land use patterns. Looking thirty years ahead, the county explored its vision of the future using a series of scenarios that integrated various land use patterns with different transportation investments and pricing policies—\(^{221}\) three out of the four accessibility policy levers described in Part I, above. The county used the output of the Growth Policy Study as the basis for changes to its transportation and land use policies, plans, and ordinances.\(^{222}\)

At the project level, 1000 Friends of Oregon—a respected land use planning nonprofit organization—\(^{223}\) launched Making the Land Use, Transportation, Air Quality Connection (“LUTRAQ”), also in 1989, seeking to articulate an integrated land use, transportation, and demand management alternative to the Western Bypass, a proposed new suburban freeway west of Portland, Oregon.\(^{224}\) Having successfully delayed the freeway through

\(^{217}\) \textit{Vt. Yankee}, 435 U.S. at 552.


\(^{219}\) See supra note 138 and accompanying text.

\(^{220}\) \textit{DOUGLAS R. PORTER, MANAGING GROWTH IN AMERICA’S COMMUNITIES} 55-64 (2nd ed. 2007).

\(^{221}\) \textit{MONTGOMERY COUNTY, MD.}, supra note 135.


\(^{224}\) See \textit{1000 FRIENDS OF OREGON}, supra note 135.
legal action, 225 1000 Friends worked with a team of internationally recognized experts to craft an alternative that centered transit-oriented developments along two extensions of the region’s transit network and incorporated a transportation pricing system to provide free transit passes to commuters and charge solo car commuters for parking. 226 As with the Comprehensive Growth Policy Study, LUTRAQ effectively used three of the four accessibility policy levers. The Oregon Department of Transportation incorporated the LUTRAQ alternative into its Major Investment Study for the Western Bypass, making it the first NEPA document in the country to include a land use-based alternative for a proposed new highway. 227

At the time, the LUTRAQ project was viewed as unique 228 and cutting edge. 229 As mapped out above in Part II, however, in the nearly twenty years since the project began, land use–transportation scenario planning has become commonplace enough for one commentator to observe:

225. Sensible Transp. Options for People v. Metro. Service Dist., LUBA No. 89-030 (1989) (reversing a decision to include the Western Bypass in the regional transportation system), appeal dismissed, 787 P.2d 498 (1990) (finding the agency decision not yet ripe for appeal); 1000 Friends of Oregon v. Washington County, 17 Or. LUBA 671 (1989) (reversing a decision to include the Western Bypass in the county transportation plan).

226. 1000 FRIENDS OF OREGON, supra note 135, at 12.


The rise of scenario planning coincided with the recognition that state and local governments could not “pave their way out of congestion.” Instead, they would have to reduce the need for car travel by smarter land-use planning. . . . [A study] of 80 scenario planning projects from 48 U.S. metropolitan areas[$230$] . . . shows that regional scenario planning has become a common best practice.$231$

This suggests, rather strongly, that land use-based alternatives to proposed transportation projects meet Morton’s “rule of reason.”$232$ If they were once “uncommon or unknown,” they are no longer.$233$

The “pleading” requirements of Vermont Yankee$234$ still apply, of course: participants in NEPA processes cannot just assert the need to study land use-based alternatives; they must articulate such alternatives with sufficient specificity to “allow the agency to give the issue meaningful consideration.”$235$ This lesson is illustrated by Utahns for Better Transportation v. U.S. Department of Transportation,$236$ where plaintiffs who made general assertions of the need to study land use-based alternatives to the proposed Legacy Parkway in Utah were rebuffed in their challenge to the Parkway EIS for failure to incorporate such alternatives.$237$ During a remand on other grounds, however, the plaintiffs developed a detailed “Citizens Smart Growth Alternative,” which became the basis for a settlement of the litigation.$238$ Tellingly, in a subsequent study of another proposed highway associated with the Legacy Parkway, the Utah Department of Transportation—the primary defendant in the Legacy litigation—decided on its own accord to incorporate land use-based alternatives in the analysis.$239$

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230. See Bartholomew, supra note 132.
231. Ewing, supra note 137, at 38 (emphasis added).
233. Neither can they be considered “technologically infeasible.” See Bartholomew, supra note 132, at 410 (noting that the rise of easy to use GIS-based software in the last decade has made land use–transportation scenario planning projects “too numerous to count”).
234. 435 U.S. 519, 553 (1978) (stating that NEPA participants must “structure their participation so that it . . . alerts the agency to the [parties’] position and contentions”).
236. 305 F.3d 1152 (10th Cir. 2002).
237. Id. at 1172.
The final way in which an accessibility based planning regime might fit within the context of federal law is through NEPA’s indirect impacts analysis requirement. NEPA, of course, requires the assessment of federal actions “significantly affecting the quality of the human environment.”\textsuperscript{240} The CEQ NEPA regulations, however, split the definition of effects into direct effects and indirect effects. Direct effects are those that are “caused by the action and occur at the same time and place.”\textsuperscript{241} Indirect effects are also caused by the action but “are later in time or farther removed in distance,” while still being reasonably foreseeable.\textsuperscript{242} Indirect effects include “growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems.”\textsuperscript{243}

The impacts of major highway projects on land use patterns—induced development—would appear to fall within this latter definition, and federal courts have largely agreed: highway related environmental documents failing to address induced development impacts have generally been found to violate NEPA.\textsuperscript{244} A growing number of these cases, however, are requiring more than just acknowledgement of potential induced development impacts: they are insisting that the margin of induced development—the variations in land use allocations between no-build and build alternatives—be incorporated into the modeling of travel demand forecasts.\textsuperscript{245}

\textsuperscript{241} 40 C.F.R. § 1508.8(a) (2008).
\textsuperscript{242} Id. § 1508.8(b).
\textsuperscript{243} Id.
Highways create demand for travel and expansion by their very existence. However, the final impact statement in this case relies on the implausible assumption that the same level of transportation needs will exist whether or not the tollroad is constructed. In particular, the final impact statement contains a socioeconomic forecast that assumes the construction of a highway such as the tollroad and then applies that forecast to both the build and no-build alternatives. The result is a forecast of future needs that only the proposed tollroad can satisfy. As a result, the final impact statement creates a self-fulfilling prophecy that makes a reasoned analysis of how different alternatives satisfy future needs impossible.246

In other words, it is not enough for transportation planners to assess the possible induced development impacts of a proposed transportation project; they must also use the land use allocation from that assessment, as well as the allocation for the no-build alternative, as inputs to the travel demand analysis. Only then can NEPA’s requirement to take a “hard look” at the possible environmental impacts of the proposed project be satisfied.247

Thus, in theory, induced development analysis under NEPA produces roughly the same type of outcome as that produced through the regional emissions conformity analysis process outlined above: scenarios where the land use and transportation assumptions are consonant.248 Certainly, the recognition of the need for such congruity is an important step toward creating an accessibility-oriented planning process. In practice, however, the wide variety in the quality of the analysis provided,250 and the courts’ willingness to accept shoddy work under the guise of administrative deference,251 severely limit the potential positive influences of this development.

246. Sierra Club, 962 F. Supp. at 1043 (citations omitted).
248. Sierra Club, 962 F. Supp. at 1043-44 (“[I]nformation about the growth inducing impact of tollroad construction is crucial to a reasoned conclusion.”).
249. The geographic scope of the two processes differ, however, with NEPA focused at the project level and conformity at the regional/systems level.
251. See Wilds v. S.C. Dep’t of Transp., No. 00-1808, 2001 U.S. App. LEXIS 8794 (4th Cir. May 9, 2001) (approving, without explanation, of agency’s cursory evaluation of induced growth); Stop H-3 Ass’n v. Dole, 740 F.2d 1442, 1462 (9th Cir. 1984) (approving a “less than complete evaluation” of H-3’s possible secondary impacts because “NEPA only
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CONCLUSION

In the end, none of these statutory regimes, as currently constructed, works terribly well at recasting land use and transportation planning in an accessibility mold. SAFETEA-LU has accessibility-oriented aspirations for what long-range systems planning could and should be, but the language is hortatory, unsupported by incentives or enforcement, and, hence, unlikely to be implemented broadly. The Clean Air Act conformity requirements, while containing a much more vigorous enforcement mechanism, has resulted in only sporadic alterations in transportation infrastructure decisions and has had almost no impact on the other three accessibility policy levers. Incorporating an accessibility-based alternative into a NEPA analysis may be more possible than it once was, but developing the required specification of such alternatives is costly, especially for non-governmental proponents and there is a persuasive argument that incorporating accessibility-based policy measures is more effective at the systems-planning level, not within a project-level EIS. Finally, as noted above, the state of the practice for indirect impacts analysis is uneven and immature.

requires a ‘reasonably thorough discussion’ that ‘fosters informed decisionmaking,’ not a ‘complete evaluation.’”); Citizens Advocate Team v. U.S. Dep’t of Transp., No. 02 C 5962, 2004 U.S. Dist. LEXIS 5419, at *16-19 (N.D. Ill. March 31, 2004) (finding that conclusory statements about induced growth is sufficient to satisfy NEPA where “the projected impacts at issue are consistent with the overall purpose and need for the project”).

252. See McCarthy, supra note 183, at 4-5. The impacts of conformity could be greater in the future, however, as the combined effects of increased emissions from sport utility vehicles, a tightening of the “grandfathering” provisions in the conformity regulations (as a result of the decision in Environmental Defense Fund v. Environmental Protection Agency, 167 F.3d 641 (D.C. Cir. 1999)), and more stringent standards for ozone and PM2.5, come into force. Id. at 7. In addition, eventual EPA compliance with the Court’s directive in Massachusetts v. Environmental Protection Agency, 549 U.S. 497 (2007), to develop mobile-source emission standards for CO2 could substantially affect results of future conformity analyses. See Ewing et al., supra note 1, at 135-36.

253. For example, the LUTRAQ alternative is reported to have cost 1000 Friends of Oregon, the alternative’s proponent, $1.5 million to develop. See What’s a LUTRAQ? And Why Can’t We Build Our Highway? (2006), http://www.onethousandfriendsoforegon.org/issues/transchoice.html. Development of the Citizens Smart Growth Alternative to the Legacy Parkway cost approximately $50,000. See Email from Roger Borgenicht, Director, Utahns for Better Transportation, to Keith Bartholomew, Assistant Professor, Dept’t of City & Metro. Planning, Univ. of Utah (Sept. 14, 2008) (on file with author).

254. See ICF Consulting, Handbook on Integrating Land Use Considerations into Transportation Projects to Address Induced Growth 2 (2005), http://nepa.fhwa.dot.gov/ReNEPA/ReNepa/All/Docs/Documents/E096B40B01B9D4B185256FCF004BBDF/5/FILE/Fin%20Report%20%2525%20Task%20%20.pdf (“[T]he use and transportation planning should be integrated at a broader scale than is usually used for NEPA analysis, and begun earlier than is generally done for NEPA project-level analysis.”).

255. ICF Consulting, Executive Order, supra note 250, at 23.
Despite the suboptimal nature of these statutory structures, some enterprising agencies and advocates have developed innovative ways of using the existing framework to realize accessibility oriented outcomes. The successes, however, are not widespread enough for land use and transportation to contribute meaningfully to a climate stability solution. As the analysis above demonstrates, achieving that contribution will require significant statutory changes, which, in turn, will require effective policy leadership at the national level.

Traditionally, federal transportation legislation has focused on the parceling out of federal dollars to the states. Planning came late to the system, with the first mandates for long range planning for metropolitan areas appearing in 1962 and for states in 1991.\textsuperscript{256} Even then, the emphasis was, and remains, on planning procedures, not outcomes. Given that most other federal programs that allocate funds to states and local governments—for example, those related to education, public housing, and welfare—contain performance-based requirements, it is rather remarkable that transportation funding (with some exceptions) is more or less provided with a blank check.\textsuperscript{257} It is time for transportation to incorporate performance standards as well.

Performance- or goal-based planning is not a new technique. Land use planning statutes in many states contain substantive standards that local government planning documents have to meet. In one of the most famous examples—Oregon—the state land use agency articulates nineteen goals that cities and counties must satisfy in their comprehensive land use plans.\textsuperscript{258} A similar structure should be included in the next transportation bill, scheduled for adoption in 2009. That legislation—which some are calling “Green-TEA” in playful response to the acronyms for the last three Acts—should articulate a national vision for transportation—one based on increased accessibility and reduced mobility—and define a set of national goals. To ensure attainment of these goals, Green-TEA should require that all planning documents—including state and MPO long range plans and transportation improvement programs, project level environmental impact statements, and MPO certifications—demonstrate compliance with these

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\item \textsuperscript{256} Weiner, supra note 136, at 33, 183.
\item \textsuperscript{257} See Not So Fast: Key Policy Considerations for Surface Transportation Investment Needs, Before the H. Comm. on the Budget, 110th Cong. 2 (2007) (testimony of Robert Puentes) (“The sad fact is that now that the Interstate Highway System is completed there is no coherent national vision for addressing a complex and conflicting set of transportation challenges. As a result, America’s transportation policy is adrift with no clear goals, purpose, or ability to meet these challenges.”).
\item \textsuperscript{258} Or. Dep’t of Land Conservation and Dev., Statewide Planning Goals (2008), http://www.oregon.gov/LCD/goals.shtml.
\end{enumerate}
\end{footnotesize}
goals. The U.S. Department of Transportation, or a new independent commission,\textsuperscript{259} should be put in charge of reviewing planning documents for goal compliance and should be given the enforcement tools necessary to guarantee compliance. This, essentially, is the model used by California in the recently passed Senate Bill 375, which requires the state’s MPOs to include as part of their long-range transportation plans a “sustainable communities strategy” that is designed to meet greenhouse gas reduction targets set by the state Air Resources Board.\textsuperscript{260}

The scientific consensus is that achieving climate stabilization will require reducing carbon dioxide emissions to 60% to 80% below 1990 levels.\textsuperscript{261} Slowly, we are coming to realize the enormity of that task, and the need to rely on all sectors of our economy—industrial, commercial, residential, and transportation—to make significant shifts in business as usual. Within the transportation sector, it is also becoming apparent that meaningful reductions in CO\textsubscript{2} emissions require not just technological shifts to more efficient vehicles and lower carbon fuels, but reductions in the amount we drive as well.\textsuperscript{262} A planning regime directed toward accessibility, and away from mobility, will be essential to getting us there. Congressional and administrative action in the coming months on the next transportation bill—Green-TEA or whatever it will be called—will indicate whether we will begin the hard work of “growing cooler” toward climate stabilization or whether we will stay in denial, continually looking for technological bail-outs to keep us from facing our carbon addiction.

\textsuperscript{261} See EWING ET AL., supra note 1, at 40-42.
\textsuperscript{262} Id. at 43-44.