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Transect Planning

Andrés Duany and Emily Talen

This article outlines a new approach to the implementation of New Urbanist and smart growth principles. The approach is termed *transect planning* and is based on the creation of a set of human habitats that vary by their level and intensity of urban character. In transect planning, this range of environments, from rural to urban, is the basis for organizing the components of the built world: building, lot, land use, street, and all of the other physical elements of the human habitat. Transect planning seeks to create immersive environments, created to preserve the integrity of each location along the rural-to-urban continuum. This is a matter of finding an appropriate spatial allocation of the elements that make up the human habitat. Rural elements must find their place in rural locations, while urban elements must find their place in more urban locations—not unlike natural ecological systems where plant and animal species coexist within habitats that best support them. The transect is designed to strengthen the integrity of each immersive environment and can be used as a new, alternative approach to conventional zoning systems.

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There is widespread agreement that the current pattern of growth in American cities is regrettable. Calls for the promotion of a more sustainable urban form—defined simply as an urban pattern that is compact, pedestrian oriented, less autodependent, and not disaggregated into single, functional-use zones—now define the planning agenda. Planners are also being asked to return to their perennial "placemaking" role as physical planners (Rodwin & Sanyal, 2000), working to restore the importance of "image" and "plan" (Beauregard, 1991).

This article explains the theory and application of a new approach to urban planning called the *transect*. Based on ecological theory, the transect is a regulatory code[1] that promotes an urban pattern that is sustainable, coherent in design, and composed of an array of livable, humane environments satisfying a range of human needs. Its principles are thus aligned with those of ecological and regional planners, as well as those of urban theorists who have written about the need for a more enlightened approach to our current method of urban expansion and regulation.

Much inspiration can be drawn from the fact that the notion of good urban form, at least from within the urban planning profession, is firmly rooted and remarkably consistent. Current calls for walkable urban areas that reinvigorate the public realm and work to integrate regions socially, culturally, and economically have their roots in the ideas of leading planners, notably Ebenezer Howard, Patrick Geddes, Lewis Mumford, and Jane Jacobs.[2] Continuing in this tradition, the writings of Duany and Plater-Zyberk (1991; Duany et al., 2000), Calthorpe (1993), Kunstler (1996), and Kelbaugh (2000) have focused on designing solutions that pick up the "urban conversation" (Fishman, 2000) begun in the early part of the 20th century.

The crisis of urban form and its proposed solution encompasses the goals not only of planners but of environmentalists and economists as well. Both groups are now intimately involved in exposing the liabilities of current urban growth patterns. Environmentalists may speak about the need to reduce the ecological footprints of cities (Beatley & Manning, 1997), whereas economists speak in terms of rectifying externalities and social costs (Persky & Wiewel, 2000), but the objectives are fundamentally the same. Even libertarian views (Lone Mountain Coalition, 2000) have recognized the need to provide living environments that offer an alternative to standard urban growth patterns, based on the desire to expand consumer choice.

Despite this convergence of opinion and a large amount of publicity against unsustainable urban form (i.e., sprawl), widespread redirection of

urban growth in the U.S. is proceeding at a painfully slow rate (Harvard University Joint Center for Housing Studies, 2000). A number of reasons for the continued proliferation of an urban pattern widely known to be unsound have been identified: The American preference for low-density housing (Audirac, 1999), racism and White flight (Jackson, 1987; Thomas & Ritzdorf, 1997), lending practices and federal subsidies (Fishman, 1987), construction practices (Kelbaugh, 1997), and systems of governance (Orfield, 1997) are commonly cited. Ironically, the field of planning itself is partly to blame. Planning rigidly regulates *out* good (sustainable) urban form in its implementation devices—the separation and spatial scattering of urban land uses that is endemic to the vast majority of zoning ordinances and subdivision regulations imposed throughout the U.S. The regulatory framework within which urban planning currently operates—conventional, Euclidean-based zoning—stands in direct opposition to urban planning goals.

Empirical studies have verified this. A recent survey of land use regulation in the State of Illinois (Talen & Knaap, 2000) verified the extent to which planning is the victim of its own devices. An analysis of the regulations of 168 cities and counties found that mixed-use zoning was limited, smart growth tools were almost nonexistent, and prescriptive requirements for lot sizes, setbacks, road widths, and parking decidedly favored low-density sprawl and urban fragmentation. Pendall's (1999) study of land use regulation decisively linked land use controls to sprawl, and a study of smart growth plans found a lack of connection between sustainability goals and corresponding implementation devices (Berke & Conroy, 2000).

There seems to be a growing recognition that conventional zoning schemes and the way they encourage development to separate and disperse are counterintuitive to the way in which we ought to be planning and regulating urban development. Yet clearly a reworking of the tools of planning implementation has not kept pace with the rigorous denouncement of urban sprawl. This should be cause for great concern among planners. Why have the regulatory devices that implement planning objectives failed to change? Why, more specifically, do conventional zoning regulations and subdivision ordinances persist in their promotion of suburban sprawl amid increasingly vociferous calls for a renewed approach?

One reason may be that the planning profession is stymied by a system of specializations. Economic development planners, transportation planners, environmental planners—each group of specialists competes to make its own particular issue the dominant force in development politics. Similarly, specialization has transferred to the development industry, where, largely as a result of our current system of zoning, developers and lenders specialize in building or financing only certain types of developments (Duany et al., 2000).

These separations create problems for planning practice by splintering efforts, pitting specializations against each other, and thwarting attempts to implement a consolidated approach. What is needed is a new system of land regulation that works to implement a more sustainable urban form.

The Transect Approach

The transect approach described in this article is based on a publication known as the *Lexicon*, a multi-authored compendium of New Urbanist definitions and codes published by Duany Plater-Zyberk & Company (2000). Further, the transect idea has been codified in a model zoning ordinance known as the SmartCode (see Note 1).

A transect is a geographical cross-section of a region used to reveal a sequence of environments. For human environments, this cross-section can be used to identify a set of habitats that vary by their level and intensity of urban character, a continuum that ranges from rural to urban. In transect planning, this range of environments is the basis for organizing the components of the built world: building, lot, land use, street, and all of the other physical elements of the human habitat.

One of the key concepts of transect planning is the idea of creating what are called *immersive environments*. This term is borrowed from the notion of virtual reality—the subfield of computer science in which cognitive spatial representations (i.e., three-dimensional computer graphics) are constructed to simulate actual movement through or interaction with a particular environment. When these virtual environments are successful, they are said to be immersive—virtual models that function as if they were actual environments. Participants who are successfully "immersed" in virtual space will have the illusion of actually being in that space because it is coherent—that is, its elements perform as expected. This performance is based, in part, on the selection and arrangement of all the components that together comprise a particular type of environment.

The logic of the transect is similar. It seeks to create an experience of immersion in any one type of environment by specifying and arranging the elements that comprise that environment in a way that is true to locational character—that is, in a way that is expected, given the nature of the place. Just as computer scientists are able to program immersive environments that look and feel natural, transect planners may be able to specify different urban intensities that look and feel appropriate

to their locations. Appropriate intensity and character sound burdensome but they are not particularly difficult to perceive. A farmhouse would not be expected and therefore would not contribute to the immersive quality of an urban core. A highrise apartment building would not be expected nor would it contribute to the immersive quality of a rural environment. Immersive rural environments might consist of wide streets and open swales, while immersive urban environments might consist of formal boulevards and public squares. Based on local vernacular traditions, most elements of the human habitat can be similarly appropriated in such a way that they contribute to, rather than detract from, the immersive character of a given environment.

In transect planning, the essential task is to find the main qualities of immersive environments, not unlike Lynch's (1976) search for the "sense" of a region. Once these are discovered, transect planning principles are applied to rectify the inappropriate intermixing of rural and urban elements—better known as sprawl. This is done by eliminating the "urbanizing of the rural" such as office towers in otherwise pristine environments or, equally damaging, the "ruralizing of the urban" such as undefined, vacant open space in the urban core. The prescribed urban pattern is therefore based, theoretically, on finding the proper balance between natural and human-made environments along the rural-to-urban transect.

To aid in the specification of different types of immersive environments, the rural-to-urban continuum can be segmented into discrete categories. This approach is also dictated by the requirement that human habitats fit within the language of our current approach to land regulation (i.e., zoning). To explain this more exactly, a diagram of the nomenclature of the transect is presented in Figure 1.

Here the segmentation of the transect continuum is accomplished by dividing it into six different *ecozones*:

- Rural Preserve
- Rural Reserve
- Sub-Urban
- General Urban
- Urban Center
- Urban Core

The term ecozone is used to promote the link to natural ecologies. While these categories work well, it is important to note that other immersive categories have been proposed and bear some resemblance to the ecozones discussed here. Brower's (2000) typology of neighborhoods is one example.

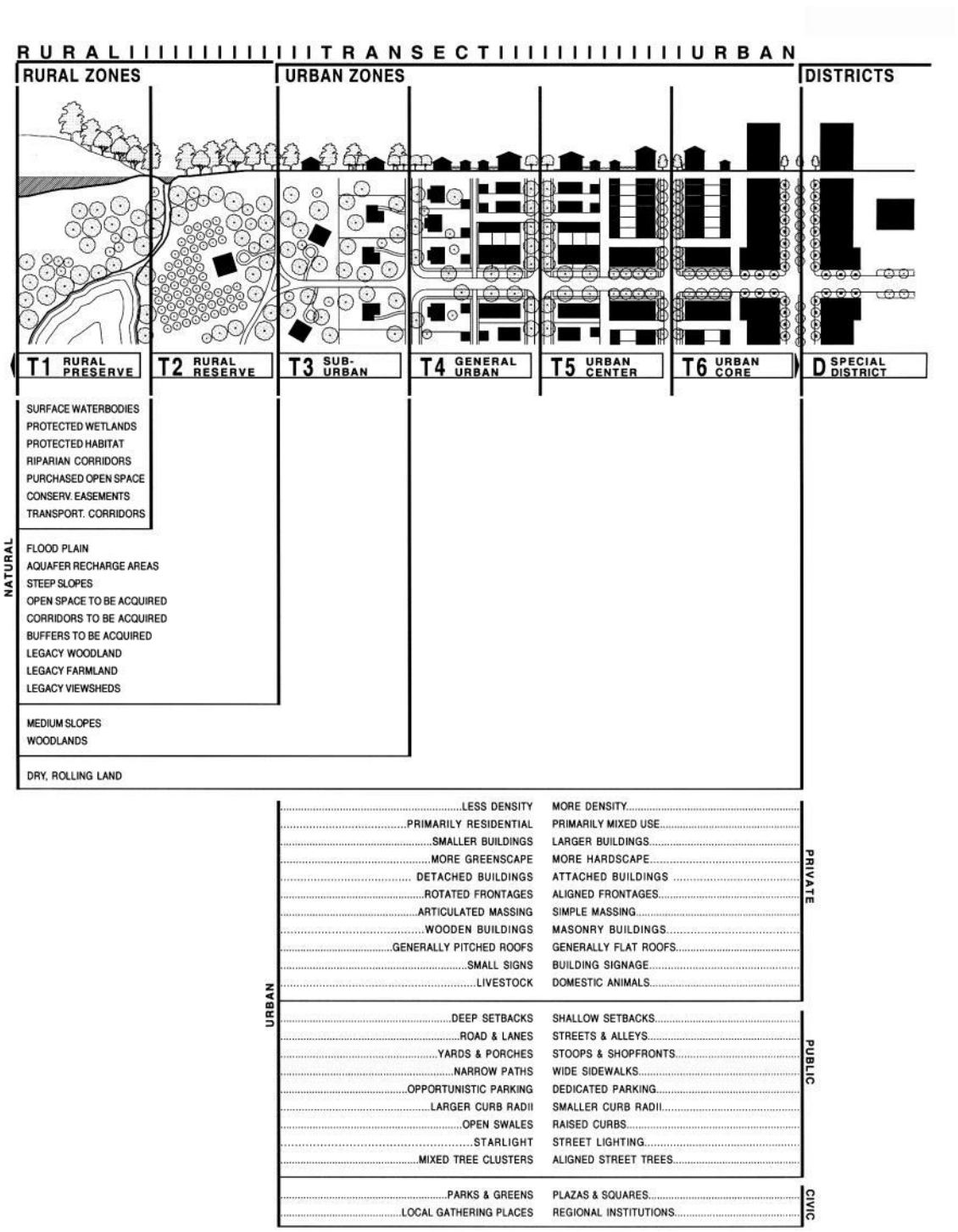
The transect approach is essentially a matter of finding an appropriate spatial allocation of the elements that make up the human habitat. Rural elements should be located in rural locations, while urban elements should be located in more urban locations—not unlike natural ecological systems in which plant and animal species coexist within habitats that best support them. In the transect system, urban development is distributed so that it strengthens rather than stresses the integrity of each immersive environment.

The transect should also be viewed as a way of applying a set of core principles of good urban form to a range of human habitats. Thus the idea that human environments should be walkable, pedestrian oriented, diverse, and promoting of public space is intrinsic to each type of environment along the transect. This directly addresses the criticism that these principles, especially when labeled New Urbanism, are a "one size fits all" approach to rectifying urban form, narrowly focused on "tinkering with the physical layout of a development" (Beatley & Manning, 1997, p. 21) and sidestepping the importance of the larger environmental issue of regional sustainability. What most planners know, however, is that it is critically important to be able to connect to this larger view, to apply New Urbanist principles of urban form on a regional scale (see, for example, Congress for the New Urbanism, 2000, pp. 13–69; Calthorpe & Fulton, 2001). This is what transect planning seeks to accomplish.

Transect Lineage

It is possible to connect a number of important planners and planning approaches to the transect idea. This lineage is most direct with regional planning, notably the Scottish biologist Patrick Geddes and the landscape planner Ian McHarg. The regionalist perspective is in fact the basis of much current planning thought (see especially Calthorpe & Fulton, 2001), and there now seems to be a wide understanding that in order to rectify the problem of urban growth (i.e., land-consumptive sprawl) a regional framework is needed (Wheeler, 2000).

The connection with Geddes is most direct, since his theory of settlements was based on the idea of the *valley section*, which is essentially a transect. He used the device as a way of discovering the values of a place—the basis of his survey methodology. More specifically, he used the valley section to find "the rhythms of the land masses of the earth . . . from snow to sea, from highland to lowland" (Geddes, 1915, p. xviii). Studying a place in this way, Geddes believed, the region of the geographer, the anthropologist, and the economist could be brought into focus to gain a better understanding of a place. Geddes maintained that each valley section had a different level of nat-



Source: Duany Plater-Zyberk & Company

FIGURE 1. Diagram of the transect system.

ural intensity which would determine what occupation was likely to be found there: miners and hunters in the higher elevations and shepherds on the grassy slopes, for example. Environment and occupation in turn determined the essential character of cities. Like transect planning, Geddes used the valley section to relate geography and settlement pattern to an understanding of existing cities as well as the laying out of new ones.

A less explicit but important part of the transect lineage is the regionalist idea that planning should be derived from the unique qualities of *place*. This notion has its roots in Mumford and the regional planners, but J. B. Jackson and Ian McHarg in particular promoted the idea that vernacular and regional ecology should be the essential ingredients of planning (McHarg & Steiner, 1998). McHarg stressed the importance of understanding the social and natural processes of a specific place. Through investigation of each "layer" of an environment—physical, biological, and social—McHarg worked to reveal "successive stages of urbanization" that were deemed successful or not, depending on whether they were "regressing from health or evolving towards health" (McHarg & Steiner, 1998, p. 207). His "communities of land use" are based on the interaction of land uses and their internal compatibility, clearly a strong parallel with the transect system.

While McHarg's strategy of basing land use on land type in order to develop a "fit" environment has much in common with the transect idea, the integration of rural and urban environments is conceptualized differently under the transect system. The ultimate goal under the transect system is to foster quality environments, whether rural or urban. Violating any one type of transect zone—for example, when rural environments are permitted to be urbanized or urban environments are permitted to be ruralized—creates the potential for systemic effect. When immersive environments are compromised, they become degraded, lose their appeal, and eventually join the stockpile of lands that are neither urban nor rural, but an inappropriate, unappealing mixture of elements that are unable to completely satisfy human preferences.

In this conceptualization there are some affinities to Alexander's *Pattern Language* (Alexander et al., 1977). Both ideas rest on the ecological notion that patterns are not isolated, but are interwoven into a system of larger patterns. Nothing exists in isolation. In the case of Alexander's approach, all types of environments become coherent and whole if the patterns are followed. This is because the 253 patterns, ranging in scale from region to house interior, form a linked hierarchy. Adherence to a pattern language allows each environment to find its place in the "web of nature" (Alexander et al., 1977, p. xiii). Of course, this approach differs from the transect in that the transect is not set up as a hierarchical network, but both draw from the principle of interrelatedness that is so essential to natural ecology.

Conceptual Framework

The Application of Ecological Principles

The transect is a normative theory based on universal ecological principles. But the application of these principles has a substantive basis which, as Moudon (2000) observed, is necessary as a "proof of goodness" for any normative theory—to take such theories "from a state of conjecture and advocacy to one of greater certainty" (p. 38). Transect planning connects to substantive theory via the application of these ecological principles.

Transect planning begins with the idea that planning must be based on finding the proper balance between human-made and natural environments. Finding the connection between the living world and the world of cities, the "warp and woof that make up the fabric of our lives" (Van der Ryn & Cowan, 1995, p. 3) is necessary in order to achieve good urban form—one that is ecologically, socially, and economically sustainable. Though this interconnection of urban and natural domains is the defining feature of both urban ecology and regionalism, it is a departure from the usual view that cities and nature are in virtual opposition. According to Beatley and Manning (1997), this constitutes a new brand of environmental thinking. Under the "new urban ecology" (Collins et al., 2000), cities are no longer viewed as necessarily detrimental but are in fact part of the solution to environmental problems. It is important to note that this way of thinking is not new to planning. The Regional Planning Association of America, for example, explicitly stressed the need to decentralize communities in balance with nature during the 1920s (Thomas, 2000).

The transect is intrinsically related to the idea that deep connections exist between urban and natural environments, and it fosters these connections through its application of ecological principles. In this it has some similarities to the goals of ecological design—design that "minimizes environmentally destructive impacts by integrating itself with living processes" (Van der Ryn & Cowan, 1995, p. 3). Usually, this integration is achieved by lessening the environmental impacts of design, typically via an appropriate choice of materials and renewable energy sources and through a keen sensitivity to ecological context. Another approach is based on landscape ecology (see especially Forman & Godron, 1986; Steiner, 2000), in which a range of ecological principles is used to

produce better plans, promote conservation, and assist in land use management. For example, knowing the principles of habitat patches (size, number, location), edges and boundaries (structure, boundary shape), or corridors (barriers, connectivity) can have important implications for land use planning (Dramstad et al., 1996).

The transect uses ecological principles in a somewhat different (although not mutually exclusive) way, particularly in its focus on the internal planning and design of urban areas. At least four ecological principles are applicable. The first of these is the notion of a sequence of habitats or, in the language of ecologists, *ecosystems*. Scientists have observed that nature conforms to a certain spatial ordering of ecosystems, a progression of biodiversity that ranges from prairie to woodland or tundra to foothill. The transect mirrors this principle, applying it to create a range of human habitats composed of varying degrees of urban intensity.

The appeal of this notion is that it provides a basis for specifying a range of human habitats. Planners have often recognized the need to provide variety, fitting different types of environments to different types of locations. For example, this principle is the basis of Arendt's (1997) approach to cluster techniques which, he argues, should vary in response to different types of residential development situations. Environmentalists recognize the need to provide a range of sustainable development solutions, each appealing to different "aspects of sustainability" (Williams et al., 2000, p. 355). British planner A. C. Hall (1996) has proposed a system of "design areas" in which a variety of habitats can be formed and maintained by varying the level of design and regulatory intervention. The regionalist perspective, too, is based on the recognition that a variety of human habitats must be planned for. The "regional city" of Calthorpe and Fulton (2001), for example, is based on providing a variety of "human-scale communities" (p. 45).

Second, the transect incorporates the fundamental ecological principle that within a specified area there exists an interrelatedness—a functional linkage—between organisms and their physical environment. The transect uses a similar principle by stressing the importance of connecting the elements of urbanism—building, lot, street, use—to their physical environment. This linkage defines the appropriateness of certain types of elements within a given human habitat. Under the transect system, elements of the built world are linked to their physical location in an appropriate way. For example, elements with a lower level of urban intensity belong in less urban areas, while elements with a higher level of urban intensity belong in more urban areas.

Of course, in natural ecosystems the distinction between *organism* and *physical environment* may be more obvious than in human-made environments. A street, a building, or a type of use are all elements of the built world (the organisms, by analogy), but they also comprise the physical environment. What is important is the basic ecological principle of interrelatedness, the multidimensional nature of ecosystems in which elements are bound to context and cannot be treated as an isolated, singular dimension. Under the transect system, planning the built environment is focused on creating immersive environments comprised of elements that are, in an ecological sense, interrelated.

A third ecological principle that the transect employs, related to the first two, is the idea that each habitat requires a certain degree of internal diversity. In natural ecologies, different kinds of habitats exhibit a different mix of elements, satisfying a range of different species. Ecologists refer to this as *complexity*. This concept can be applied to human environments, whereby different human habitats—immersive environments—present the full range of elements necessary to create an environment that satisfies a particular living preference. In fact, the transect system maintains that it is only through this complete diversity of elements that living preferences are truly satisfied. Unsuccessful environments are monolithic and lack internal diversity and coherence. Further, like natural habitats, human habitats are successful when they exhibit a variety of elements that cohere. In planning human environments, the emulation of this principle is based on an understanding (through empirical knowledge) of local environments that have been or are currently considered to be internally coherent.

Finally, the transect system makes use of the idea that ecological principles work simultaneously—but in different ways—at different spatial scales. In nature, there is a continual flow of energy and nutrients across multiple scales, "a nested series of coherent levels, from organism to planet, each manifesting its own design integrities" (Van der Ryn & Cowan, 1995, p. 3). What this means in ecological design is that scale must be taken into account in designing the most appropriate solutions to environmental problems. For example, at a fine scale a habitat may appear fragmented, while at a broad scale it may appear intact, and each of these situations may call for a different intervention strategy (Dramstad et al., 1996).

This principle also has to do with the idea that design prescriptions ought to work across multiple scales. Design solutions should, as in nature, acknowledge the interconnections across scales and not apply only to one scale at a time. This is, to some extent, a different way of phrasing the previously cited problem of disciplinary specialization in planning. Recognizing the integration

of scales is another way of strengthening an interdisciplinary, generalist approach to planning.

This idea is also what Calthorpe and Fulton (2001) have in mind when they discuss the parallel design strategies that exist for regions and neighborhoods. The authors assert that, if seen as an integrated whole, regions and neighborhoods can be designed similarly. For example, both the regional and neighborhood scales require a center, a circulation system, and a civic realm. While a region requires a diversity of economic functions, a neighborhood requires a diversity of uses and housing types. And just as a street network can be designed to increase walkability to destinations appropriate to the neighborhood level, a regional transit system can be designed to better organize and focus redevelopment in a region.

The transect makes use of ecological principles having to do with scale, first by paying attention to the fact that different elements have a different range of effect and second by integrating design across scales. In the former sense, the transect system seeks to ensure that different types of elements are placed in a way that is appropriate to their sphere or range of influence. For example, a road with high-speed geometrics should be placed in an area that is meant to serve or connect a wide geographic range, while a narrow residential street responds to a much smaller range. In the case of scale integration, the transect works at more than one scale at a time in the sense that different combinations of immersive environments, when nested together, create complete villages, hamlets, towns, cities, and regions. Different types of immersive environments thus form the building blocks of other normative proposals that operate on a more regional scale.

Clearly, ecology provides some useful, heuristic analogies for the planning of human environments. Only some modification of language is needed: for example, using the term *ecozone* rather than *ecotone*. Whereas ecologists use the phrase "assemblage of organisms" (Pickett et al., 1997, p. 186), urban planners can substitute the phrase *assemblage of urban elements*. However, the transect's use of an ecological analogy goes beyond a convenient descriptive device: There are explicit design consequences. The transect seeks to employ "nature's own design intelligence" (Van der Ryn & Cowan, 1995, p. 10), extending it beyond the design of individual "green" projects to the arrangement of metropolitan regions as a whole.

Justifications

How is the transect approach justified in using ecological principles in this way? By patterning urban environments as a sequence that varies in urban intensity, creating immersive human habitats from interrelated and cohesive elements, linking these elements to their physical environment, and fostering integration across a range of spatial scales, is transect planning simply using ecology as a useful analogy? And if so, why these particular principles and not others?

One purpose of using analogies in planning or any type of endeavor is to help develop innovative approaches to theorizing, explaining, or predicting patterns, events, or other phenomena. In this case, the ecological analogy of the transect provides a basis for a new way to conceptualize the relationship between natural and human habitats. Fostering a new conceptualization helps, at least potentially, to reinforce their interconnection. This is critical since most urban development is not envisaged in a way that interconnects it to natural environments.

The ecological analogies serve the purpose, then, of spelling out a new approach to rural/urban integration. The transect conceives of rural and urban conditions as interconnected parts of a system that requires different responses, depending on where development is situated. It then strengthens the connection by basing urban planning and design on the degree of relative intensity of urban elements *with respect to* natural systems. In the transect approach, design principles are based on the degree of urban intensity appropriate to a given area, in turn a function of the level of rural intensity appropriate to each area. One is prescribed in relation to the other, and a range of human habitats is defined on this basis. The transect thus attempts to define a sequence of environments that reflect a complete range of different levels of integration.

What this means practically is that transect zones exhibit a range of responses to natural conditions. In more rural areas, green infrastructure is given priority. Therefore, the rural transect zones delineate lands that should either be preserved in perpetuity or reserved for future protection (i.e., as land becomes available). At the opposite end of the transect continuum, the urban core, urban qualities are given priority. In the urban transect zones, the primary consideration of development is to strengthen the urban fabric, which may mean that natural features are subjected to an urban treatment. If viewed in broad terms, this should not be seen as environmental insensitivity, but rather as a system that ultimately ensures the preservation of natural resources.

It is important to recognize the difference between the transect and other applications of ecology in human settings. Specifically, the human ecologists of the Chicago School of Sociology, who were most active during the first decades of the 20th century, used natural ecological principles in describing the internal structure of

the city. Well known to urban planners are the writings of E. W. Burgess and Robert Park, who provided highly influential, generalized descriptions of the residential structure of Chicago in the 1920s, modeled directly on ecological processes (Park & Burgess, 1925). These and other members of the Chicago School found an observable spatial pattern of social characteristics that was connected to the natural world in that, according to Park, "all living organisms, plants and animals alike, are bound together in a vast system of interlinked and interdependent lives" (Park, 1952, p. 145).

Recent urban ecological work has rediscovered the relevance of the Chicago School (Collins et al., 2000), extending the conceptualization of ecology to incorporate the full range of environmental phenomena, from natural ecosystems to urbanized cores (Breslav et al., 2000). In fact, whereas the early human ecologists of the Chicago School used ecological theories of invasion and succession to explain human behavior, urban ecologists today propose an even stronger connection whereby human-dominated ecosystems are incorporated into ecology itself (Gober et al., 1998; Pickett et al., 1997).

The crucial difference between these uses of ecological principles in the urban context and the transect approach to urban planning is that in the former the principles are used to predict patterns of urban growth. They are used as explanatory devices, not as an underlying analogy guiding a prescribed urban pattern. Thus, as a normative theory of city planning, the transect does not use ecology to *explain* patterns of, for example, urban succession and invasion. Instead, the heuristic utility of the ecological analogy is that it forms a design basis for integrating urban and natural environments. The rules of ecosystems are applied not in an attempt to understand and predict human behavior but as a basis for developing a normative approach that links human and natural environments.

As it turns out—and this is the source of the second justification for using ecological principles as a basis for transect planning—there is an empirical foundation to this analogy. In particular, the ecological principles of interrelatedness and diversity have been observed in what are considered to be "successful" urban environments. Accordingly, it has been recognized that the redevelopment of urban areas in which "megaprojects" such as stadiums are imposed on an otherwise fine-grained urban fabric can have disastrous effects (Gratz, 1998). This is analogous to the principle in nature that each element of an organized community serves a constructive or at least stabilizing role, a theme recently developed by Johnson (2001) in his book *Emergence: The Connected Lives of Ants, Brains, Cities, and Software*. This same principle of interrelatedness was described by Sears (1956), who observed that if organisms are introduced that are not adjusted to the habitat, the community can become destabilized. This effect has been observed in urban environments as well.

There is also a strong empirical basis for the notion of promoting diversity within different types of environments. Planners have adeptly recognized the link between natural and human variety, stressing the need for urban diversity that mirrors and integrates with the complexity of natural ecologies. Ian McHarg (1969) applied this need to the regional scale, observing that the fundamental problem with conventional suburban sprawl was the imposition of a destructive simplicity on a complex system (Fishman, 2000). Jane Jacobs (1961) emphasized the intraurban situation, pointing out that the diversity of a healthy city is analogous to the diversity of a natural ecosystem. Before Jacobs, the Regional Planning Association of America recognized the need to promote variety in decentralized communities, avoiding monolithic urban fragmentation wherever possible (Thomas, 2000).

There has been a sustained recognition that complex interdependencies found in natural ecosystems are beneficial in human environments. Applied to human systems, it is the intermixing of diverse cultures, peoples, and land uses that creates the richness of urbanity. Urban economists in particular have accepted this idea: that dense, diverse cities breed innovation, and that the resultant knowledge accumulation and spillover effects are a vital component of economic growth (Glaeser, 2000; Romer, 1986; Sassen, 1993). The transect uses the ecological principle of diversity to formulate a basis for rectifying urban monocultures so pervasive in modern cities. This is necessary since, under our current system of land regulation, areas tend to develop into monocultures—large areas of single-use zones. Within this type of urban pattern, the elements that make up a complete, immersive environment become disaggregated. Most importantly, separation of uses into functional zones digresses significantly from natural systems in which interdependencies create and maintain a healthy diversity.

The Transect as an Analytical Tool

The transect is an urban planning approach based on ecological principles, but it is also an important analytical tool. In order to discover the full range of human habitats that exist locally and to gain an understanding of the elements that define them, transect methods can be applied.[3]

Transect methodology involves taking a linear cut across a landscape, usually horizontal (although vertical

is also used), along which a diversity of systems and habitats is sampled, measured, and analyzed. Data is collected at points along one or more transects in a region (the equivalent of core samples in geology) to better understand populations as well as communal associations occurring within selected habitats. Scientists use these samples to track changes over time, looking for ways in which the entire ecosystem is affected. Thus it is possible to focus not only on the changes occurring in one particular system, but also on the effects of abiotic and biotic parameters on the various units within the system (Fletcher, 2001). There is no limit to the variety of systems that can be studied, ranging from individual organisms to atmospheric conditions, and from the level of microscopic to global.

The practical use of the transect method is in research and education about biological and other natural systems (for example, see Humphreys, 1987; Walsh, 1991). However, uban environments have been incorporated in transect analysis either by extending the transect line into the urban core and investigating the intensity of biological diversity in this abiotic realm or by using transect methodology in urban analysis. One example of the first type of application was undertaken by researchers at Fordham University's "Research Program in Urban and Suburban Ecology" and elsewhere (McDonnell et al., 1997). Students investigated habitat changes along a 130-km urban-to-rural transect from New York City to northwestern Connecticut, looking in particular for biotic and abiotic contrasts, habitat fragmentation, and plant community changes along the transect gradient.

It has also been recognized that the transect method makes sense for the study of urban areas. Transects are drawn, and the variety of human habitats along them are investigated in depth as a method of urban analysis. In a recent application, urban design students have used transects to "unearth the chances, the collisions, [and] the coherences" at points along an urban-to-rural transect, developing in the process a creative taxonomy of urban conditions (University of British Columbia, 2001, p. 1). Researchers at the University of Toronto's Centre for Landscape Research (2001) used three linear transects to describe the city's urban form, effectively describing the aggregate urban pattern by investigating disaggregated patterns of demography, morphology, land use, and historic settlement. In a study of historical patterns of urban growth, Thrall et al. (1995) used transect analysis to investigate the regularity of land use patterns in a Florida county over a 90-year period.

Best known to planners is the work of Grady Clay, who produced an "unconventional guide to America's generic landscape" by his own method of walking a number of cross-sections, in "rigorous pursuit of generalizations along a linear path" (Clay, 1994, p. x). In a recent article entitled "Will the real Portland please stand up?", Clay (1998) lists 13 cross-section criteria, including "go where the flow begins" and "go for the center" in an attempt to find "elements that make the place tick" (p. 155–156). Interestingly, in this article he connects his transect method not only to Patrick Geddes' "valley section" but also to J. B. Jackson's "Strangers' Path" and the 16th-century anatomist Vesalius (Clay, 1998).

There are other methods, not necessarily involving a cross-section of the landscape, that are useful to the transect planning approach. In particular, there are methods used to investigate the existence and composition of immersive environments (although the term *immersive* is not usually used). Urban morphology, "the study of the city as human habitat" (Moudon, 1997, p. 3), is particularly relevant. The principles of urban form, resolution, and time are sometimes revealed by what morphologists call the "plan unit" or what Italians call *tessuto*—groups of buildings, lots, open spaces, and streets that form a cohesive whole (Moudon, 1997, p. 7). Morphologists look to the reasons why these cohesive units were formed and sustained, such as time frame, regulatory constraints, or transformation similarities.

All of these methods are fundamentally related to transect planning, but there is an important difference. While the above examples focus on discovery, interpretation, and analysis, transect planning integrates this knowledge as a basis for normative planning. Except in the case of certain branches of urban morphology (e.g., the Italian School of urban morphology; see Moudon, 1997), most of the methods described above are not explicit about how the elements discovered could form a basis for prescription. While natural, urban, and urban-to-rural transects feed into this process (e.g., by exposing the regional vernacular as a foundation for a new regulatory code), the purpose of transect planning is to proactively guide the urban pattern in a way that solidifies transect principles.

Theory into Practice

How is transect methodology to be put into operation in such a way that the pattern of urban expansion is improved? The translation from theory to practice has always been problematic for planning. Yet the strategy of transect planning is very direct: It offers an alternative to the conventional mechanism of planning implementation (Euclidean zoning). It is essentially a new system of classification, one that organizes the elements of urbanism according to the principles of a transect-based distribution. Planners facilitate this system by learning

how to allocate spatially, finding the appropriate location and juxtaposition of urban elements along a continuum of human habitats from urban to rural.

It is therefore necessary to give maximum focus to the coding of a transect-based system. Such a system must:

- spatially locate a discrete number of transect environments, ranging from urban to rural;
- apply standards within each environment so that development within them is intrinsically complex, while not detracting from the integrity of each place; and
- be flexible enough to allow one transect zone to evolve into another, thereby incorporating a dynamic, rather than static, approach to guiding urban development.

A transect-based code should be based on a number of pragmatic considerations. To be successful, it must be comprehensive, simple, and worded in technical language. The first condition is intuitive, particularly for planners. Being "comprehensive" conventionally means that planning is required to simultaneously consider the interrelationships between social, economic, and geographic factors (Kent, 1990). But it also implies that planning should be able to integrate and define its implementation devices at varying scales, that is, at the level of building, lot, block, neighborhood, city, and region. This means that in order to be effective, a new system must be applicable to the whole cacophony of development standards—traffic engineering standards, fire codes, brownfield redevelopment laws, school site location standards, and storm water management requirements, to mention a few.

At the same time, the implementation of a new system must be kept simple. Various innovative approaches that have been devised, such as rating schemes for new proposals or measures of environmental performance, suffer from being too complex and therefore too difficult to administer. As a practical matter, a new regulatory approach must not only be comprehensive, it must be as simple and elegant as the one it is seeking to replace. Standard zoning and subdivision regulations have strong appeal in this regard, which undoubtedly explains their persistence. But the transect code can attain an equal standard of clarity by making use of simple diagrams, tables, and other visual devices.

Finally, a new coding system must be able to speak the language of technocracy in order to be politically feasible and legally defensible. Despite the tendency for planners to continually question technicist approaches (Innes, 1998), the American system of planning is nevertheless heavily reliant on technical measurement. Lucid examples are the regulatory codes that act as a kind of DNA of the planning system, articulated as densities, setbacks, parking ratios, and all other forms of statistical expression. Since quantification pervades all aspects of our society, it is necessary that any new system absorb this technical language, a realization that has not been lost on environmental groups who successfully pursue an agenda that rests on a foundation of scientific, quantified "fact."

The challenge, then, is this: to apply a new system of land regulation that is comprehensive, simple, and technically worded, but at the same time is able to create a range of human environments that are internally coherent as well as diverse, reflecting the ecological principles on which it is based. This is the promise of the transect system. It is comprehensive in that it can be applied at a variety of scales; it is simple in its system of regulating urban form according to distinct spatial categories; and, using a coding language, it is amenable to technical presentation. These characteristics can work to create the desired range of immersive environments.

A Model Transect Code

A model transect code, known as the SmartCode, has recently been developed by Duany Plater-Zyberk & Company (2001).[4] It segments the rural-to-urban continuum into discrete categories that fit within the language of our current approach to land regulation (see Figure 1). This continuum has six different ecozones (Rural Preserve, Rural Reserve, Sub-Urban, General Urban, Urban Center, and Urban Core). Qualities of natural and urban elements are differentiated according to each ecozone.

The elements of a more generalized set of planning goals (which would conventionally form the basis of a separate general plan rather than a code) are an essential basis of the SmartCode. The code begins with a list of the basic principles of good urban form and then proceeds with laying out specific sets of standards:

- *Building disposition,* specifying lot size, frontage, and setback requirements for each ecozone;
- *Building configuration*, specifying frontage type (e.g., porch, stoop, or gallery) and building height;
- *Building function*, which indicates the uses prescribed for each transect zone; and
- *Standards* for parking, architecture, landscape, and signage.

The sets of standards vary according to ecozone in terms of their placement along the rural-to-urban transect. Applying standards to each ecozone is a matter of specifying the degree of urban intensity appropriate to that zone. A few general guidelines give a sense of what

this entails. At the rural end of the continuum, standards would call for less density; smaller, detached buildings; deep setbacks; paths, trails, and open swales; and irregular plantings. At the most urban end of the continuum, standards would call for higher density; larger, attached buildings; shallow setbacks; street and alley sections; and formal plantings. From rural to urban, the density and complexity of human elements are increased, while the density and complexity of natural elements are decreased.

Table 1 provides a summary of the main characteristics of each type of ecozone, showing how the character of each type of zone progresses from rural to urban. All of the familiar elements of urbanism are located, but strict attention is paid to their spatial assembly along the transect. Put another way, the familiar land uses of urban areas find their place, but that place must be appropriate to locational context.

This attention extends not only to land use but also to building type, frontage, streetscape, thoroughfare, and open space. These categorical specifications are based on ideas about how certain urban forms have intrinsic qualities that define their appropriate spatial context. To use a simple example, a large office building belongs in a more urban than rural position along the transect, since both its form and function are intrinsically urban. Conversely, roads consisting of high-speed geometrics are generally more appropriate in rural as opposed to urban settings. It is this kind of sensitivity to spatial appropriation that the transect requires to be successful. This may be challenging in places where Americans have become desensitized to transect principles,

TABLE 1. Main characteristics of ecozones.

Ecozone	Main characteristics
Rural Preserve T1	Open space legally protected from development in perpetuity. Includes surface water bodies, protected wetlands and habitats, public open space, and conservation easements.
Rural Reserve T2	Open space not yet protected from development but should be. Includes open space identified by public acquisition and areas identified as transfer of development rights (TDR) sending areas. May include flood plains, steep slopes, and aquifer recharge areas.
Sub-Urban T3	The most naturalistic, least dense, most residential habitat of a community. Buildings consist of single-family, detached houses. Office and retail buildings are permitted on a restricted basis. Buildings are a maximum of two stories. Open space is rural in character. Highways and rural roads are prohibited.
General Urban T4	The generalized, but primarily residential, habitat of a community. Buildings consist of single-family, detached houses and rowhouses on small and medium-sized lots. Limited office buildings and lodging are permitted. Retail is confined to designated lots, typically at corners. Buildings are a maximum of three stories. Open space consists of greens and squares.
Urban Center T5	The denser, fully mixed-use habitat of a community. Buildings consist of rowhouses, flexhouses, apartment houses, and offices above shops. Office and retail buildings and lodging are permitted. Buildings are a maximum of five stories. Open space consists of squares and plazas.
Urban Core T6	The densest residential, business, cultural, and entertainment concentration of a region. Buildings consist of rowhouses, apartment houses, office buildings, and department stores. Buildings are disposed on a wide range of lot sizes. Surface parking lots are not permitted on frontages. Open space consists of squares and plazas.

Source: Adapted from Duany Plater-Zyberk & Company (2000)

expecting, for example, urban-level facilities in rural settings. The transect seeks to rectify this misallocation (i.e., the improper assembly of urban elements in rural contexts and of rural elements in urban contexts).

There are fundamental differences between transect-based codes and conventional zoning. Transect zones are not spatially floating, homogenous subgroups of land uses. A diversity of elements are attended to within each transect category, and, unlike in conventional codes, this has the important advantage of requiring the mixing of land uses at a variety of intensities. Single-use zoning and its creation of housing subdivisions, shopping centers, and business "parks" is incompatible with the transect approach, since each of the transect ecozones is intended to be immersive, resulting in an environment where the elements of the human habitat reinforce each other to produce something greater than the sum of their individual parts.

What makes this system particularly palatable is that it does not eliminate the language of current zoning. Rather, it seeks to apply it in ways that are appropriate to transect principles. It assigns established standards and zoning "rules" to their proper location, that is, to the section of the transect in which a particular standard appropriately belongs. For example, building types are variegated in the code according to transect location, ranging from villa, house, and cottage to rowhouse and flexhouse. Because of the inclusiveness of the system, various urban elements are not treated as categorically wrong. Instead they are treated as transect elements that need to find their correct allocation along the transect.

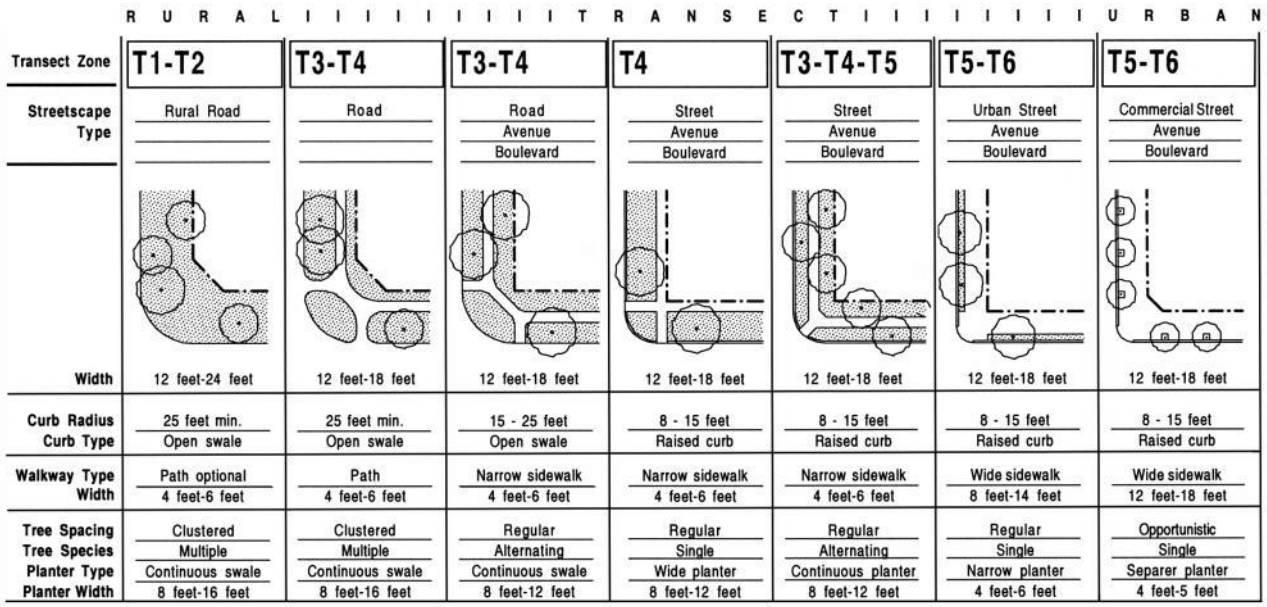
Planning for urban development, then, becomes a process of geographic allocation. In itself, this should not be problematic, as planners are generally comfortable in the realm of spatial distribution. The more difficult issue is that planners must at the same time cross professional realms and become comfortable with the design aspects of urban development at a range of levels. As a prescriptive code, the transect classification system entails not only the gradient of urban-to-rural land uses, but also the defining characteristics (e.g., architectural, setback, and thoroughfare standards) associated with each type of immersive environment. Further, standards change not only by scale but according to different bulks and densities. As densities increase from rural to urban, there are sets of design principles that apply at each increment (i.e., for each ecozone). An example is shown in Figure 2 where the elements of a streetscape (e.g., curbs, sidewalks, and planters) are shown to vary depending on their location along the transect. A road in a rural part of the transect is characterized by having open swales and no separate pedestrian path. Moving in the direction of increasing urbanism, roads may acquire a walking path along one side, followed by raised curbs and narrow sidewalks, and finally, in the most urban part of the transect, raised curbs and wide sidewalks.

Some types of uses are justified in not fitting neatly into a transect ecozone and therefore must be treated separately. First, it is necessary to include a category (or "district") for land uses that are either exceedingly large, noxious, or for some other good reason do not fit automatically into an ecozone. Airports and landfills are in this category, since they must be located according to local budgets and constraints, not necessarily according to where they fall along an urban-to-rural gradient. Second, certain civic uses, such as hospitals, museums, and religious institutions require special treatment. The all-important civic realm must be allowed some freedom from code restraint, both architecturally and locationally. Permitting flexibility in design and location allows the possibility of placing an educational complex in a rural ecozone or a cemetery next to its urban chapel.

The process of ecozone delineation begins, as in many other planning approaches, with the identification of areas that can and cannot (or should not) be subjected to urban expansion. This process is inspired by the work of Ian McHarg (1969), who promoted the importance of establishing some basic development parameters (based on natural ecosystem capacity) as the essential foundation of planning. When areas open to development have been identified and differentiated from areas to be protected (the Rural Preserve and Rural Reserve zones), urban change should proceed according to the spatial delineation of transect ecozones.

While there are generalities in the transect in terms of the relationship between urban elements and environmental performance, there are also regional differences that must be accounted for. As mentioned earlier, the process of delineating the boundaries of transect ecozones rests on an understanding of the indigenous urban-to-rural transect. Thus there are two sources that must be reconciled: generalizable principles of good urban form and the "regional vernacular." Because of this merger, there is no *one* transect—there are in fact many transects, each specific to local building traditions and a variety of other locally derived nuances of urban form. It is the transect as *method* that is universal, the process of urbanizing in such a way that form and function are appropriate to context, that is, sensitive to their transect position.

With the transect classification system in place, metropolitan areas can begin, over time, to organize in a way that strengthens a well conceived urban-to-rural gradient. Most importantly, the transect system of classifica-



Source: Duany Plater-Zyberk & Company

FIGURE 2. Streetscapes by transect zone.

tion should extend the human habitat in such a way that existing urban centers become more diverse while existing rural areas are not permitted to be randomly urbanized. Application of the transect means that more urban areas should fill in with urban development that makes sense in urban contexts—higher density housing in an Urban Core ecozone, for example. At the other end of the continuum, rural areas that are not protected or reserved should develop only in ways that strengthen their rural qualities—not, for example, by placing large buildings and shopping centers in areas that should retain an essentially rural character.

This sorting out process means that the greening of cities, just like the development of rural areas, must conform to explicit criteria. Neither environment should be compromised. The well intentioned but sometimes misplaced greening of urban areas as an approach to environmental responsibility may in some cases undermine pedestrian activity (for example, by adding berms at the base of high-rises).

Of course, within these general guidelines, adapted to the regional vernacular, some flexibility is necessary to accommodate change as well as range of preference. In short, if urban growth is to follow the rules of natural systems, the codes must allow for adaptability. The importance of being pliable is one of the conditions of urbanism that has long been recognized by urban theorists (see especially Jacobs, 1961; Lynch, 1981). This requires pragmatism—the transect must accommodate a full range of urban elements, and it must also be open to continual local adjustment. This strategy will help prevent the transect code from becoming an anachronistic system of rules in the same way that our current codes have. It must be responsive to place as well as time, striking a balance between timeless principles and changing urban conditions.

Traditional Neighborhood Development Principles

Woven into each of the transect categories is the language of traditional neighborhood development (TND), a set of normative principles that speaks to the human need for diversity, connectivity, and access. The principles of a successfully designed neighborhood have been reiterated many times, most recently in texts such as *Suburban Nation* (Duany et al., 2000) and the *Charter of the New Urbanism* (Congress for the New Urbanism, 2000), and based in part on the principles laid out by Clarence

Perry (1929). These elements are considered by many to be the building blocks of a successful and sustainable urban pattern. The neighborhood pattern has a strong historical presence as well, persisting as the basis of such cities as Manhattan (Jacobs, 1961), Florence, and Venice (Bacon, 1992). Krier's (1984) notion of urban quarters is a similar recognition of the need to organize the city in terms of the human (rather than the automotive) perception of space and scale.

The difference between TND and conventional suburban development goes well beyond stylistic notions. TND involves the mixture of land uses, the importance of public space, and an emphasis on pedestrian access. The essential principles of TND have been used as a basis for human settlement proposals, for example, Hamlets (Arendt, 1999), Villages (Krier, 1984), and transit-oriented developments (TODs; Calthorpe, 1993). The transect code integrates with these ideals. Using TND principles that reflect an appropriate mixture and intensity of land use, each immersive environment of the transect is able to satisfy a different set of human needs and conditions. The creation of immersive environments requires not only finding an appropriate spatial context for development in its various manifestations, but also that the interdependencies of a large variety of urban elements be taken into account. TND principles provide a conceptual framework for organizing these elements within and among transect categories.

This framework relates to the fact that, although the transect ecozones are spatially distinct, there are different ways they can be fit together. For greenfield sites, it is possible to encode a complete neighborhood (the General Urban ecozone). But other ecozones could also be accommodated, creating a modular and hierarchical pattern in which different combinations of ecozones yield different combinations of immersive urban environments. The relationships are expressed in terms of ratios, as shown in Table 2. For example, a Hamlet, similar to that prescribed by Randall Arendt's (1994) cluster development, is created when different percentages of four ecozones are assembled. A different set of ratios combine to create a Village (Krier, 1984). Adding an Urban Core ecozone creates a Town Center, similar to Peter Calthorpe's (1993) TOD. Conceptually, even Lynch's (1991) polycentric net and Howard's (1898) satellite city can be approximated using different combinations of ecozones in different ratios. Importantly, all of these modules and spatial schemes can be assembled using a single set of transect zones.

Some examples from the transect-based SmartCode illustrate how these different types of environments are incorporated. The basic approach, unique in current regulatory practice, is that transect-based environments are coded at different scales. Zoning ordinances are usually organized as a series of rules for discrete zoning categories that do not interrelate. In the SmartCode, rules are prescribed for different types of Communities, relevant to different scales. These Communities, regulated by the Community Plan, provide a structure for the transect zones.

Table 3 presents the basic structure. Three different scales are used and are shown along the top horizontal axis:

- Sector Plans, which are regional in nature;
- Community Plans, which represent an intermediate scale and are used as a framework for the transect zones; and
- Site Plans, which focus on specific standards for the smallest scale of development.

The entire system is organized according to transect principles, varying in urban intensity from the rural to the urban along the vertical axis.

Note that the SmartCode integrates procedures for the preparation of plans directly into the code and uses these procedures as its main organizing structure. These are not plans in the sense of long-range, comprehensive plans that are often vaguely defined and difficult to translate into code. The plans that make up the SmartCode are specific guiding principles of good urban form that are used to provide a framework for the transect zones.

Sector Plans operate at the largest geographic scale, the region. An example from Sarasota, Florida, is shown in Figure 3. The main focus of a Sector Plan is to achieve an ecologically sound framework composed of environmentally protected resources, throughout which different types of communities are interspersed. At this level, Rural and Urban Tiers are specified. These are defined simply as areas that, at least initially, have an approximate geographic boundary.

At the scale of Community Plan, the SmartCode demonstrates its ability to implement more than one development type using a single set of transect zones. Different types of development are appropriate to the Urban Tiers identified at the higher geographic scale of the Sector Plan. Within the two types of Urban Tiers (Greenfield and Infill) different types of Communities, covering a full range of development types, are accommodated. For Greenfield Tiers, such communities consist of Hamlets, Villages, and Town Centers. An example of a Community Plan employing the full spectrum of transect zones is shown in Figure 4. (For Infill Tiers, appropriate Communities are composed of Neighborhoods and Downtowns.)

The Site Plan operates at the smallest geographic scale. The Site Plan prescribes lot and building require-

TABLE 2. Allocation of density and zones by settlement type.

Ecozone	T1	T2	T3	T4	T5	T6	D
Density allocation							
			Average units per acre				
Maximum density	By variance	By variance	6	12	24	92	By variance
Allocation of zones							
Hamlet	No min.	50% min.	20–30%	30–50%	0–10%	prohibited	20% max.
Village	No min.		10–30%	30–50%	10–30%	prohibited	20% max.
Town Center	No min.			10–30%	10–30%	40–80%	20% max.

Source: Duany Plater-Zyberk & Company

TABLE 3. Tiers, communities, and transect zones in different types of plans.

Sector Plans		Community Plans		Site Plans
Tiers		Communities	Transect zones	Lots & buildings
RURAL				Building disposition
RP	Rural Preserve		T1 Rural Preserve	Building configuration
RR	Rural Reserve		T2 Rural Reserve	Building function
URBAN				Parking standards
Infill				Architectural standards
UIT	Urban Infill Tiers	Neighborhood	T3 Sub-Urban	Landscape standards
			T4 General Urban	Signage standards
			T5 Urban Center	
		Downtown	T4 General Urban	
			T5 Urban Center	
			T6 Urban Core	
Greenfield				
CLD	Conservation Land Development	Hamlet	T1 Rural Preserve	
			T3 Sub-Urban	
			T4 General Urban	
TND	Traditional Neighborhood Development	Village	T3 Sub-Urban	
			T4 General Urban	
			T5 Urban Center	
TOD	Transit Oriented Development	Town Center	T4 General Urban	
			T5 Urban Center	
			T6 Urban Core	
Other				
DA	District by Assignment		DA District by Assignment	
			VW Warranted Variance	
			VE Exceptional Variance	

Source: Duany Plater-Zyberk & Company

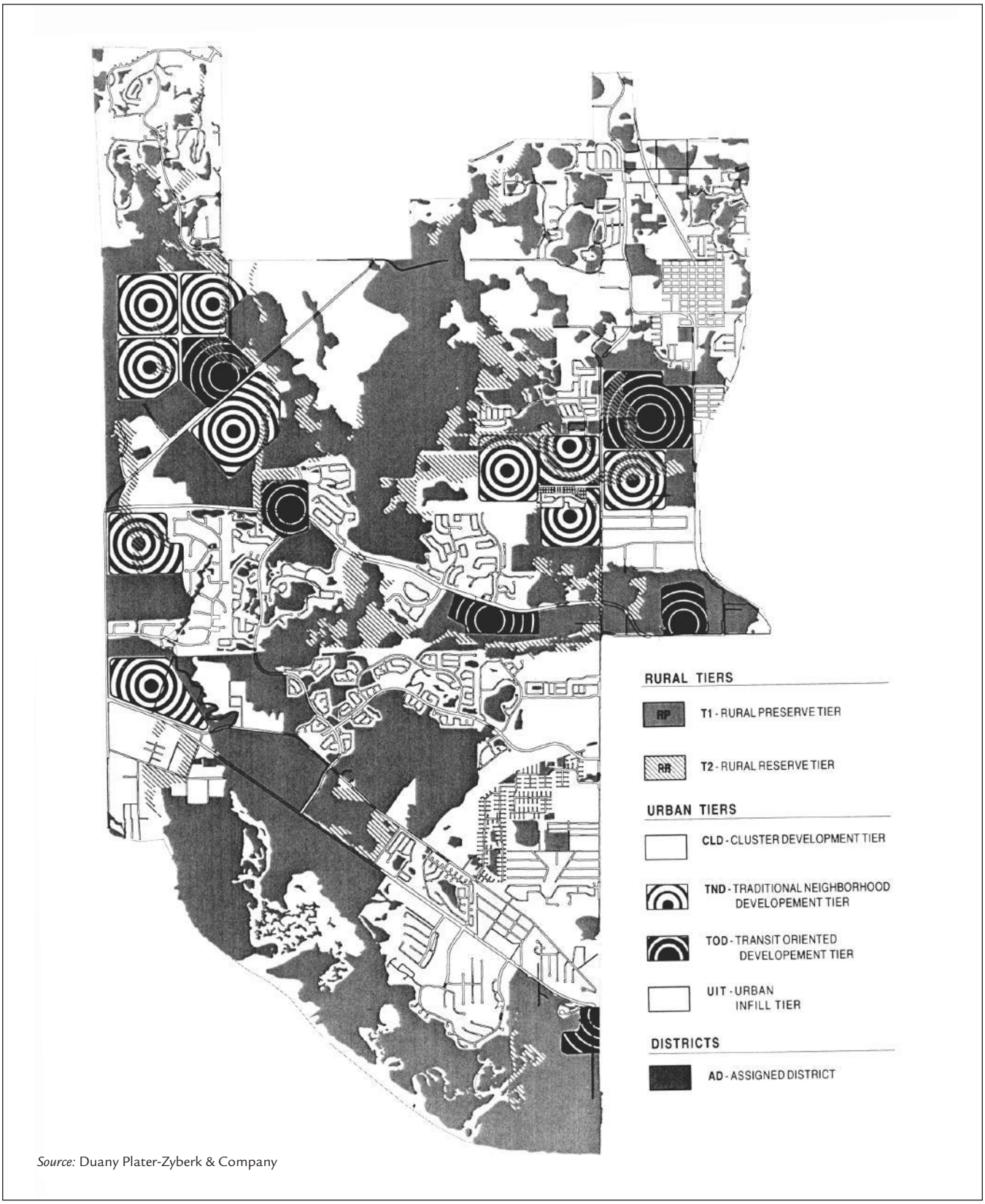
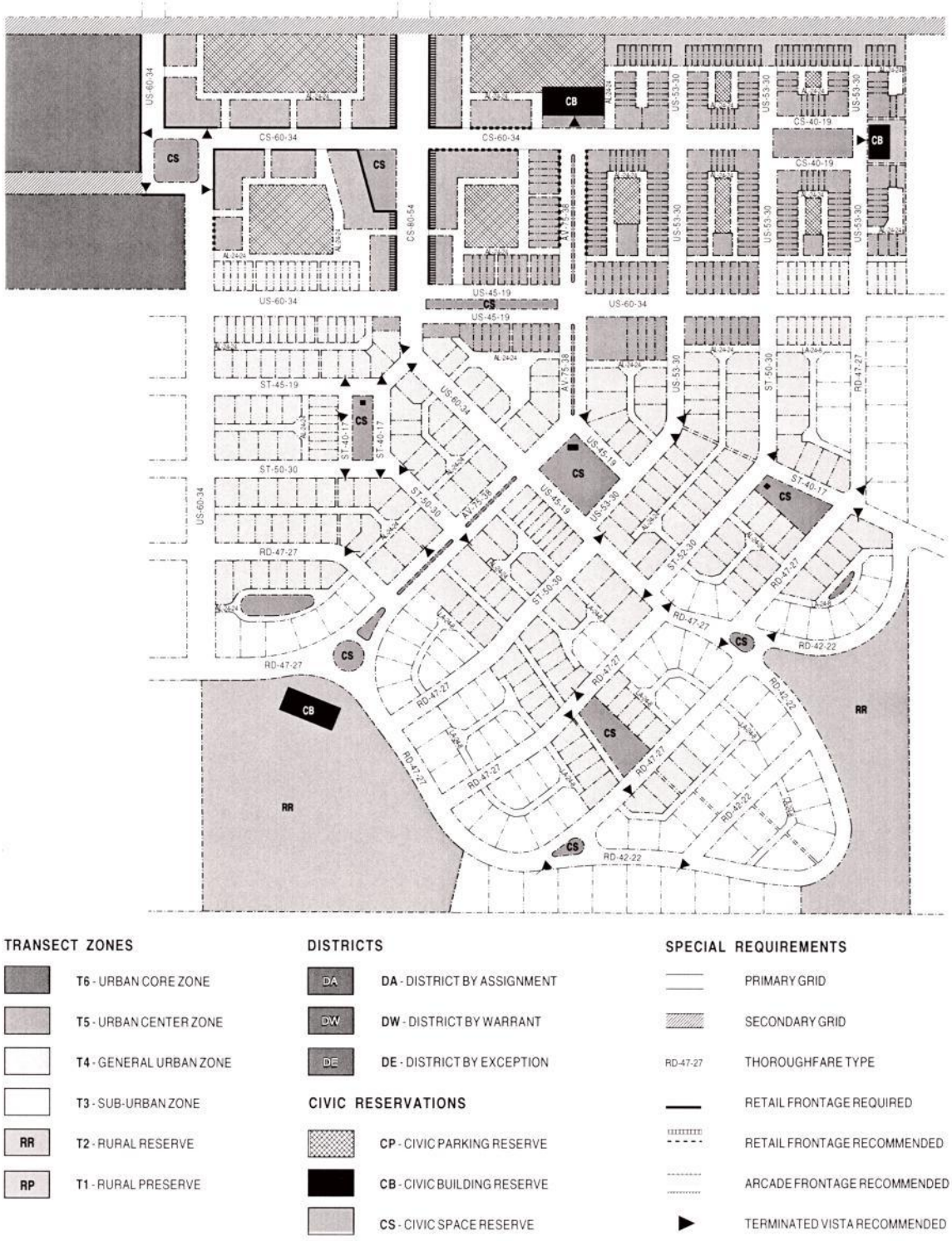


FIGURE 3. Sample Sector Plan.



Source: Duany Plater-Zyberk & Company

FIGURE 4. Sample Greenfield Community Plan.

ments, which vary for each type of transect zone. In conventional zoning, zones such as Single-Family Residential, Multiple-Family Residential, or Commercial are specified, and the associated requirements for use, height and bulk, setback, lot size, and parking are listed for each in segregated fashion. The SmartCode is made up not only of a different set of zones—ones that vary by level of urban intensity, not by use—but also a different set of standards for each type of zone. An example of how these standards vary by zone was shown in Figure 2.

It is possible to juxtapose one transect zone with another in many different ways. Figure 5 gives an example from an Infill Community Plan for Sarasota, Florida. To some extent, successful placement of each immersive environment is the essence of our most vibrant, best-loved cities. The adjacencies may be in radical juxtaposition, as in the case of Central Park in New York City (where an Urban Core zone abuts a Rural Reserve zone), or they may be interwoven in a more complex, mosaic arrangement in which the edges of one zone are imperceptible from another. To achieve a successful integration of environments (ecozones) at their boundaries, the transect must be coded in terms of parameters. This is theoretically appealing since it mirrors the fact that in nature there are no exact boundaries that differentiate one ecozone from another.

Compliance with the Transect

Transect planning offers a different approach to the usual separation of plan and code by incorporating planning goals directly into the devices of implementation. Rather than "forcing" zoning and subdivision regulations to conform to well conceived plans (a largely unsuccessful endeavor; see Meck, 1999), the plan and code are conceived as being inseparable from the outset. This is one way to imbue a community's aspirations with legal enforceability.

This shift in the usual sequence of planning events will succeed only if the transect code remains optional, at least in the short term. Two phenomena underscore the need for this kind of strategy. First, transect planning does not breed well with conventional coding borne under a diametrically opposed set of principles. Transect codes and conventional codes are not reconcilable. A merger, in fact, would have the unfortunate but likely effect of watering down the fundamental spatial objectives of the transect, resulting in the continuation of existing urban patterns. As a practical matter, this kind of operational effectiveness can be achieved only if the transect is implemented as an optional regulatory system.

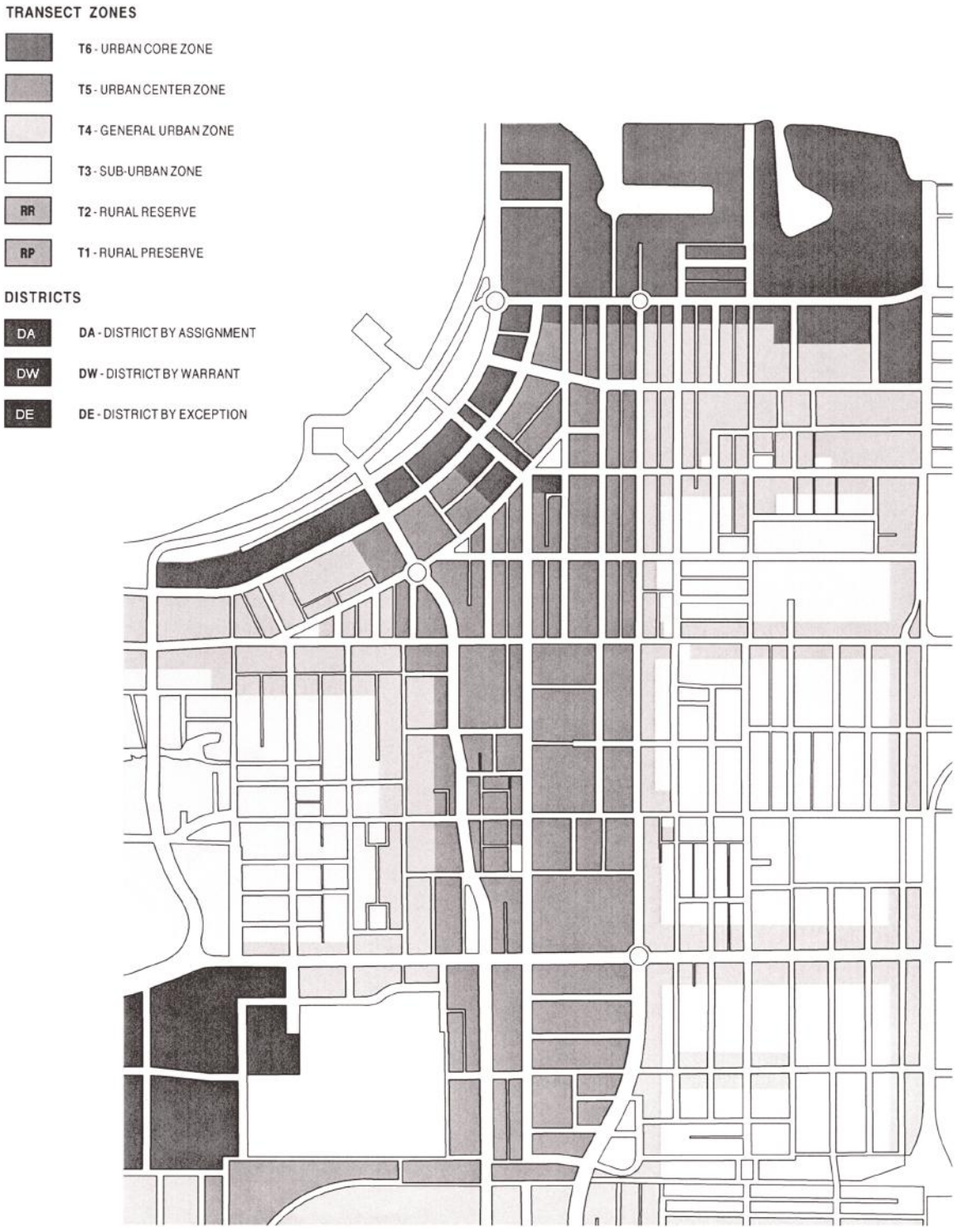
The second phenomenon is the political reality that achieving any substantial transformation of existing codes is highly unlikely. Codes are entrenched in the existing bureaucratic system, and changes to them are viewed with deep anxiety and active resistance. To be politically viable, then, an innovative code should be cast as an extension of consumer choice. States that have recently adopted SmartCode legislation (Wisconsin and Maryland) have adopted this approach. The strategy is rooted in the firm belief that innovative codes, especially if instilled with some kind of incentive program (such as fast-track permitting), would easily become the codes of choice.

Of course, it would be highly advantageous if an incentive structure were part of the transect planning system, whereby adherence to the transect code would be vested and adherence to a conventional code would require a variance. By making the "good" easy and the "bad" difficult (to paraphrase Le Corbusier from another context; see Serenyi, 1975), developments that do not conform to these principles would have the burden of proof; they would need to be justified through the successful procurement of a variance or some other form of conditional approval. In this way, there would be a strong incentive to develop in the direction of the transect model since it would represent the path of least resistance. This would reverse the status quo in which anyone who wishes to construct a traditional neighborhood development is required to obtain a variance to do so.

Conclusion

Transect planning is a normative prescription that is linked to the ecological and regional streams of planning thought. At the same time, it operates at the most basic regulatory level. Like it or not, the American system of planning elevates the importance of numbers, codes, and other quantifiables. Such systems are technocratic and rigid, but the simplicity with which they are applied produces an administrative supremacy that cannot be denied. Above all, such systems are defensible in a culture dominated by legalism.

Where urban growth takes place on previously undeveloped sites, transect-based codes should follow the historical precedent of our best urban patterns, which can be defined here as human habitats that do not inappropriately intermix urban elements from different transect ecozones. But planners must also work with the existing urban fabric to strengthen the distinctions that the transect embodies. In either case, planners must seek ways to rectify the problem of spatial misappropriation: density in rural landscapes without the compensation of street life, marsh grasses on main streets, and deep setbacks in urban centers. They must seek integrity in all types of natural and built environments along the rural-to-urban transect.



Source: Duany Plater-Zyberk & Company

FIGURE 5. Sample Infill Community Plan.

We can readily describe the theoretical basis of the transect and even the steps required to translate these ideals into a regulatory framework. But what must be required from the planning profession as a whole in order to encourage planners to champion this new approach? While the transect idea may appear elegant on paper, how can the required inertia from the swelling ranks of local practicing planners be channeled in a direction that works to effect change?

Obviously there has to be political will from outside the planning profession, and there is strong evidence that this is already in place (American Lives, 1995; New Jersey Future, 2000). But more relevant to the discussion here is the need for a substantial change within planning practice itself. Widespread adoption of transect planning will not necessarily require an overhaul of the current planning ethos, but rather widespread energy directed at a new instillation of the "genetic material" of the profession—its codes, ordinances, and quantifiable rules. This material is largely controlled by planners themselves, and while this gives reason to be optimistic that planners will be able to effect this transformation, they will have to instigate change with a kind of enthusiasm that is not always evident.

Even though transect planning is based on ecological principles, planners may be uncomfortable with the normative aspects of the transect idea. However, the transect, like any normative ideal in planning, is a proposal that must be able to stand up to local scrutiny. One reason that it may withstand and even thrive under public scrutiny is that it seeks to offer a range of immersive environments. Human preferences for living environments vary in response to different stages in the life cycle (see especially Brower, 2000), yet the ability of our current patterns of urban growth to accommodate these changes is sorely lacking. In contrast, the transect's ability to accommodate a variety of preferences and lifestyles is intrinsic to the system.

It will be critically important, too, to enlist the support of environmental groups. Transect planning could boost the growing coalition between urbanists and environmentalists by facilitating the assessment of urbanism from an environmental point of view. Rather than simply gauging whether urban development is taking place inside or outside an urban growth boundary, for example, transect planning could assist environmentalists in evaluating development patterns in terms of ecological principles. Urban ecologists are in fact working to build predictive models of urban expansion that incorporate the human dimension, taking into account cultural factors, institutional constraints, and sociodemographic variables, for example. The goal of transect planning is to ensure that the impact of the human dimension is based not only on these factors but also on sound planning principles that emulate our best urban models. Rather than looking to the human dimension for variables that explain urban-to-rural expansion as an invasive act of human aggression, transect planning could eventually produce a seamless, nonhostile integration between natural and human ecologies.

NOTES

1. The transect zone system has been coded by the firm of Duany Plater-Zyberk & Company (DPZ) and this code is copyrighted as the SmartCode. It is a commercial product marketed by DPZ. Information is available at <http://www.smartcode.org>.
2. Sustainability, of course, involves strategies that extend beyond the design of cities. Beatley and Manning (1997), for example, call for modifying the way cities do business, particularly how they procure and provide services.
3. Transect methods similar to those described in this section were used as the basis of a course taught in the Yale School of Architecture during the spring of 2001 by Andrés Duany and Leon Krier. Information is available at <http://www.charrettecenter.com>.
4. The SmartCode has been implemented in several places in the U.S., such as Belmont, North Carolina, and Hillsborough County, Florida. We keep the discussion here generic in order to relate a broader perspective of the main elements. Information on these particular codes is available at <http://www.ci.belmont.nc.us/tnd.htm> and <http://www.hillsboroughcounty.org/pgm/home.html>.

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