Planning for Place and Plexus

“A lively, engaging book . . . which uses ‘neoclassical’ economic principles . . . in a digestible format. The authors go so far as to draw from the film Thelma and Louise to show how game theory can be applied in predicting whether someone will drive or take public transit. This provocative, highly relevant book deserves to be on the bookshelf of everyone concerned with urban planning and transportation.”

Robert Cervero, Professor and Chair
Department of City and Regional Planning
University of California, Berkeley

Congestion is worse than ever and land development continues unabated into the countryside. Recent accounts suggest that unprecedented conditions are ahead; coordinated land use and transport planning in metropolitan areas is both targeted as a solution and the subject of increased scrutiny.

Planning for Place and Plexus provides a fresh and unique perspective on metropolitan land use and transport networks, challenging current planning strategies and offering frameworks to understand and evaluate policy.

The book suggests actions for the future urban growth of metropolitan areas and includes current and cutting edge theory, findings, and recommendations which are cleverly illustrated throughout using international examples. Planning for Place and Plexus is a valuable resource for students, researchers, practitioners, and policy advisors working across transport, land use, and planning.

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Planning for Place and Plexus

Metropolitan land use
and transport

David M. Levinson and
Kevin J. Krizek
For KJK: To my parents, Claudia and Ray, who taught me to always finish what I started.

For DML: To my children Benjamin and Olivia, who have yet to start.
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Our motivation for this work was straightforward. We were slated to jointly teach a course at the University of Minnesota on land use-transportation, combining perspectives from urban planning and civil engineering. Like most instructors, we looked for a suitable text.

This is where “straightforward” morphed into “complex.” In pursuit of an appropriate text, we inventoried syllabi from other instructors who taught similar courses. We surveyed the instructors; we studied their syllabi; we digested the information. We subsequently published an article describing our content analysis of this work in the Journal of Planning Education and Research (2005; vol. 24, 3:304–316). Among other things, we concluded—as did many instructors—that no single text satisfactorily covered all important land use-transportation topics from a pedagogical perspective. We therefore endeavored to write our own.

Given the “hot” topics of land use and networks, especially transportation, we thought we could do more than just write a textbook. We desired a piece of work with more zip than a book whose life would be limited to the classroom. We wanted to write a book that high-level policy advisors could also sink their teeth into and one that stood up to the rigor of academe. This is the point where “complex” morphed to “evasive.”

We realized we were trying to satisfy three goals. We endeavored to write a text that would: (1) merge two sub-disciplines (land use and transport) in a straightforward and coherent, but also compelling manner; (2) be useful for graduate-level education in urban planning, civil engineering, geography, regional science, urban studies, and other allied disciplines; and (3) be interesting and engaging enough for other “professional” citizens, high-level policy advisors, or even politicians to want to wade through. It became apparent to us that there is good reason why no single book stands out in terms of satisfying these demands. Were we aiming for the impossible?

We produced what we thought to be a good outline and structure. We then scrapped it. We tried another outline. We scrapped it again. We reworked the structure. This happened over and over. To say our efforts were iterative would be an understatement. After countless iterations to the overall structure, we achieved equilibrium. It was a long time coming. Did we satisfy all three
of our goals? We think so. Ultimately, the readers (and reviewers) will let us know.

We divided the book into three parts; the subject of each part represents a class of agent that acts over the landscapes of metropolitan areas in terms of patterns of land use and transport: individuals; businesses (firms); and governments. Separately examining the behavior of these three agents provided an effective strategy to better dissect and understand their actions. Is this the best structure? We thought so; it makes sense to us. We hope it makes sense to you, the reader, as well.

We kept the discussion at a relatively high level—being sure to explain concepts in sufficient terms—but by no means strictly serving as a trade manual. We thought broadly, being sure not to equate urban transportation with congestion. We were always conscious of the larger planning, sociological, and economic context and most importantly how individuals, businesses, and governments interact with one another and with urban landscapes over networks. Those looking to this book for recipes on how to conduct traffic impact analyses, write zoning codes, or run four-step travel demand models will come away disappointed. We feel such skills, although important, are specifics best left to practice. The more challenging part is understanding the larger transportation-land use system and its components, articulating reasons for change, and prescribing workable solutions to vexing urban problems.

The 14 chapters are intended to mesh well with the timing of the semester system on many university campuses—a chapter for each week. Instructors will undoubtedly want to season to their own taste, particularly in terms of scheduling with assignments and exams and supplementing the text with other materials. In our course we make extensive use of student-run case studies to help bring theory to practice.

We offer this edition to help today’s students of cities, be they enrolled in school or experience life, think about how both place (areas of space with definite or indefinite boundaries) and plexus (the combination of networks, including both social networks and physical infrastructure) function. Despite identifying flaws in existing systems, as a result of past decisions and dysfunctional decision-making processes, we think these systems can be made better. If we did not have hope there would have been no point in the penning of Planning for Place and Plexus: Metropolitan Land Use and Transport.

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At a crossroads. Again.

“One needs to have a lot of money to sleep in this town. The vehicles moving down the narrow, winding streets, the quarrelsome crowd refusing to move on. The rich man, when called away on business, will have himself borne through the crowd, which opens to make way for him; he will make swift progress over everyone’s head in his vast Liburnian litter. As he goes, he will read, write, sleep within. And for all that he will arrive before us. In my case, the human tide in front of me prevents me from hurrying; the hastening throng behind me is thrusting into my back. Someone shoves an elbow into me; another man gives me a nasty jolt with a long beam. Here’s a fellow also set on giving my head a whack with his joist and yet another with his mighty cask. A wagon is coming forward with a great bulk of timber swaying about on it; a second is loaded with a pine trunk. These are threatening the crowd as they swing in the air.”

Juvenal describing congested conditions in ancient Rome as translated in Roman Roads [1]

Urban areas are at a crossroads. Again. Traffic congestion is worse than ever. Again. The urban crisis is getting more severe. Again. Environmental catastrophe awaits us. Again.

We title this book Planning for Place and Plexus. Most readers will easily recognize that Place refers to the land use pattern and the distribution of activities across space. The less familiar word, Plexus, refers to the complex of networks that connect people and places. These networks include transportation, but also communication and information, other infrastructure, and perhaps most neglected, the social networks that serve to glue people together.
Modern society has unconsciously created a Place and a Plexus that disaffects many. In the developed world, places are increasingly made up of dispersed, low-density developments; the plexus is dominated by an automobile-highway system that connects but simultaneously disconnects us. Both place and plexus are also subject to new information and communication technologies that, ironically, enable citizens to cocoon rather than to consociate. The current “default setting” for urban growth relies on the automobile to reach an ever-widening set of destinations.

In contrast, the conventional wisdom in turn-of-the-millennium urban planning urges tightly knitting land use and transportation together, preferably in compact developments containing diverse uses, which make it easier to walk, bicycle or take transit and discourage driving. Scores of practitioners, politicians, and professors claim that designing communities which more closely resemble built environments of centuries ago will allow households to live simpler, easier, higher quality, and altogether copasetic lives. The attention and policy focus devoted to these issues is real. The desires to contain development and control traffic are passionately felt by many and these matters are receiving increasing attention, both in the press and in policy.

Identifying urban traffic problems and devising strategies to remedy them, however, is not a novel pursuit. Julius Caesar, for example, fashioned a system that involved banning unnecessary vehicles from the streets during daylight hours:

... no one shall drive a wagon along the streets ... where there is continuous housing after sunrise or before the tenth hour of the day, except whatever will be proper for the transportation ... of material for ... public works, or for removing from the city rubbish. [2]

Imagine the economic consequences of implementing this edict in modern cities. Influential urban writers of the mid-twentieth century therefore touted a more holistic solution to congestion that relies on land use to address transportation problems.

In a nation that is both motorized and urbanized, there will have to be a closer relation between transportation and urban development. We will have to use transportation resources to achieve better communities and community planning techniques to achieve better transportation. The combination could launch a revolutionary attack on urban congestion that is long overdue. [3]

If the problem of urban transportation is ever to be solved, it will be on the basis of bringing a larger number of institutions and facilities within walking distance of the home; since the efficiency of even the private motorcar varies inversely with the density of population and the amount of wheeled traffic it generates. [4]
However, these ideas—while powerful—are now over a half-century old. Thus, if the problems and proposed strategies to solve them are not new, then what is? The problems of urban growth—particularly efforts to mitigate relentless expansion and increases in traffic congestion—have been on political radar screens for years. It seems as if modern society should be in an opportune position to pointedly address these issues. It seems.

Previous research and debate prompt us to re-evaluate whether society really is at the crossroads we implied at the outset. The problems are more than vaguely familiar. Has civilization merely been spinning its wheels for half a century (or for two millennia)? The opening epigraph suggests that congestion was problematic even in Roman times. Congestion was also reported in Renaissance Paris, in Victorian times (where novelists describe hordes of workers crowding bridges into European cities following the Industrial Revolution), and in major US cities at the turn of two centuries ago (caused by horse-drawn carriages). Even a 1958 essay by William Whyte warned Americans that their penchant for using five acres to do the work of one was not only “bad aesthetics” but “bad economics.” [5] If the issues of congestion and concern over dispersed land uses are not new—and many of the proposed strategies have been around for some time—then what is? Can a more contemporary spin on urban planning and policy satisfactorily address the transportation-land use problem?

Efforts to harness the automobile and its associated relatively expansive land use practices has grown in fits and starts following cycles loosely correlated with the economy and government administrations. The issues and solutions introduced once before are re-emerging for several reasons. Although the nature of the problem has not changed, its breadth, scale, and intensity have increased. At the same time, matters of place and plexus have been increasingly under the microscope. Despite highly visible calls put forth decades ago, development on the expanding fringe of metropolitan areas has blistered ahead, riding roughshod over common values and principles espoused in many professional fields concerned with the built environment. For example, environmentalists cringe with the filling of each wetland. Architects despise “garagescape” housing. Urban designers demonize seas of parking lots. Civil engineers seek context-sensitive design. Planners lament dispersed land uses as the root of many problems. Even economists are frustrated by the subsidies provided for expensive exurban development requiring new infrastructure. The list goes on. Perhaps only now is society wealthy enough to deal with the problems of wealth.

**Current situation**

The modern world’s relentless march to develop the pristine countryside is driven by numerous factors, not the least of which is population. To illustrate, the US population is growing faster (in an absolute sense) than at any time in
history, adding some 2.5 million people every year—equivalent to a new city the size of San Diego. Many urban planning concerns result from an increase in population. The Census Bureau expects a total US population of 392 million by 2050; an increase of about 100 million people over 50 years. [6] But answers to population growth—war, famine, disease, space exploration, emigration (to where?), rapture, or draconian birth regulations—are either undesirable or unlikely. A growing population needs somewhere to live and Americans are consuming more land per capita for living space than ever before.

Land consumption, however, needs to be placed in the context of other related phenomena. For example, reliable and long-term sources of energy remain uncertain. The transportation system, though cleaner than decades ago, still pollutes the air and threatens to change the climate. The heralded hydrogen economy holds out hope of eviscerating the energy and environmental enigmas, but gives no guarantees. Other hopefuls turn their attention to the possible “renewable” power from wind and solar energy.

Addressing the problems of expensive imported energy and environmental emissions may be possible through technological solutions such as hybrid-powered or hydrogen-fueled vehicles. The issue of congestion, however, requires something else. People are driving more while transit use continues to hold steady. Even in the auto-friendly United States more than one in four of all dollars (both federal and state) spent on surface transportation has gone to transit over the past 25 years ($29,000 million for transit vs. $95,500 million for highways in 1999). [5] Can society build its way out of congestion? Congestion is not merely an inconvenience—it costs money and time: time that could be better spent doing almost anything else, time that in today’s hurried lifestyle is scarcer and scarcer.

There is little to suggest that trends of migration outward from central cities will subside in absolute terms. This trend will continue to leave, as it has for decades now, a wake of disadvantaged people with declining municipal services. [7] A transportation network that adequately connects a landscape of spatially separated activities only with automobiles inadequately serves the poor, the physically and mentally disabled, immigrants, the elderly, and children. Children call on their parents to act as chauffeurs, while other groups require special services, suffer unreasonably long trips, or simply remain sequestered in their homes.

Residents care most about what they confront daily: traffic congestion and the relatively ambiguous concept known as sprawl. In fact, these two issues, congestion and sprawl, are now beginning to trump other, highly visible and long belabored matters such as crime and education in public opinion polls. [8] Issues associated with urban growth are now among the most important concerns facing public officials, business interests, and citizens. In fact, one would be hard pressed to identify planning efforts from any growing community not trying to control sprawl (however it is defined).
The path to the present

The present situation cannot be traced back to a single event, policy, or invention. Rather it is the product of a variety of factors. For example, urban scholars have identified the top ten influences on the US Metropolis over the past half-century:

1. the 1956 Interstate Highway Act and the dominance of the automobile;
2. federal Housing Administration mortgage financing and subdivision regulation;
3. de-industrialization of central cities;
4. urban renewal: downtown redevelopment and public housing projects (1949 Housing Act);
5. Levittown (the mass-produced suburban tract house);
6. racial segregation and job discrimination in cities and suburbs;
7. enclosed shopping malls;
8. sunbelt-style sprawl;
9. air conditioning;
10. urban riots of the 1960s. [9]

But even the product of fifty years of dispersed settlement results from more than ten influences. Missing from that list are motives. Box 1.1 considers the American Dream as a motive for individuals to shape the landscape.

At the local level, zoning regulations were developed in the early twentieth century in part to isolate noxious uses (and improve public health) and to avoid lawsuits over public nuisances. Zoning’s purview has been significantly expanded since then. Separating land uses—in the manner referred to as Euclidean zoning due to a legal case concerning Euclid, Ohio—is alive and well in communities today. Separation implies distance, and large distances create space for free parking and encourage reliance on the automobile, which in turn has prompted not only road building, but also minimum parking requirements and excess pavement. And on top of this, one cannot look past the role of exclusionary development regulations: minimum lot sizes and the like. The regulatory “stick” surely shapes contemporary cities.

That which cannot be conquered with the stick of regulation is seduced with the carrot of subsidy. Over the past half-century, an array of state, local and federal programs have, through incentives, been built into the development process. The biggest contribution lies in the billions of dollars spent by all levels of government on building new roads, thereby enabling and directing future development into corridors formerly considered appropriate only for agriculture. On the state and local levels, the “corporate enticement game” played by everyone from county supervisors to state governors encourages footloose commercial development most often located on the urban outskirts. Corporations have become increasingly skilled at pitting communities against one another to wrest perks from their governments. The result is often isolated
At a crossroads. Again.

Box 1.1 The American Dream

Policy factors have shaped the landscape, but so have individuals. Individuals in the US desire to partake of the “American Dream,” and engage in two mechanisms to satisfy that desire, for which we use the terms rugged individualism and collective action.

One cannot underestimate the power of people’s desire for the American Dream. In 1928, US presidential candidate Herbert Hoover ran on a platform that called for “a chicken in every pot and a car in every garage.” Today, citizens demand more from their politicians: expecting multiple cars in two- and three-car garages—all in an area devoid of congestion, pollution, urban ills, crime, or signs of classes lower than yourself, paid for with a minimum of taxes. These desires have prompted demands for the idyllic existence that many believe can only be had in suburban environments.

Following on the heels of striving for the American Dream is the pursuit of “rugged individualism.” Again, Herbert Hoover coined this term as he extolled free, private enterprise and initiative as the foundation of America’s “unparalleled greatness.” Government entry into commercial business, he argued, would destroy political equality, increase corruption, stifle initiative, undermine the development of leadership, extinguish opportunity, and “dry up the spirit of liberty and progress.” Rugged individualism implies a spirit of discovery, entrepreneurship, and innovation. The same entrepreneurial spirit that opened up the wilderness applies to outward migration within cities, where new residents of the suburban fringe consider themselves pioneers. Collective action for the public good may take place with or without government, but increasingly with. Another of Hoover’s great quotes was, “it is just as important that business keep out of government as that government keep out of business.” The irony, however, is that despite Hoover’s advocacy of rugged individualism, individuals could not express their ruggedness without government support, even before Hoover was shuttled out in favor of an even more activist government under Franklin Delano Roosevelt’s New Deal. Government intervention began with the use of the military to seize territory held by indigenous populations, and has included massive land giveaways (in the US to the railroads, to homeowners via the Homestead Act, and to public universities via the Morill Act, among others). In the twentieth century, government involvement continued with rural electrification and telephone subsidies, road building, irrigation and hydroelectric projects, farm subsidies, and farm foreclosure loans. In fact, “it would be hard to find a Western family today or at any time in the past whose land rights, transportation options, economic existence, and even access to water were not dependent on federal funds.”

Is it too simple to trace the current situation back to the American Dream and attempts to achieve it through both rugged individualism and collective action? Probably. The American Dream, however it is manifested today (possibly in the form of continued auto reliance and wide, expansive lots) is alive and strong and railroading public policy. US Presidential candidate Adlai Stevenson may have been alluding to
business parks or big-box retailers at the metropolitan edge, surrounded by acres of asphalt.

But many subsidies are also built into the development process. The majority of new residential development costs government more to build and service than it generates in taxes and fees. [13] New residential or commercial development requires roads, sewer systems and water lines, and eventually schools and emergency services. On-site development costs (e.g., sidewalks, sewer laterals, cul-de-sacs) are often passed on to buyers by developers as part of the price of a home, but off-site costs (e.g., trunk sewers, water mains, schools, fire stations, wastewater treatment plants, arterial streets) are not. Some governments charge impact fees to developers to connect to existing community infrastructure. [14] But it is frequently the case that the costs of off-site infrastructure are averaged across the entire population, and are thus mostly paid by people who don’t benefit from it, leading to an over-consumption of public services and straining the budgets of local and state governments.

This book is not so much about understanding the whys, whens, and hows of twentieth century urban form as it is about knowing how the legacy of this form will impact the future. George Santayana asserted that “Those who
do not remember the past are condemned to repeat it.” [15] Accounts from planning history and closely aligned fields have provided a good understanding of the whys, whens, and hows (despite Santayana also asserting that “history is a pack of lies about events that never happened told by people who weren’t there”).

From a transportation perspective, several explicit and implicit policy decisions have spawned generations who rely almost exclusively on auto travel; they expect to travel at free-flow speeds for only the cost of their car and their gasoline. By this logic, there must be something wrong with non-drivers—for what kind of person would willingly rely on a slow, unreliable transit system that lacks amenities and is often touted as a welfare service? Many advantages result from the policies that have transpired. Free-market economists continually remind us that, in the aggregate, our quality of life has never been higher. There is undoubtedly going to be a ripple or two of contention here or there, but in the developed world, people’s freedom and flexibility of choice is indeed unprecedented.

**Perspective**

Municipal policies, programs or initiatives that fall under the rubric of land use and transportation issues have been in place for years—sometimes decades. We have subsequently been privy to decades of research examining the efficacy of policies and initiatives. We question, however, the degree to which research has effectively informed or guided current policy.

Economist Anthony Downs contended in 2004 that “a region can reduce its peak hour traffic congestion—or at least slow such congestion’s rate of increase by relying on the principle of one hundred small cuts.” [16] Just as a woodsman with a small axe can only chop down a large tree with many small blows struck over a long time, this incrementalist theory suggests that a region needs to apply many different tactics simultaneously in a coordinated manner. Having seen over one hundred small cuts (in the form of different policies and initiatives), we contend that our rate of progress in harnessing congestion, or sprawl for that matter, has been minuscule to date.

If society is indeed at a new crossroads, the situation may be related to changes in the composition of the typical American household, a changing real estate market in which the demand for traditional suburban housing is waning, or the anticipated large growth in non-residential space and new residential construction over the next 20 years. [17] Although, it may be due to nothing more than society having recently turned the corner into a new century and a new millennium, providing the opportunity to critique and evaluate the efficacy of past—and current—transportation and land use policy regimes.

Now may be the time to question, and perhaps to abandon, an incrementalist paradigm suggested by the death of one hundred cuts. Can real solutions emerge from weak or in some cases even misguided policy? We contend that
most cities have reached a point that requires a more comprehensive approach to refabricate land use-transportation outcomes that will result in a superior place and a sounder plexus. A comprehensive approach, of course, takes time: decades if not half-centuries (major change does not come overnight). Our approach, described and documented in the following pages, stresses the need to recognize the focuses of Planning for Place and Plexus.

Place (Metropolitan issues, not intercity issues)—We focus discussion on issues that affect metropolitan areas. These issues traverse urban, suburban, and what has been referred to as exurban areas. In so doing, we do not focus exclusively on the inner city or on exurbia, but rather focus our attention on the metropolitan issues of land use and transportation. We cannot adequately consider rural land uses or intercity transportation, and so do not.

Problem (Accessibility, not congestion)—Considerable attention of late has focused on the worsening nature of traffic congestion in metro areas. We question the degree to which congestion is the disease or merely a symptom. Some claim the root cause of congestion is dispersed land uses that trigger automobile travel. The refutation of that argument lies in the evidence that there was congestion before the automobile (as noted in the quotation from Juvenal at the outset of this chapter), and there appears to be more localized congestion in dense areas. Some even see additional congestion as a solution to auto reliance, begging the question of “what is the problem?” Congestion is the result of many factors, including socio-demographic forces, technology, and economic development. To the extent that travel is undertaken so individuals can engage in activities in other places—work, recreation, shopping, health services—it is important to understand how these activities are distributed throughout a metropolitan area. The success of land use in influencing travel behavior depends in large part on the opportunities that land use provides. Our attention therefore turns to examining the relation between these activities and the manner in which people travel to them.

Perspective (Activity, not travel)—Finally, our analysis does not limit itself to the set of activities that occur once an individual leaves home. As mentioned above, it is important to consider the broader aspects that influence the demand for travel. For example, many shopping tasks can be satisfied via the Internet without leaving the home or the workplace, minimizing the need for personal travel (replacing shopping with shipping). Building on a foundational principle of current activity-based transportation modeling efforts, we consider travel relative to the larger influences that govern one’s daily interactions.

Overview and approach

A comprehensive examination of Place and Plexus requires holistic thinking. Figuring out creative approaches to move people across networks over time and space, all in keeping with the goals of a community, requires us to move beyond our disciplinary upbringings. Although we, the authors, have been
trained as transportation planners, transportation policy analysts, transportation engineers, and transportation economists, we are interested here in the inter-relationship of transportation and location or land use. The study of this system is sufficiently interdisciplinary to warrant a discipline of its own. We therefore think of ourselves as transportationists. [20] This means we are interested in understanding the transportation system holistically. However, we are also trained in land use planning and consider ourselves locationists because we seek to understand land use and location holistically. Turning the emphasis from the methodological area (policy, planning, engineering, economics) to the substantive (transportation and location) this book provides unique insights into important questions. The traditional methodologies are often reductionist in approach. Even the field of city planning, despite often classifying itself as an interdisciplinary profession, falls into this trap. Although at times a reductionist approach is needed in order to understand specifics, integration is also required—seeing the whole from the parts.

This book uses several techniques to approach these important questions, considering both theory and observation, and allowing them to inform each other. We argue both that theories destroy data and that data destroy theories. By the first statement, we imply that a simple, clear theory, model, or worldview is worth thousands of observations and anecdotes in shaping understanding and ultimately decisions. By the second, we mean that solid, well-founded, and replicable observations that contradict theories (especially so-called common sense theories, which may be common but seldom make sense) destroy those theories as valid world-views.

We divide the book into three parts; the subject of each part represents a class of agent that flexes its muscle over the landscapes of metropolitan areas: (1) individuals, (2) businesses (firms), and (3) governments. The behavior of each

Figure 1.1 Conceptual framework for understanding land use-transportation interactions
class of agent is inextricably linked to the behaviors of the others, as shown in Figure 1.1. Individuals (and their households) consume land (where they live) and space on transportation infrastructure (provided, in large part, by the government). Individuals also consume housing that is (or, at one time, was) provided by developers as well as goods that retailers sell. Developers respond to firms’ preferences for land uses and locations, and are influenced by the property rights and transportation infrastructure that government provides. Firms come primarily in two forms: retail-based (those that sell goods and services to consumers) and non-retail based (those that produce goods and services).

Separately examining the behavior of these three agents provides an effective strategy to better dissect and understand their actions. The behavior, and subsequent action, of each of these three agents, we claim, is largely influenced by different series of factors we call “diamonds” because of the way we array their relationships. At the beginning of each part of the book, we therefore describe the Diamond of Action, the Diamond of Exchange, and the Diamond of Evaluation, respectively. Figure 1.2 describes this structure.

Part 1 begins by focusing on factors that affect individual behavior. We rely on four factors—Chances, Constraints, Complementors, and Competitors—to explain individual decision-making using the Diamond of Action. We find it useful to decompose individual actions into four different decision frameworks, each representing choices of individuals. For example, when exploring long-term individual behavior, we describe residential location decisions. We discuss notions of accessibility, which measures the opportunities provided by the transportation location system, and the ease of reaching places from other places. We also examine aversion principles to explain the spatial separation of

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**Figure 1.2 Overview of the structure of place and plexus**
racial, socio-cultural, and ethnic groups that can be observed around the world. Although the legal barriers enforcing segregation have been eliminated in many areas, the informal social barriers, though often deplored, remain. We introduce Thomas Schelling’s segregation model, which proposes a mechanism by which individuals having different comfort levels with people of other races will lead to self-segregation according to race. [21]

Next we consider aspects of the most frequent single destination for most people (besides home)—their workplace—and how workplace locations relate to land use-transportation systems. A key tenet in this discussion is association, the matching of origins and destinations. How do workers choose jobs? This choice is in many ways a product of social networks and “the strength of weak ties” as suggested by Mark Granovetter. [22] But it is also the product of physical networks, and gravity models demonstrate that travel time still matters.

This discussion is followed by examining the behaviors associated with mode choice and vehicle ownership decisions. Game-theoretic models (e.g., the Prisoner’s Dilemma and Arms Race scenarios) apply to a variety of circumstances, but are particularly useful in understanding the difference between a user equilibrium, wherein individual users seek to minimize their own cost and time regardless of the effects on others, and a social optimum, in which everyone acts for the collective good. This difference explains why people prefer automobiles to transit for personal travel yet continue to advocate for additional transit service, why bicycles are being driven off the road in Beijing, and why sport utility vehicles (SUVs) are getting taller and taller.

Once residents have decided on where to live and work and how to travel, people have to schedule their daily activities and make decisions about when to travel, taking into account the congestion that is a product of longer-term decisions. These factors affect which destinations people frequent, when they travel, and how they combine different types of trips. We explain how a set of constraints helps to visualize what choices are feasible and uncover what we refer to as the language of travel.

Part 2 focuses on firms, which come in various shapes and sizes. One breakdown differentiates between developers (responsible for making decisions such as where to build, what to build, and how much floor space to build) and locators (responsible for deciding where to place their businesses to receive maximum return on investment). Developers, however, respond to and anticipate the needs of locators (occupants who would locate in the buildings that are developed). Often, the importance of both developers and locators has been underestimated in studies of how cities are formed.

As with the Diamond of Action, the Diamond of Exchange considers competitors and complementors. However, we apply a supply chain approach to examine suppliers and customers as well, allowing us to analyze the economy as a network phenomenon in the Diamond of Exchange. The issues for firms arise from agglomeration economies—which provide the spark for the...
formation of place and plexus in the beginning. Agglomeration explains why firms cluster. The necessary consequence is that some places have many more jobs than houses (and most areas have more houses than jobs). This arrangement of jobs and houses is a key element in many plans. Agglomeration is counterpoised against job–worker balance, as a trade-off that markets and regulators must face.

Firms locate in relation to both their suppliers and their customers. Selling and retailing are major shapers of cities, and of people’s opinions of cities. Again, agglomeration is important, though alternative communication, information, and media networks are reshaping the traditional shopping experience.

Part 3 considers place and plexus in terms of design, provision and regulation—tasks generally associated with the public sector. This part begins with the Diamond of Evaluation, focusing on four planning objectives: Efficiency, Equity, Environment, and Experience, mediated by the politics of Expediency. By and large, government actions rely on a combination of approaches: designing place and plexus, assembling transportation infrastructure, and then allocating use of space and facilities.

In Chapter 11 we focus on design, because proper design of systems of place and plexus ultimately sets the stage for all that follows. Our framework is built around four themes, suggesting that a hierarchy of roads and transit routes needs to be synchronized with a hierarchy of places. The design approach embodies a morphology that applies pattern and structure to the environment and needs to be compatible with the community’s history and its goals for the future. To accomplish this, good design is built with different layers and is sensitive to its architectural content.

We follow with Chapter 12 describing the impacts of assembling different types of infrastructure. Governments may build infrastructure to expand supply (e.g., roads and transit systems). However, this additional supply changes demand patterns.

The penultimate Chapter 13, Operating, responds by describing strategies to appropriately allocate capacity of the land use-transportation system, highlighting the important role played by pricing. That is, governments attempt to influence the use of these systems or regulate land development to affect demand. Congestion arises because of allocation problems: a scarce resource (road space) is under-priced and over-consumed. Given demand and supply, how does congestion actually work? Queues form and discharge. Understanding this engineering concept enables the transportationist to fully comprehend traffic. Understanding the causes of congestion in terms of supply and demand leads us to some conventional solutions, and to some radical solutions.

The final chapter emphasizes how “mature” land use-transportation systems are subject to the same conditions as developing systems. Incremental improvements have limited power to make dramatic changes. We also suggest that technologies such as specific transportation networks advance over time. This evolution and revolution in technologies follows from innovation. Not all
innovations are viable. The lifecycle model explains the deployment of networks, but it is important to consider how new networks are launched. We explain these ideas in the form of suggestions to better position and “straighten” many of the policies and actions debated in land use-transportation discussions.

Throughout each of the chapters a series of boxes reinforce, illustrate, or challenge a particular theme presented in the text. They highlight some key points or concepts that support the reader’s understanding of the rest of the book, and of transportation-land use interactions as a whole. These boxes fall in one of five forms because they:

1. reveal further technical detail about particular topics;
2. describe the efficacy of a particular policy, program, or initiative and comments on its potential to serve its stated aims;
3. shine additional light on a particular behavior that is important to understand and consider;
4. provide additional interesting information (sometimes interesting trivia) that provides context around a particular issue; or
5. challenge some longstanding dogma.

Together, the boxes provide a refreshing diversion from the linear narrative of the text, while conveying important information related to land use-transportation discussions.

Cumulatively, the three parts of this book examine the theories underlying transportation and location interactions. Collectively, the chapters explain how cities work: a bold claim perhaps, but one which we strive to live up to. Adapting Schelling, we believe identifiable structural forces explain the travel behavior and activity patterns that we see. These structures, although created by millions of individual actions, are only marginally affected by any one individual. Yet these structures shape what each individual, firm, or agency can and will do. The macro-structures we observe all have micro-foundations, the actions of agents. Yet the micro-structures (individual patterns of behavior) are shaped by macro-foundations (the set of choices and constraints that others impose). These chapters present a series of inter-related models that relate transportation and land use. Throughout this book, we strive to minimize the use of equations, except where they are necessary to clearly understand the theories under discussion.

The land use and transportation system in many metropolitan areas is often thought of as the problem leading to growth, gridlock, and sprawl. We disagree. These are mere symptoms. The problem is how to satisfy people’s needs and desires for where and how to live. We do not mean just members of the middle and upper classes, but all people. The problems of congestion and unconstrained growth are the problems of the fortunate. Collective problems do not necessarily require legislative solutions, but the search for solutions should not
preclude public policy. An understanding of the past and a vision of the future sheds light on the decisions required to travel the path ahead. We conclude by suggesting strategies for enabling the transportation-land use system to drive out of the rut in which it has been spinning its wheels. A new millennium argues for new approaches, new ways of thinking, and new ways of acting. Although it has not started especially well, we still have well over nine centuries to get things right and see little reason to discover the familiar crossroads, again.

**Notes**


**References**

At a crossroads. Again.


