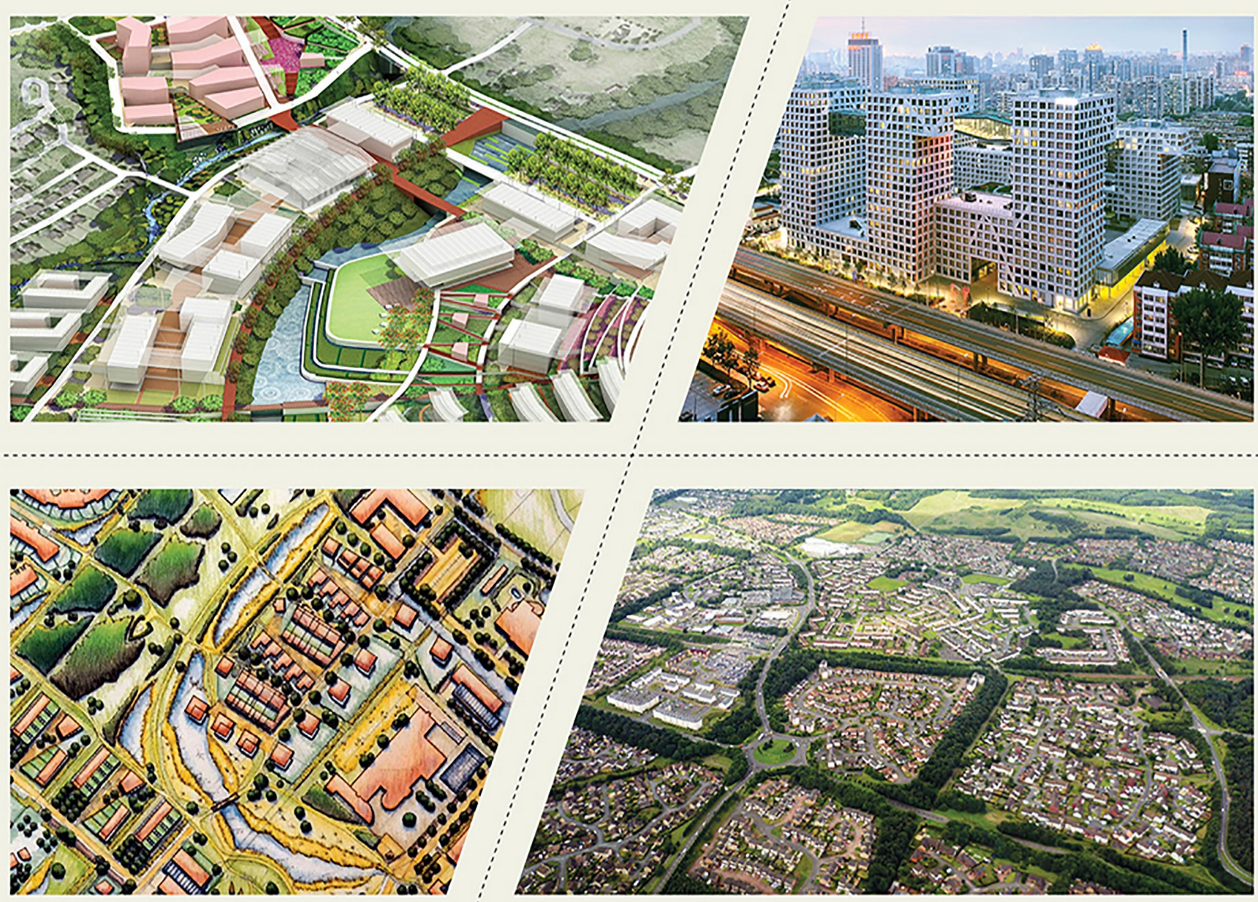
Site Planning

International Practice



Gary Hack

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Preface

This international edition of *Site Planning* continues a long tradition of compiling and distilling the experiences of designing settlements on the land, as a guide for students and practitioners of the art of site planning. It emphasizes the importance of sustainability, cultural attitudes, and emerging technologies that can overcome the sameness that afflicts so much development today. Sites, and the way we inhabit them, support the sense of localism that we must not lose.

In his preface to *City Planning, with Special Reference to the Planning of Streets and Lots*, the first American textbook on site planning, Charles Mulford Robinson wrote:

> A book of this kind, whatever its other deficiencies, must not be one of fine-spun theory. It must be practical, if it is to be serviceable. It must depend for value upon what it can draw from the experience of many cities and many nations, and from the thoughts of many practitioners. It must represent the slow fruition of years devoted, not to introspective study, but to research in places and books and records—and among the men who are doing the actual work of city building. (Robinson 1916)

Robinson, the first professor of civic design at an American university, drew together knowledge gained from almost half a century of progress and experimentation, from Olmsted's remarkable plan for the village of Riverside, Illinois (1859) to the prosaic suburban subdivisions that were proliferating on the fringes of every Midwest city. Much of the knowledge of land planning then, as today, resided with individual consultants; the Olmsted firm alone planned over 50 residential developments across the US. *City Planning*, together with Robinson's earlier tract *The Width and Arrangement of Streets* (1911), conveyed best practices and served as manuals for planning new streets, lots, parks, and centers. They also became textbooks for educating the growing number of professionals in

city planning, landscape architecture, architecture, and civil engineering.

Other books from Europe also became widely used in the US in the early decades of the twentieth century, especially Raymond Unwin's *Town Planning in Practice: An Introduction to the Design of Cities and Suburbs* (1909), rooted in the garden city experience. And texts for site planning continued to evolve after Robinson's pioneering volumes, each updating the state of the art. F. Longstreth Thompson's *Site Planning in Practice* (1923), which includes a preface by Unwin, drew together the salient issues in the planning of housing estates. It was the first book to use the term site planning in its title, and covered topographic issues, street types and dimensions, the form and aesthetics of housing areas, and infrastructure for sites.

Thomas Adams, also a veteran of the garden city movement, covered some of the same territory in his book *The Design of Residential Areas* (1934), adding Canadian and US examples, including his work in the reconstruction of Halifax, Nova Scotia after the great explosion of 1917. Adams designed the new planning curriculum at MIT, and during the 1930s site planning became a required course in most architecture and planning programs in US universities. Robinson's and Adams's books were the favored textbooks. In 1939, the US government also got into the act with the highly influential guidebook *Design of Low-Rent Housing Projects: Planning the Site*, issued by the United States Housing Authority.

Kevin Lynch began teaching site planning shortly after he arrived at MIT as a junior faculty member in 1949, sharing notes and ideas with Hideo Sasaki who taught a similar course at Harvard, and inheriting materials assembled over the years by Draveaux Bender on planning site infrastructure. Gradually the subject evolved to reflect Lynch's special passion for the value of landscape and his lifelong interest in how people sense and experience places. His first edition of *Site Planning* was published by the MIT Press in 1962, reflecting these sensibilities while not shying away from the analytics, rules of thumb, and technical detail required to create a practical site plan. A second edition followed in 1972,

and I had the pleasure of joining him in preparing a third edition, published in 1984. In it we sought to expand the scope of site planners' knowledge beyond the physical aspects of sites to include issues of economics, logistics of site construction, and public engagement in the planning of sites. The contents of the book were largely drawn from the North American experience. Nonetheless the book was translated into several languages, and to my dismay continues to be widely used in other societies without accounting for cultural differences. I hope to compensate for that in this international edition.

Much has changed since the publication of the last edition of *Site Planning*. Issues of sustainability have become critical, reflecting the existential threat of climate change. We are learning how to predict and minimize the environmental effects of site development. Lessening the draw on unrenewable resources, including energy, materials, and water, has become an imperative in both building and maintaining sites. Infrastructure technologies have improved dramatically, loosening the dependence on large public systems. We know much more today about how people use and value public spaces, and the cultural differences that shape activities in common spaces. Public engagement has become a norm in decisions about site development, and predictions about site impacts are important in the debates about what should be permitted. The emergence of hyperdensity in many cities across the globe, and the growing preference for mixing work, living, shopping, and recreation, demand new ways of thinking about site development. Currently some of the most innovative site planning and development projects may be found in Asia and the Southern Hemisphere, where growth rates outdistance those in older cities of the West. And, of course, planners work quite differently today: using digital tools, drawing resources from the Internet, collaborating electronically, and moving seamlessly from site data to concepts to detailed plans for sites. Many of the tasks done by hand three decades ago have been reduced to apps that reveal results in an instant.

The format of this book is a response to the fast-changing nature of the

practice of site planning. Each of its 40 chapters covers a discrete subject, organized in five broad areas: values and visions that guide site planning, site analysis techniques, site planning processes, site infrastructure, and prototypes of site development. This modular format will allow new information and examples to be added to the electronic version of the book, and to reissues of the print edition. Much as automobile models are improved through continuous change, my intent is to initiate an ever-evolving volume on site planning.

I am deeply indebted to many people who have contributed to the knowledge reflected in this new edition. Kevin Lynch taught me about the field of site planning and how to teach it, and his passion for discovering the meaning and potentials of sites and places continues to be a guiding light. Much of what I know about innovative development I learned from another mentor, William Teron, while working with the Canadian government's housing and urban development agencies. My professional partners, Stephen Carr and James Sandell, were wonderful collaborators on projects that sought to improve the public realm, and many of the results are included here. Over the years, my co-teachers of site planning, case studies, and design for development courses at MIT and Penn, including Rick Lamb, Steve Ervin, Dennis Frenchman, Jinai Kim, Martha Lampkin-Welborne, Walter Rask, Tom Campanella, Greg Havens, Tsing-Wei Chung, Peter Brown, Khaled Tarabieh, Zhongjie Lin, Melissa Saunders, Paul Kelterborn, Sisi Liang, and others before them, brought new insights to the subject. The Penn site planning class of 2010 compiled a fine catalog of sustainable infrastructure technologies and techniques for employing them that helped launch the site infrastructure section of this volume.

As with each of its predecessors, the book would not have been possible without the generous contri-butions of the professionals whose work is cited and illustrated in it. Dennis Pieprz's inspiring work at Sasaki Associates has had an outsized influence on the book, as is evident from the number of the firm's projects I have included. His colleagues Fred Merrill and Mary Anne Ocampo also helped immeasurably. Joe Geller of

Stantec, L. Bradford Perkins of Perkins Eastman, and others in their firms helped me understand the NewBridge case and provided illustrations. Ellen Lou of Skidmore, Owings and Merrill, Tsing-wei Chung, and Albert Chan Kain Bon and Michael Hsiung Shu Pon of Shui On Development were invaluable in compiling information on the Taipingqiao development. Literally hundreds of professionals in firms breaking new ground allowed me to publish illustrations of their work. I was not turned down by a single professional firm or development organization from which I requested information. And professional photographers extended the courtesy of allowing me to use their images, many without a fee. Adam Tecza's creative work in preparing the illustrations helps set the tone for the book and explains concepts far better than words alone.

Several chapters benefited from the close reading and suggestions of individuals more knowledgeable about their subject than I could ever hope to be. Martin Gold helped me understand land regimes internationally, as did John Keene. Susan Fine greatly aided my appreciation for land regulations. Chuck Lounsberry and Joe Geller of Stantec helped expand my knowledge of the use of digital media in today's practice, and provided many of the images that I have included. Barbara Faga, then of EDAW, introduced me to their working methods and influenced what I have written. Donna Walcavage of Stantec helped me think about how to distill the subject of landscape planning and focus it on site decisions. Steve Tiesdell and David Adams gave Lynne Sagalyn and me the opportunity to explore the relationship between urban design regulations and the value of sites in the chapter we published in their book *Urban Design and the Real Estate Development Process* (2011), and this work is reflected in chapter 17.

Roger Conover has been been the editor in charge and steward of all four editions of Site Planning, and along with Victoria Hindley, oversaw the talented team at the MIT Press that made this book a reality. Matthew Abbate, my editor, was invaluable in clarifying ideas, and skillfully managed the process of organizing the materials. Mary Reilly took charge

of the illustrations. Emily Gutheinz, the designer, found a way to assemble it all creatively on the pages of the book. I thank all of them, and others too numerous to mention, for helping publish this volume.

Books such as this reflect the accumulation of understandings gained through years of visiting sites, often speaking with site designers and listening to their descriptions of how they were inspired to create places of lasting value. My family has tolerated regular diversions of trips to see this or that project, for which I thank them. Lynne Sagalyn, my wife and intellectual partner, has shared much of the journey, tutoring me on the hidden hand of economics that has shaped what I am looking at, while patiently tolerating my discourses on aesthetics and materials. She provided the encouragement that brought this book to fruition. I thank them all for their support.

Great Wass Island, June 2017

Part 5 | Site Prototypes

Very few site plans are created totally de novo. Site planners will look to precedents to see how others have addressed the issues they are facing, accounting of course for obvious differences of site form, culture, and built context. The point of departure will be the program type: is the site intended for housing, or capable of supporting mixed uses, or large enough to create a complete community? By looking for exemplars, the planner will assemble much useful knowledge about laying out the site, and a set of benchmarks against which her plan can be judged.

Over time, successful examples of types of site development emerge that become *prototypes*—models that are widely emulated and reveal fundamental ways of organizing a site. They usually cannot (and should not) be copied directly, but adapted to the current circumstance. The new *type* then improves upon the prototype and moves the field forward. Many designers and planners fear a lack of originality in consulting prototypes, but originality is only one of many virtues in site planning. It is essential in unprecedented situations—with a site that is totally unique or a program that has never been tried before. But much wisdom is captured in successful prototypes, and in most situations steady and consistent innovation is what is required.

There are dozens of books and a steady diet of print and electronic articles on the major types of urban development—housing, shopping areas, workplaces, public spaces, recreation areas, mixed-use and community developments. This part of the book focuses on identifying the major issues for each type, and offers examples from which one can begin an investigation of precedents. Fortunately, the Internet now allows access to information and images of most important projects throughout the world. Less obvious is how the projects have performed economically or in human terms—the field is rife with rumors about much-publicized projects that have failed or are unlivable. Some professional associations and awards programs serve a screening function: the ULI awards program and case studies program investigates financial performance before selecting a project, the Rudy Bruner Award program conducts field investigations of

the finalists, the Landscape Architecture Foundation’s case studies program looks at performance of sites in detail, and a number of universities and research institutes conduct post-occupancy studies that reveal the accomplishments and flaws of projects. Communication with the sponsors of projects is also a useful way to learn about their successes and failures.

The following chapters offer a summary of what has been learned about site development prototypes.

33 | Housing

Housing occupies over two-thirds of the developed land in most urban areas, and designing housing areas is the most frequent challenge faced by site planners. Housing areas change much more slowly than commercial or industrial zones of cities, because residents and living patterns tend to persist far longer than businesses. Hence, the design of housing sites requires a long view, with careful attention to culture, lifestyles, demographics, and values.

The *dwelling unit* is the fundamental component of residential site planning. Usually defined as space occupied by a single household, with a separate entrance and cooking facilities, it may shelter a wide range of family and nonfamily groups. In some parts of the world, extended families are the norm. In the US housing is usually designed for nuclear families with two parents and children, but over three-quarters of housing units today are occupied by single individuals, single parents with children, unrelated groups of singles, multigenerational households, or other unconventional groups. Over the life of a housing unit, it may have many types of occupants, so it is important to design for the generality of needs, within a social context.

Housing Types and Densities

In the most general sense, housing may be divided into four categories:

Detached housing: each dwelling unit is a freestanding structure on its own site. Detached housing can range from the country home on many hectares of land to small-lot housing in the city to zero lot line houses to temporary mobile homes.

Attached housing: each unit has a separate outdoor entrance and often private outdoor space, but units are joined side by side or one above another. Duplexes, semidetached units, row or townhouses, maisonettes, and stacked townhouses are the common forms.

Apartments or flats: several dwelling units share a common access and are enclosed by a common structural envelope. Depending upon the traditions and climate, the access ways may be indoors or outdoors. Apartments can be walk-up buildings, where stairs serve upper floors, or elevator buildings. A unit may be on one floor (flats) or have internal stairways to serve two or more levels. Apartments take a variety of shapes including linear slabs, towers, and units arranged around courtyards.

Mixed housing forms: two or more forms are combined, or housing is mixed with other uses. A detached house may have a granny suite or accessory apartment with a separate entrance; a tall apartment structure may devote the lower floors to self-contained units with private yards and entrances from the street; housing may be located over ground-floor shops, or may be mixed with offices or work spaces in a single structure as in live-work housing.

Each housing type can be built at a range of densities. A skilled designer can often move densities up beyond the norm, and it is always possible to develop fewer units on a site than its capacity suggests. On steeply sloping sites or places with vegetation that must be preserved, one may not be able to achieve typical densities. The ultimate density of a housing site depends on three critical decisions: how to store the automobile (and how many

must be stored); the amount of private and common open space to be provided; and regulations or norms about privacy distances.

33.1 Single-family detached houses with garages in rear, Prairie Crossing, Grayslake, Illinois. (Gary Hack)

33.2 Townhouses near town center, Celebration, Florida.
(Gary Hack)

33.3 The Interlace housing complex, Singapore.
(Courtesy of Iwan Baan)

33.4 Mixed-use, live-work housing, University Avenue, Shanghai Knowledge and Innovation Community, Shanghai, China.
(Gary Hack)

Economics also plays an important role in determining densities. In places with efficient land markets, land values will be set by the perception of the density that can be achieved, or by the densities permitted by local zoning or regulations. Once a site becomes priced based on such an assumption, it will be difficult to justify fewer units. However, a small number of high-priced units may be possible, each absorbing a greater per unit cost for land.

In considering what is possible, a distinction needs to be made between *gross residential density* and *net residential density*. The gross density is calculated by simply dividing the area of the site by the number of housing units located on it. The figure is useful in making a first-cut calculation of the capacity of a site, but difficult to use for comparisons since the figure will depend on the amount of space set aside for roadways, open spaces, and other uses—this could be as much as 25–40%. Net residential density is more useful for comparisons, reflecting the actual area of the site used for housing divided by the number of units. A skilled site planner will know the density ranges for typical housing types.

Table 33.1 | Typical densities by housing type

Housing type	FAR	Units per ha (per ac)	
		Net density	Gross density
Single-family detached	Up to 0.2	Up to 20 (up to 8)	Up to 12 (up to 5)
Zero lot line detached	0.5	20–25 (8–10)	15 (6)
Semidetached	0.4	20–25 (8–10)	15 (6)
Duplex	0.5	25–30 (10–12)	18 (7)
Row house	0.5	40–60 (16–24)	30 (12)
Stacked townhouses	0.8	60–100 (25–40)	45 (18)

3-story walkup apartments	1.0	100–115 (40–45)	50 (20)
6-story elevator apartments*	1.4	160–190 (65–75)	75 (30)
12-story elevator apartments*	1.8	215–240 (85–95)	100 (40)
25-story elevator apartments*	2.2	280–320 (120–140)	140 (55)
40-story elevator apartments*	5.0	550–650 (220–260)	275 (110)

* In most situations, parking must be in structures.

Planning Principles

Living on a courtyard along a Paris boulevard is quite unlike life in a car-dependent American suburb, but both sets of residents share needs for light and air, a degree of privacy, nearby shopping, entertainment, and education, and, above all, human contact. Such generalities can only go so far, however, and need to be seen through the lens of cultural norms about the meaning of home, lifestyle, resources, tenure, and progression through the cycle of life.

In countries such as the US, Canada, and Australia, where home ownership rates hover between 60% and 70%, there is a greater demand for private space and for personalizing housing than in societies where rental housing is the norm. In Europe and North America, renters may satisfy their desires for personalization through weekend cottages or allotment gardens, or through elaborately decorated interiors of their apartments. The most prestigious housing in most American cities may be

found in exclusive suburbs, while in most European cities it will be in the tony neighborhoods near the center. Brazilian gated enclaves provide the security sought by residents, while in Japanese or Chinese neighborhoods, and an increasing number of American cities, “eyes on the street” serve the same purpose (Newman 1972; Jacobs 1992).

These examples illustrate that, while human needs are similar, the role of housing in satisfying them varies widely. Humans are adaptable and can learn to live in a range of housing situations. They will quite likely seek different forms of housing as they move through the stages of life, from independent singles, to coupling or marriage, to childrearing, to child-free years. Some will remain single all their lives and live alone or with relatives or friends. Others may choose congregate housing arrangements. Individuals may prefer the contact and easy access to facilities and services that come with high-density living, or may regard their housing as a respite from too much human contact on busy streets or in the workplace. Thus, even within any society there will be a range of preferences for housing. Developers understand these differences and generally specialize in a narrow range of housing forms, acquiring an in-depth understanding of the housing preferences of those they serve and leaving alternative markets to others.

Privacy

Privacy is among the fundamental housing needs that must be addressed in planning sites. It can be gained through physical distance, visual separation, sound isolation, or cues embedded in the environment that signal the transition from public to private realms. Privacy is a cultural construct, shaped by perceptions of what must be shielded from others and how best to achieve this. Americans value visual privacy above all, which accounts for the preference for fences and the wide spacing of detached

housing. Germans, on the other hand, value sound privacy more, and will not tolerate housing that doesn't shield neighbors from others' noises. In many Islamic societies, privacy of family life results in the bifurcation of the environment into spaces reserved for close relatives (where traditional outerwear isn't worn) and more public spaces in the house and yard where visitors are welcome.

Most traditional housing incorporates some form of a *privacy gradient*, marking the progression from a public street to a personal enclave (Alexander and Chermayeff 1965). In American suburban housing, the front lawn with its walk or driveway, the porch, a covered entrance, the parlor and living room in front are all steps en route to the more personal spaces of the home—the family room, kitchen, bedrooms, and private back yard. The traditional Chinese courtyard house is organized as a clear progression from street to entrance courtyard to public areas of the house reserved for entertainment, then to progressively more intimate courtyards and living spaces. Even in dense urban housing, the raised stoop provides psychological separation from the street, just as an entrance canopy marks the zone of transition from street to apartment lobby.

Housing spaces may be organized with subtle distinctions on the gradient between *public* and *private spaces*. There may be *group-public* or *semipublic spaces*, such as entrance courtyards in apartments, auto courts, or private streets providing shared access. Anyone may wander into such spaces from the street, but will soon become aware that these are territories belonging to a specific group of individuals. Even more private shared areas may be provided, such as enclosed courtyards surrounded by apartments or row houses, reached only through private lobbies or the houses that rim the space. These are often called *group-private* or *semiprivate spaces*. In high-density housing areas, these spaces may also be located on rooftops or indoors, or may be incorporated into recreation facilities. The subtle blend of group-public and group-private spaces is nicely illustrated at Bayside Village in San Francisco, a high-density, low-rise development near downtown.

33.5 Group-public space at entrance to apartment building, West Philadelphia.
(Gary Hack)

33.6 Group-private space in senior housing cluster, Lanxmeer, Culemborg, Netherlands. (Gary Hack)

33.7 Aerial view of Bayside Village, San Francisco, with group-public and group-private spaces.
(Google Earth)

Promoting Contact

Shared spaces on housing sites encourage human contact, another important need of most individuals and societies. The best shared spaces are not coercive—they provide the users of sites the opportunity to

determine their level of contact with others. This is not always possible: users may have no choice whether to use entryways, lobbies, common driveways, shared parking areas, mailboxes, refuse collection areas. Experience suggests that these are most successful socially if the number of households they serve is limited. Some studies suggest that 8–12 households sharing common entries (in mid-density housing) is optimal. The exception is the growing desire for shared social spaces among young adults in apartment communities—places to mingle around the swimming pool, barbeque, and party areas—where the more the merrier is the guiding rule.

Homogeneity plays an important role in determining the willingness of neighbors to share space, and studies of the social space of neighborhoods repeatedly emphasize the importance of clustering units likely to attract people at similar stages of the life cycle, social class, and lifestyle if they are to share facilities. But exposure to differences is also an important social objective, most successfully achieved if neighbors have some things in common. Experience in mixed-income housing in the US demonstrates that households can bridge income differences if they are similar enough along other demographic dimensions. Thus, the commonality of being elderly may trump income differences, or residing in a community dedicated to active outdoor life may bridge differences of age or income. The ability to opt in or out of activities is of greater importance in socially mixed communities.

At a scale beyond individual housing clusters, there are a variety of places in larger developments that can encourage human contact—convenience stores, child care centers, car washing areas, community gardens, children's playgrounds, workout areas, and other recreation facilities. Sidewalks and walkways through open areas can be important integrators on a housing site, if designed with human contact in mind. Teenagers, often the most neglected group in planning housing sites, have the greatest need for human contact—safely away from adult eyes.

33.8 Greenwood Avenue Cottages, a pocket neighborhood with eight housing units, Shoreline, Washington.
(Courtesy of Ross Chapin Architects)

Security

Human *security* is another important preoccupation in site planning, particularly in the American context. Many crimes are opportunistic; they occur in places that are out of sight and not frequented by others. One approach is to harden the environment by eliminating shared spaces and landscaped areas where criminals might prey, building walls to protect private spaces, and adding security guards and surveillance devices to discourage crime (Newman 1972). The not-so-subtle message of this strategy is that the world beyond the house is dangerous, and ought to be

avoided in off hours. The result is usually a reduction of the number of humans using outdoor spaces, particularly at night.

Increasing the number of eyes on the street is a far more desirable way to promote security, since few crimes are committed in areas where they are likely to be seen. This implies opening up a housing site to views from individual houses, and being sure that every outdoor space clearly belongs to a group who will take responsibility for its security. Maintaining sites well and removing graffiti promptly reinforces the sense of public order, and can markedly discourage crime.

Contact with Nature

People in most societies seek contact with nature in their housing environment, although the traditions of acquiring it vary widely. Americans seem to want houses that are lost in nature, and if that is not possible they will pay a substantial premium for sites that look out on parks, waterfronts, golf courses, and other areas preserved in a somewhat natural state. Tree-lined streets bordered by broad lawns are the urban counterparts for those who lack easy access to larger open spaces. In England or France, a few magnificent trees in a tiny square rimmed by houses and shops may offer a sufficient reminder of the natural world. In a dense Japanese city, a carefully tended strip of bamboo, no more than 1 m (3 ft) wide, may serve as a reminder of the larger natural world beyond the city. Residents of a Chinese city may import nature into their courtyard in the form of bonsai plants grown in ceramic vases, while the area outside their door may consist entirely of hard surfaces. And in many arid Middle Eastern cities, residents rely on painted images of lush plants on the walls of their villas, or the natural version of this, bougainvillea gracing walls and roofs, with occasional palms occupying the place of honor in their courtyards.

Immediate access to open space is for some groups a practical necessity: mothers wishing a place for children to play within sight, elderly individuals seeking places for gardening projects near their home, families with pets to exercise or other outdoor hobbies, and those seeking places for outdoor entertaining, particularly in warm climates. If resources permit, they will acquire houses with outdoor yard areas under their control. In the US and much of Europe, yards as small as 5 by 7m (16 by 22 feet) can satisfy most day-to-day needs, and there is a longstanding tradition of creating small private gardens. Where this is not possible, shared spaces may serve as a substitute—garden plots, adventure playgrounds, courtyards that may be scheduled for events, nearby parks and playgrounds.

33.9 Nature in high relief, Place de Furstemberg, Paris.
(Unidentified)

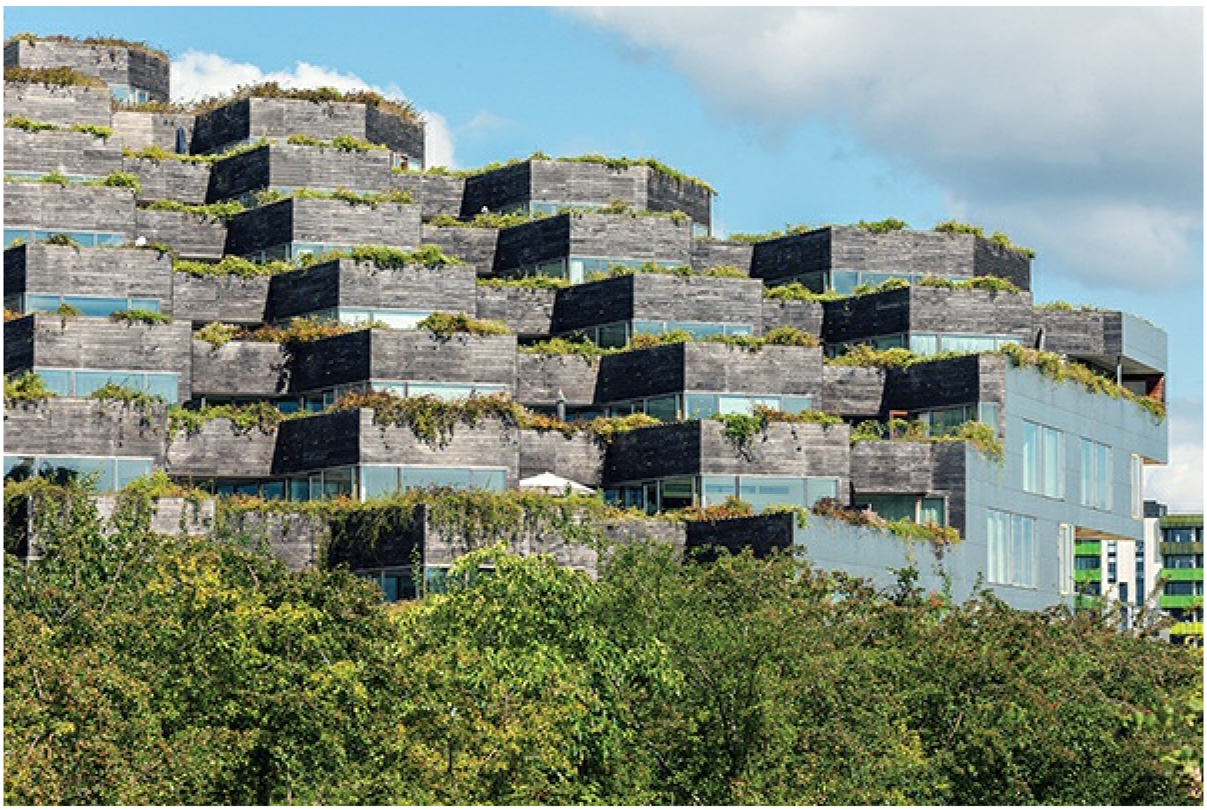
Many designers have sought to build high-density housing forms with large private spaces attached to each unit. Perhaps the most iconic is Habitat 67, built in Montreal as a demonstration project during Expo 67. More recently, The Mountain, a high-density housing project in Ørestad, Copenhagen, provides each unit with a 90 m2 (970 sq ft) south-facing terrace, with considerable privacy from adjacent units.

Household structure plays an important role in the need for private open space. It is possible for millions of families in Hong Kong or Seoul or Beijing to raise children successfully in high-rise apartments, in part because they have the assistance of grandparents and others in their extended family. In high-density American cities, a nanny or childcare helper is needed to accomplish the same. Lacking the resources for this, most families seek housing in lower-density areas, where children can play safely in backyards or nearby playgrounds while parents juggle work, home care responsibilities, and childrearing.

Accommodating Automobiles

The desire for open space on a housing site often must compete with the need to accommodate automobiles on the site, in private garages or driveways or in shared parking facilities. After the house itself, parking is the second most demanding land user. For housing at town house densities of 20 units per ac (50 units per ha), ground-level automobile parking (at 1.5 cars per unit) will consume more than a quarter of the housing site. Higher-density housing faces the choice of devoting much of the lower portion of the housing to parking ramps, or locating parking belowground at a significant cost. Most residents strongly prefer individual parking

places attached to their unit or *dedicated parking* in a lot, the least efficient ways to satisfy their needs but the most convenient. When forced to use *common or shared parking* areas, the preferred arrangement is dedicated spaces, forgoing the advantages of flexibility in parking use.Shared parking areas offer the possibility of doubling up with alternative uses—as basketball or street hockey areas, or places for festivals or gatherings. Parking areas can be designed as auto courts, and need not be asphalt pads bordered by minimal landscaping. The design of parking areas is a largely neglected aspect of site planning, with considerable room for innovation (see chapter 21).



33.10 Individual outdoor spaces for each unit, The Mountain, Ørestad, Copenhagen.
(Courtesy of © BIG—Bjarke Ingels Group/Dirk Verwoerd photo)

33.11 A multistory parking structure occupies the space below the housing at The Mountain, Ørestad, Copenhagen.
(Courtesy of © BIG—Bjarke Ingels Group/Mario Flavio Benini photo)

Personalizing the Environment

Beyond such practical needs, housing is for many people an important symbol of their identity and status, and signals their attitude toward neighbors and the wider community. Most residents want to personalize their home. Landscaping is one obvious way; designing or painting the exterior of their house is another. A visit to the False Creek residential area in Vancouver two decades after it was built reveals extraordinary lush landscaping added by residents in every corner of private space, as a demonstration of their gardening prowess but also as an expression of pride in their living environment. Puerto Rican families in the South Bronx, New York, have adapted and personalized their houses and yards in exuberant ways by adding ornamental grates and bougainvillea vines, a

startling improvement on the faceless units they purchased. The sheer density and rules of a housing area may preclude this, but individuals will find small ways to telegraph their identity—pots of plants flanking their doorway, ceramic house numbers, flags over their entrance, decorations in windows, and the like.

Attitudes toward personalizing houses and sites vary considerably across cultures and social classes, and even within communities. Some American communities have anti-monotony ordinances that prevent developers from reproducing rows of identical houses. But an even larger number of local areas in the US have tough rules that enforce consistency from house to house. One community demands that only earth tones be used in exteriors, that every house have a visible roof, and that all garages be oriented to the rear or side, thus avoiding the appearance of open garage doors (Hack 1995).

Many upper-income individuals in the US have adequate ways to express themselves beyond their housing, and are content to live in units that are attractive but have anonymous exteriors. In older cities of Europe, the collective image of the housing complex is more important than symbols of family status and identity, and adaptations are frowned upon. But offered a choice in new housing, the same individuals may have sharply differing ideas about what they desire—witness their elaborate country cottages or dachas. The site planner is well advised to offer variation in the land planning, whether or not the opportunity is seized upon by housing designers.

Housing Prototypes

Detached Housing

The single-family detached house is the mainstay of housing in much of North America, accounting for half or more of the new housing constructed. Its advantages are well known: it receives adequate light and air from its four exposures and provides room for gardening, play, parking, and other outdoor uses. It enjoys direct access to the street and its own private grounds, which can be shielded from noise and view. In some traditional societies, such as South Africa, being able to walk around all sides of one's house is a way to exorcise evil spirits.

Single detached houses can be built, maintained, expanded, remodeled, bought and sold independently. With light frame materials they are economical to build, and even in countries where concrete or block construction is the norm, they remain affordable. They symbolize the autonomy of the household or family, and in many parts of the world are considered the ideal house.

The archetypal single-family detached house in the US is built at a net density of 5 or 6 per ac (12 or 15 per ha), on lots with a frontage of 60 to 75 ft (18 to 22 m). Houses are set back uniformly, often 25 ft (7.5 m) from the front property line and a minimum of 4 to 10 ft (1.2 to 3 m) on the sides, depending on local regulations. The units may be one or two floors high, and adorned in a variety of popularly understood styles. Cars will be parked in an attached or detached garage, in the open beside the house, at the rear of the lot reached by a side driveway, or in a parking space accessible from a rear alley. Detached housing has grown in size each decade, with new houses now averaging 2,600 sq ft (242 m2), although lots have not increased commensurately.

The *villa* is the European equivalent of the detached single-family house, and it has seen renewed popularity in the outlying areas of many cities, particularly in Spain and Italy. Generally reserved for upper-income families, villas sit on lots typically 30 by 30 m (95 by 95 ft), resulting in net densities of 10 per ha (4 per ac), although they vary considerably from city to city. Cars are often parked below units, especially on sloping sites. Villas have become the aspiration of upwardly mobile families in almost every rapidly developing country.

In Japan, where land commands a great premium, single-family detached houses are being prefabricated and assembled in suburbs at densities of 40 units per ha (16 per ac), on lots that are typically 10 by 28 m (33 by 90 ft) but often as small as 10 by 15 m (33 by 50 ft). Similar housing is now being constructed in China to satisfy the demand for individual houses. There is also a growing interest in *2 × 4 houses*, with light frame construction on small lots. Setbacks to the street are minimal, and walls assure privacy for the small areas of outdoor space on the house lots. However, in the higher-income housing areas of Japan, including Fukuoka, individual designs and generous landscaping create highly desirable districts.

33.12 Standard single-family houses fronting on rain garden that absorbs runoff from the roofs, street, and driveways, Prairie Crossing, Grayslake, Illinois.
(Gary Hack)

There have been many criticisms of the detached house: that it is the main cause of city sprawl, which eats up rural land; that it makes public transit service uneconomical, that it is only suitable for two-parent families where one is prepared to mind the home front. These presumed liabilities have not deterred homebuyers, but the steady rise in land and servicing costs (including fees that account for the off-site costs of low-density development) has spurred a search for detached housing forms that can be built at higher densities and use less street frontage per unit.

One direct response is simply reducing the lot widths to 12 or 14 m (40 or 45 ft), which is adequate if houses are modest in size and two floors in height. Creating alleys and garages at the rear can help reduce the demands for frontage and allow houses to be set nearer the street. New urbanism communities in the US—in reality, a rediscovery of the traditional subdivision patterns of the 1920s—sometimes reduce lot sizes to 33 ft by

100 ft (10 m by 32 m), resulting in net densities of 11 units per ac (27 per ha). If *granny flats* or *accessory units* are added over rear garages, densities can be as high as 22 units per ac (55 per ha). A variety of housing forms modeled on traditional housing can be easily accommodated on small lots: Charleston side yard houses, bungalows, carpenter cottages, and shingle style gabled houses.

33.13 Villa development with recreation spaces, suburban Bangkok, Thailand.
(Gary Hack)

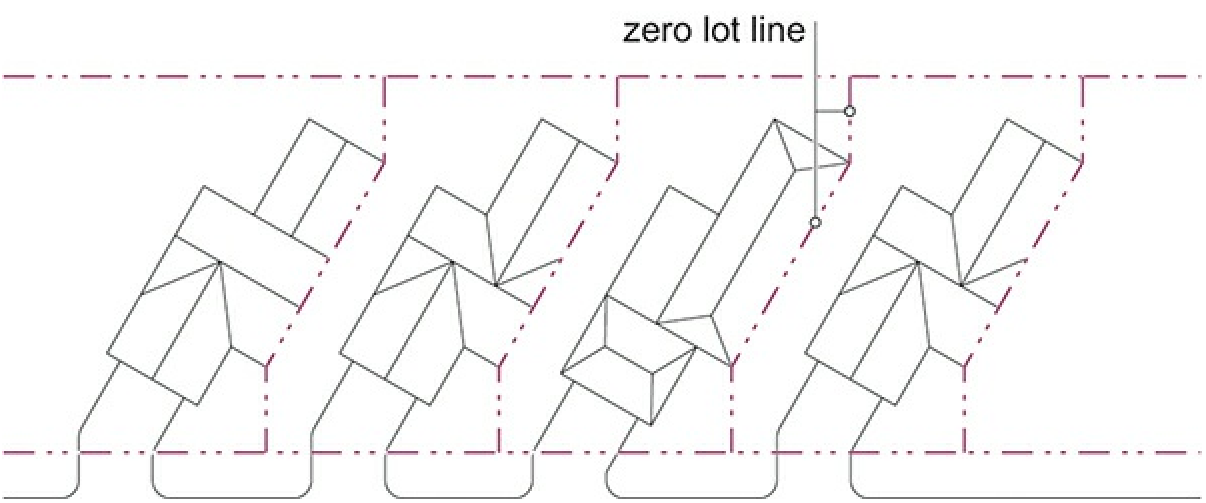
33.14 Prefabricated mass housing development, Shanghai, China.
(© Biccaya/ Dreamstime.com)

33.15 High-priced villa development, Fukuoka, Japan.
(Gary Hack)

Another way of reducing lot size is to do away with one of the side yards, setting the house directly alongside one property line. Such *zero lot line housing* can be built at a net density of 25 to 30 units per ha (10 to 12 per ac). Maintenance easements on adjacent properties are required for painting and repairing walls located on the lot line. Because of the proximity of units, it is essential that there be covenants prohibiting windows on the lot line side wall, to avoid overlooking neighbors' spaces. Fence and driveway locations must also be controlled. If housing is designed at the same time as the lots are laid out, it is possible to create ingenious lot shapes that maximize the use of open space on individual lots, such as the Z-lot. In this arrangement, the claustrophobia of narrow lots is reduced by allowing outdoor space on both sides of the house. The community of Civano, near Tucson, Arizona, makes effective use of zero lot line housing and other small-lot housing forms to increase densities and

create a strong sense of community.

33.16 (top left) Small-lot development with garages off alleyways behind, Laguna West, Sacramento, California.
(Gary Hack)



33.17 (top right) Zero lot line plan, with lot boundaries shaped to maximize privacy in rear

yards, Orlando, Florida.
(Adam Tecza/The Evans Group)

33.18 (bottom) Affordable housing development plan with small-lot, zero lot line, and attached housing, Rohnert Park, California.
(City of Rohnert Park)

Rather than reduce the lot size, the average frontage can be reduced by changing the lot shape. *Flag lots* are permitted in some localities. They make two tiers of development, the one served in the normal manner along the street, the second located behind it and reached by a driveway. The rear lot may have only 3 or 4 m (10 or 12 ft) of actual street frontage. Significant cost savings are possible if house utility lines are also combined for the two lots.

In some countries, such as Saudi Arabia, lots for single detached housing are bounded by high walls, within which elaborate mansions or a compound of houses for an extended family is built. Lots are typically 70 m (220 ft) square, and the enclosure wall is commonly built before construction begins on the house. A similar strategy has been used for low-

income housing in South America and portions of South Asia. Once the wall is complete and a core structure with plumbing facilities is constructed within it, the house can be constructed and added to as resources permit. Owners purchase materials as they can afford them, and store them on the site until needed for construction.

In North America, *mobile homes* are a further response to the problem of delivering detached housing at an affordable price. They require less land and are considerably less expensive to build than site-framed housing because of the materials used, the lower cost of factory labor, the economies of scale, and the more lenient codes that apply to them. “Mobile” is a misnomer since most of these houses will move only once—to the site where they are first located. The trailer industry, whose products originally served summer campers and migratory workers, has evolved into a prefabricated house production system, manufacturing 12 and 14 ft (3.75 and 4.25 m) wide modules and delivering them within a range of 150 mi (240 km) of the factory. *Manufactured homes*, as they are now called, now constitute nearly 20 percent of the new single-family housing units in the US, and are delivered in modules that may be combined to form houses that are indistinguishable from site-built homes. Some are stacked to form two-story structures. Manufactured houses that look like site-built ones can easily be integrated into regular subdivisions if their construction standards meet local codes.

In the southwest US and Florida, where the winter climate is welcoming to snowbirds, large retirement and seasonal communities have been created using manufactured modules. Often they are fixed permanently to land that is sold to the occupants, and residents have elaborate shared community and recreation facilities. Densities sometimes reach 15 units per ac (37 per ha), making both land and housing affordable. Residents add to their units, creating storage areas, covered car parking areas, children’s play pools, and the like, filling the spaces between the rows of houses. The best of such projects have stringent developments standards, maintain common spaces immaculately, and provide security in off-seasons when few

residents are present.

Traditional mobile home parks, on the other hand, have developed an undesirable image and are often banished to the edge of town. Frequently they are built on leased land awaiting a more permanent use. Homes are normally set on a diagonal, units have no privacy, and there is little sense of responsibility for order and maintenance. This need not be so; there are also fine examples where landscaping or natural vegetation predominates, shielding the rows of banal units from view. Sometimes permanent false fronts are erected and units are inserted within them, making the mobile component hardly noticeable from the street. In a few places, automobiles have been parked at the edge of the site and electric carts are provided to each of the units, allowing roadways to be given a more intimate scale.

33.19 Seasonal community with manufactured homes, North Lake Estates, Moore Haven, Florida.
(Courtesy of Sun Communities, Inc.)

33.20 Double-wide modular home community with recreation spine, Bay Indies, Venice, Florida.
(Google Earth)

Mobile homes highlight the visual problem in all detached housing areas: how to avoid the appearance of endless repetition on the one hand while guarding against total disorder on the other. The problem arises from the size of the separate units relative to the development area, and to the scale of the car with its associated right-of-way. Where houses can be clustered or related across a footpath or pedestrian space, the proportions become much more pleasant, and the ground surface can be designed to unify the whole. Any reduction of the street width or the depth of the front yard always helps. Topography and color can also make a difference, as the marvelous painted Victorian structures in San Francisco demonstrate.

There are other devices for giving unity to small structures. Individual houses may be linked by means of screen walls, planting, garages, or

porches. Garages may be paired or grouped in compounds to improve their proportions, although this may mean new ownership arrangements. House spacing and setback may be varied to create visual groups or modulate the street space. The Nova Scotia fishing village, with its informal grouping of structures, demonstrates that orthogonal organization is not the only alternative. And diminutive scale is not by itself unpleasant: the tiny wooden houses in Oak Bluffs on the island of Martha's Vineyard, Massachusetts are packed together along the pedestrian ways of the former camp meeting ground, and the effect is charming. But everything is in scale with these highly decorated houses: the pathways, the gardens, the vistas, and the spaces devoted to cars and service vehicles.

The town of Seaside, Florida was the first recent community to mine these lessons, which were captured in the town's urban code. Among other rules, it specifies that all houses must have metal pitched roofs with gables facing the street; there must be porches facing the street; lots must be rimmed by white picket fences; exterior materials must be predominantly clapboard; and colors must be drawn from a palate of pastels. These rules were not a deterrent to producing a great variety of house designs by many architects, including several modernist interpretations. Equally importantly, streets have been designed to be used by pedestrians as well as automobiles, and are surfaced with unit pavers. To reduce the scale of streets, parking areas along roadways were left unpaved and interrupted by trees. Similar strategies have been repeated in dozens of new urbanist communities, with results as varied as Prospect in Colorado, which has encouraged modernist housing designs, and Civano in New Mexico, which has drawn upon Southwest American vernacular traditions.

33.21 Tiny houses built on former tent sites in the Camp Meeting Association grounds, Oak Bluffs, Massachusetts.
(amis30porboston.com/Creative Commons)

33.22 Small houses with consistent details, fences, and streetscape, Seaside, Florida.
(Gary Hack)

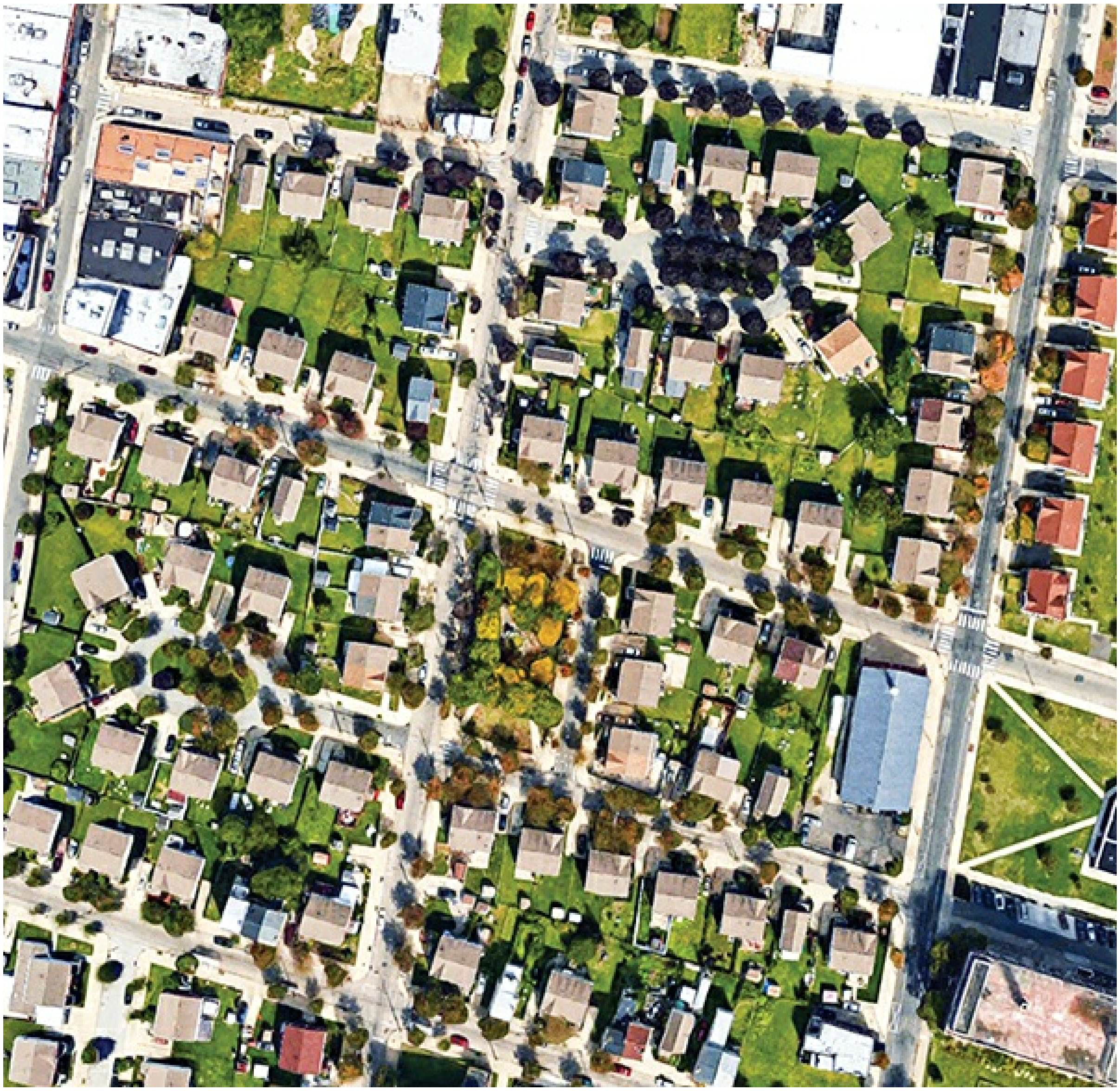
Attached Housing

In urban areas, attached housing is a practical necessity. It is simply not possible to achieve densities greater than about 30 units per ha (12 per ac) without having houses attached to their neighboring units. Older cities provide a rich array of attached housing: the Toronto semi, Philadelphia side-by-side, the Philadelphia-style duplex (in Boston), the Boston triple-decker, the San Francisco double, the Queens quads, the Montreal multiplexes, and so on, each a response to local populations and norms. Where units are stacked vertically, the owner often occupies one of the units while the others are rented out, so that houses serve different types of

households. This enriches the social fabric of neighborhoods, often allowing multiple generations to remain in the same area.

There are several distinct varieties of attached housing: the *semidetached house*, with origins in England, where two units are joined side by side; the *duplex*, where one unit is over the other; *rear-lot housing*, where one unit occupies the front half of the lot, the other the rear; the *quad*, where four units are joined horizontally, and the many varieties of *row houses* which are joined on both sides, and sometimes stacked vertically. All types have individual entrances from the street and the opportunity for private outdoor open space attached to the unit, in the form of yards, porches, or balconies.

33.23 Affordable semidetached housing, Poplar Street neighborhood, North Philadelphia. (Gary Hack)



33.24 Semidetached housing, redevelopment of abandoned public housing, Poplar Street neighborhood, Philadelphia.
(Google Earth)

33.25 Modern semidetached houses, the Cedar Lodges, Winchester, UK.
(Courtesy of Martin Gardner/Adam Knibb Architects)

Semidetached units have all the advantages of the detached house, but can be built at higher densities because they have party walls on one side. With three exposed sides they have nearly as much light as with four, and can have private entrances, driveways, and outdoor spaces. Many traditional semis also share driveways with neighbors, further reducing the frontage needed. Although in divided ownership, they may look like one large house, especially if the entrance of one unit is tucked around to the side.

The duplex can be done at even higher densities, and with separate entrances—sometimes by way of an open-air stair and balcony to the upper unit—each unit can function independently. Good sound isolation in the floor between the units is the key to privacy. Private outdoor spaces for each unit may be obtained in several ways: one unit may be given the front outdoor space and the other the rear, or a generous balcony may substitute

for ground space on the upper unit, or a roof deck may serve the upper unit while the lower unit has space on the ground. Often the two units are not equal in size, since one is intended for family occupancy, the second for child-free households. There may be a smaller ground-level unit, rented out, with a two-story unit above, or a small apartment may be located above the family unit.

The duplex and the semi are being rediscovered as housing costs increase and ways are sought to bring ownership within reach. Rear lot housing is also being reconsidered. Granny flats attached to the rear of houses are one example, popular in Australia; another is the conversion of garages in rear yards into living units. The entrance to the rear unit can be off the alleyway (if there is one), continuing the tradition of mews housing. Or, as in many San Francisco houses, it may be reached via a covered passageway from the street.

Another type of attached housing is the quad, or four-unit building, of which there are many varieties. At Frank Lloyd Wright's Suntop Homes in Ardmore, Pennsylvania, units are organized in a pinwheel pattern; each has a private yard out of sight of the adjacent units. In Quebec City, quads are widely used for new suburban housing, placed between parallel streets. While efficient in the use of land, they require more infrastructure than other units at that density, and since private yards are exposed to the street, screening is essential for privacy and to assure an ordered public environment. The Queens quad, ubiquitous in that borough of New York City, resolves this in a totally unsatisfying way by making the entire front yard an auto court. A better alternative, at a similar density, would be to build four ground-access units in a row.

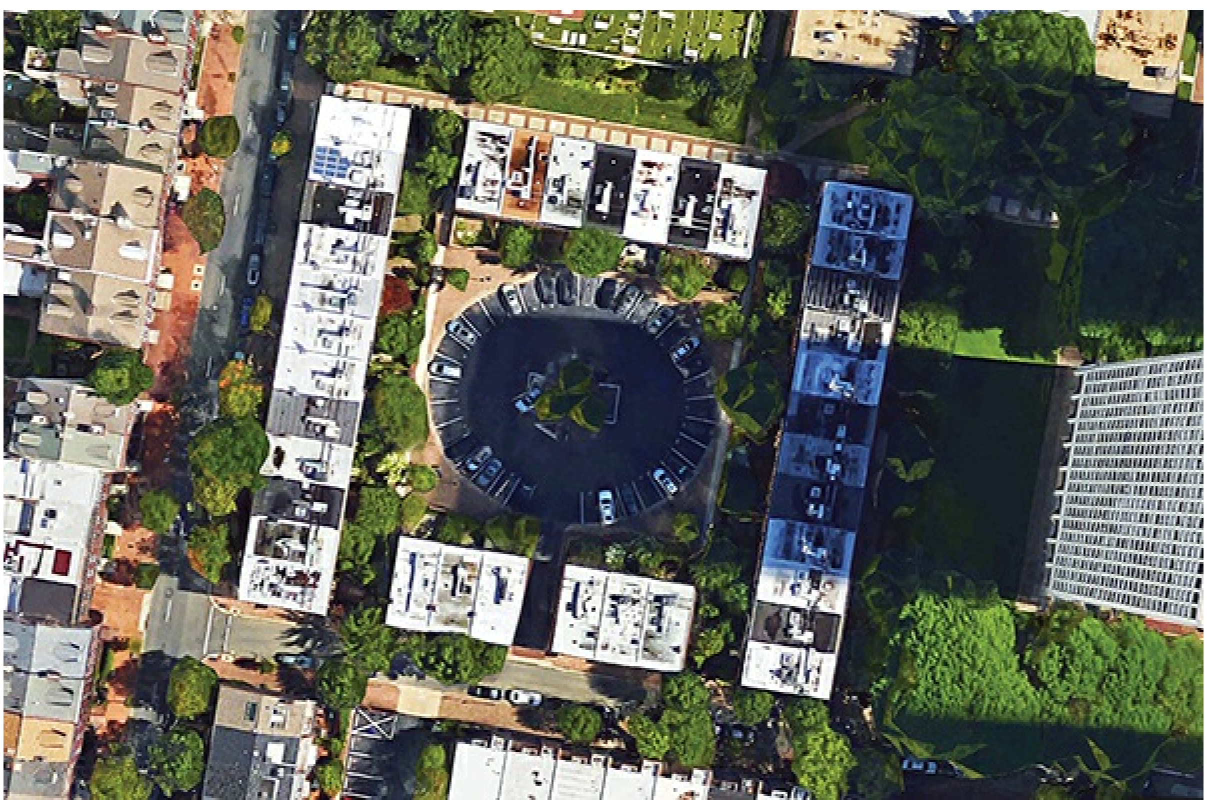
33.26 The Royal Crescent, Bath, UK, which has served as a prototype for countless row house ensembles.
(David Iliff/Creative Commons)

The row house is the most common form of ground-access attached housing. It is the cheapest to build and maintain, and by dispensing with side yards altogether makes the most efficient use of land of any ground-access unit. Row houses can vary in width from as little as 3.5 m (12 ft) to as much as 10.5 m (35 feet); they can be two to five stories high, although in new housing two or three stories is the norm. They can be shaped to fit the street with curving rows, if necessary, or organized around auto courts. Often they are thought of as working-class housing, and the term “row house” carries that connotation, but the grand crescents in Bath, England and the houses of Beacon Hill in Boston are examples of splendid row houses and pinnacles of prestige. Developers often advertise row houses as “townhouses” or “townhomes”; in England and Australia, they are called “terrace houses” or simply “terraces.”

When row houses have only one street frontage, the internal arrangement will depend on cultural attitudes. Some prefer the living and dining rooms to be on the street side—this was the historic pattern in most places, when parlors for guests were separated from more private living spaces. The public entertaining areas then become the limit of how far guests will penetrate into the home—the front stage. Backstage are the kitchen and family entertainment spaces. Others prefer to locate living rooms at the rear, where activities can flow into outdoor spaces. Under

either arrangement, storage and service spaces must be provided near the entrance, to accommodate clothes, bicycles, waste disposal, and other utilitarian needs. There is also the need for a direct passageway to the rear yard, since landscape materials, outdoor furniture, and all else that finds its way into the yard must arrive via the front door.

Access is made easier when there is a way to reach the unit from the rear as well as the front. Unless there are public alleyways, creating a vehicle or pedestrian way in the rear usually necessitates some form of shared ownership, obviating the simplicity of fee simple ownership with party walls. A homes association or condominium ownership can allow the form of row housing to become considerably more varied, with shared parking areas and common recreation facilities. The Society Hill townhouses in Philadelphia create elegant street fronts while grouping parking in rear parking courts. Clustering row houses tightly while preserving natural areas between is a strategy for preserving natural corridors on a site.



33.27 Society Hill townhouses, Philadelphia, organized around an automobile court.
(Google Earth)

33.28 Street view, Society Hill townhouses, Philadelphia.
(Gary Hack)

33.29 Automobile courtyard, Society Hill townhouses, Philadelphia.
(Gary Hack)

Most projects employing row houses consist of dozens of units, designed as a single ensemble with consistent exteriors. This was not always the case, as historic streets in Philadelphia and Amsterdam attest. Allowing each owner to custom-design their unit, within broad guidelines for setbacks and heights, can result in a marvelously varied block and a test bed for new housing forms. This strategy was employed in the redevelopment of the Ghent area of Norfolk, Virginia, and more recently in portions of the Amsterdam docklands.

Another innovative form of row housing, which has its origins in Scandinavia and Germany, is the *court garden house*, where L-shaped attached units are organized around private outdoor spaces. While the densities are relatively low and each unit requires considerable frontage, every room has a view to a private outdoor space, and units can be organized to break the lockstep monotony of conventional row houses.

They have been a favored form among architects, and examples may be found in Europe, Canada, and the US. However, they remain an undiscovered innovation that has as yet not caught on among the general public (Schoenauer 1962).

One of the most difficult issues in organizing row houses is dealing with the automobile. With narrow-frontage row houses, storing the automobile in garages on the street can deaden the facade with a continuous row of garage doors. If cars are parked outdoors, the street becomes a linear parking lot. One solution is to create alleyways and park the car at the rear, as many traditional townhouses do in Philadelphia, but unless the lots are very deep, this will be done at the expense of private outdoor space (although decks over the garage are a possibility). With wider frontages, 6.5 m (20 ft) or more, it is possible to retain a landscaped entrance while incorporating a garage in the structure. On sloping sites, it may be possible to locate the automobile below the unit while creating balconies above overlooking the driveway. All of this is made more difficult if there is more than one automobile per unit, an unfortunately common situation in the US.

One innovative way to accommodate the automobile is by placing it below a landscaped deck between two rows of houses. This is a common solution in Canada, where it has the added advantage of eliminating the need for snow removal in the parking area. Houses may then be entered directly from the parking garage or from the main entrance on the deck. Freestanding parking courts are another parking solution, although in North America it is difficult to persuade homeowners to park their automobiles more than a few feet from their front door.

33.30 Individually designed townhouses, Amsterdam Eastern Harbour development.
(Gary Hack)

33.31 Court garden houses with individual courtyards and shared play spaces, Albertslund South residential area, Copenhagen.
(Google Earth)

Row houses are typically built at net densities between 35 and 50 units per ha (15 and 20 per ac), but there may be as many as 75 units per ha (30 per ac) if the houses have narrow fronts of 3.5 or 4.5 m (12 to 14 ft). Higher densities usually require rethinking the form of housing and how the automobile is treated.

The *stacked row house* (or townhouse) is one higher-density form that retains private entries and outdoor spaces, and results in densities half again higher than row houses. The effect is that of a row of attached

duplexes, with the same choices of access and open spaces. The upper unit, which begins on the second or third floor, is generally reached by a private stairway. Fire exit regulations usually make it advantageous to locate the smaller of the two units below, minimizing the climb to the upper unit. With stacked row houses, it is nearly impossible to make outdoor spaces that are completely private, but the creative use of roof decks and covered parking areas can provide for generous outdoor spaces. At these densities, it is no longer possible to park all the automobiles on ground level and have a site that is more than a landscaped parking lot. The preferred solution is to construct a fireproof parking garage below the housing units.

Stretching the limits of what can be put on a site, some developers have created *back-to-back row houses*, or even *back-to-back stacked row houses*, reaching densities as high as 100 units per ha (40 per ac). These units have obvious disadvantages, among them the limited frontage, lack of cross ventilation, and difficulty of accommodating the automobile. But in the eastern US, consumers seeking to purchase low-priced housing have shown a strong preference for these units over apartments constructed at the same density, where units are entered from common hallways. They are also a favored housing form in suburban Bangkok.

Gallery access can also be used to allow stacking of units, so that each retains an individual outdoor entrance. Quite innovative examples may be found in England, where they are called maisonettes, and in parts of the southwest US, where the climate favors outdoor corridors. Units entered from the outdoor corridor may be one or two stories, although fire codes often require a second egress if the outdoor street is more than one story above the ground. The most extravagant (and most costly) example of gallery-access attached housing is undoubtedly the Habitat 67 complex constructed in Montreal. There units are stacked within a frame in an irregular piled-up form, and while the densities are no higher than for stacked townhouses, there is great variation in the plans of each unit and each has light and views from all sides.

33.32 Stacked townhouses, Woodland Village, London, Ontario.
(Courtesy of Orchard Design Studio Inc.)

33.33 Clusters of stacked townhouses, with parking below central courtyards, False Creek residential area, Vancouver.
(Google Earth)

33.34 Stacked townhouses with single-story ground-oriented units and two-story units above, False Creek residential area, Vancouver.
(Gary Hack)

33.35 The ground floor is elevated to allow naturally ventilated parking below at Park Place apartments, Mountain View, California.
(Gary Hack)

As densities increase, the cost of constructing units becomes a factor: expensive “new ground” in the form of garages and decks must be constructed to ease the demands on the site: housing footprints, automobile circulation and parking, humans at leisure, and outdoor spaces. One useful rule of thumb is that constructing decks or new ground can only be justified if the land prices per m2 (or per sq ft) exceed the cost of the deck, measured similarly. Construction of stacked units is also more costly because of the need for fire protection and sound isolation between units, particularly vertically. As a result, few units of attached housing are built in North America at densities between 60 and 100 units per ha (25 and 40 per ac). The economics are somewhat different in Europe and Asia, where concrete construction is more common for low-rise construction, but high land costs in those areas tend to push densities to levels that require other forms of housing.

Apartments

The distinction between attached units and apartments is in the form of access: attached units have individual private access from the street (or a street in the sky), while apartments are reached via some form of common stairs or elevators and hallways. But apartments, or *flats* as they are called in the UK and other places, offer an infinite variety of possibilities. In many parts of the world they are the predominant form of housing.

The *walkup apartment* was at one time the cheapest kind of housing available. It would still be so today if fire laws had not banned non-fireproof construction in structures more than three stories in height, and if people had not lost interest in climbing greater distances. Two-story

walkups, or three-story walkups that have their lowest floor half a level belowground, have become the most common form of inexpensive apartments in the US. They allow parking to be handled at grade, and offer excellent exposure to all rooms, particularly if organized in shapes other than rectangular blocks. Multiple stairways can allow a small number of units to share an entrance, and ground-floor units can be designed so that they have private outdoor space.

In suburban areas, walkup apartments have been rebranded as *garden apartments*, although the garden may be principally a parking lot because of high automobile ownership rates among those who rent such units. The best such developments create common courtyards between apartments, and may locate some of the parking in garages below the housing floors, as in the Park Place apartments in Mountain View, California. The term “walkup” is also becoming something of a misnomer, since inexpensive hydraulic elevators often make it economically feasible to eliminate the need to walk up stairs in buildings as low as two or three stories.

Some of the most innovative walkup units may be found in the inner city of Beijing, where they have been designed as a modern adaptation of the traditional courtyard house. Built at densities that come close to the high-rise apartments constructed nearby, they respect the traditional scale of the city’s *hutongs* and have been inserted as infill housing between historic residences. Three to four stories high, they are organized around a succession of courtyards extending back from the street. Every apartment enjoys excellent light from a courtyard, which serves as a play space for children, storage place for bicycles, and common space for gatherings and casual contact.

In China, six-story walkup apartments continue to exist, as a relic of a time when constructing apartments quickly and cheaply was the objective. However, in most of the world today, apartments taller than three stories require fireproof construction, passenger elevators, and often the installation of mechanical ventilation systems. In many places in the US, if they are above 90 ft (28 m) in height, they must meet high-rise building

codes, including providing sprinklers for fire protection. Above such a height, bearing wall construction is not possible, necessitating some form of fireproofed steel or concrete structure. Since these are costly items compared to light wood construction, they usually entail a significant jump of density if they are to remain competitive in price with walkups. Or if higher-priced, they must appeal to a market that values a doorman, urban living, and security of housing.

Elevator apartments can take many forms, and are the mainstay of new housing in most dense urban areas. They may also be the favored housing form as a way of achieving compact urban districts, or the only practical form of housing in places such as Hong Kong, where topography limits the amount of land available for development and costly foundations force it to be very tall. The basic organizing spine of any tall apartment structure is the core: elevators, fire stairs, and mechanical shafts containing building systems. The limbs of the structure are the corridors and distribution lines that extend outward from the core. These can be configured in many different ways. They can be enclosed or outdoor galleries as in the Habitat 67 housing hillside in Montreal.

33.36 New Siheyuan residential area in Ju’er hutong, centered on courtyards, Beijing, China.
(Gary Hack)

33.37 Costly foundations, difficult access, and exceptional views force developers to construct tall towers on Hong Kong’s slopes.
(© Amadeustx | Dreamstime.com)

In European cities, where height limits often restrict apartment structures to six or seven stories, apartments are usually organized with multiple cores, accessible from courtyards carefully watched over by a concierge who may live on the ground floor. As few as two to four apartments may share an elevator lobby on each floor and a stairway; depending on the size of the courtyard, there may be two or four vertical cores. The modern version of this often dispenses with the courtyard and creates *street bar housing* with cores distributed every 20 to 40 m (65 to 125 ft) along the street. Two to four units typically are reached from the elevator stop on each floor. Europeans favor this form of housing because it offers the

possibility of cross ventilation and access to the sun for all or most units. The seven-story line of development along Java Island in Amsterdam is an excellent example of street bar housing. In Buenos Aires, 11-story housing hugging the street has become the norm, and produces a much-valued and urbane setting for urban life.

In northern China, where access to the sunlight is considered a right in all housing, 6- to 30-story slablike apartments with several vertical cores were for many years the norm. Similar housing estates were developed in Korea and other Asian countries. The sheer monotony of most housing estates built with uniform slab housing has since given way to more varied mixtures of point buildings and connected slabs. There are now examples that rise above the norm, including the Jian Wai SOHO development in Beijing. An underground infrastructure of parking and commercial spaces and a lively ground-level pattern of open spaces, restaurants, and shops provide an exciting context for the residential slabs—in reality live-work structures, since many of the apartments have been converted into offices for small businesses.

Distributed cores became the preference in luxury apartments in New York in the 1880s, and many were organized around courtyards emulating the grand buildings of Paris, Barcelona, and Vienna. The most luxurious buildings offered elevators that opened directly into apartment units, dispensing entirely with lobbies on each floor. With air conditioning, individual units could be as deep as 60 ft (18 m) from the elevator core.

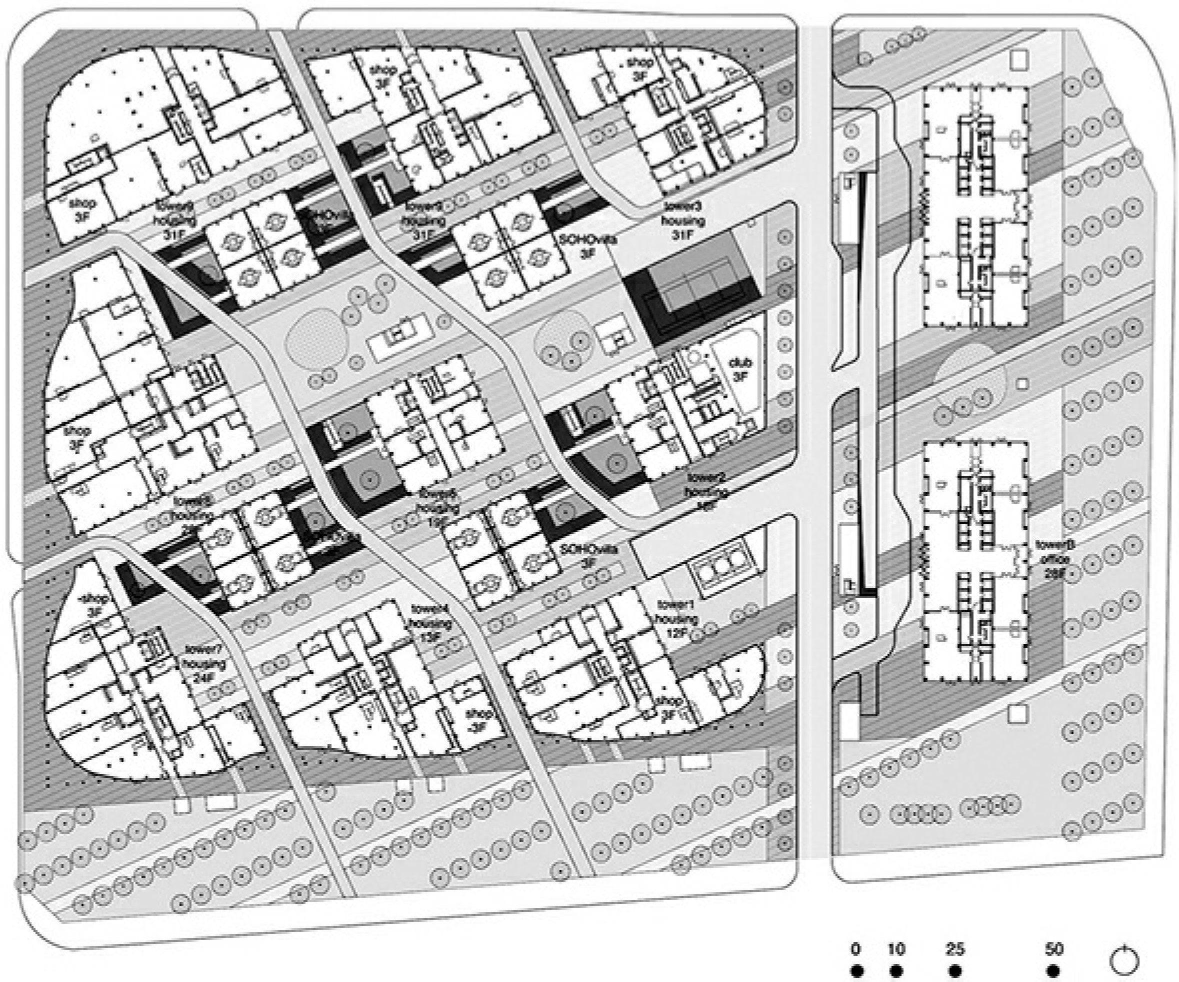
Sadly, however, the norm for street-oriented elevator apartments in the US has become the double-loaded corridor building. In such buildings, units are organized on each side of a corridor that runs the length of the building. It may be a slab in form, or a multiwinged building radiating outward from a core. While they optimize the use of costly elevators, they eliminate entirely the possibility of cross ventilation, and force residents to reach their units along corridors devoid of natural light. Typical double-loaded corridor buildings are 65 to 75 ft (21 to 24 m) in width, and depending upon the fire stair configuration may be as long as 300 ft (95 m)

in length. They often block views, cast powerful shadows, and adjust clumsily to terrain, but their advantage is their low cost and ease of construction.

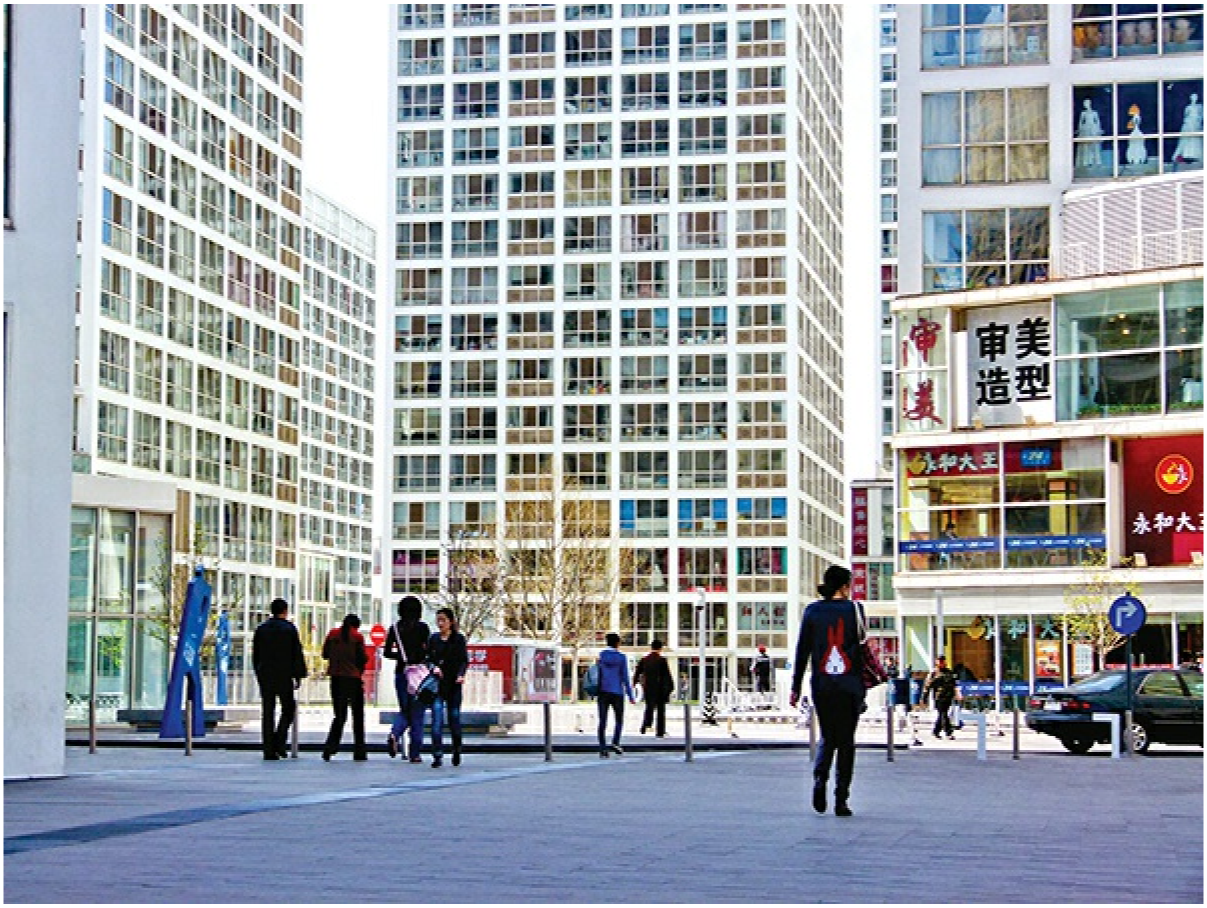
33.38 Outdoor gallery access connects individual units to elevators at Habitat 67, Montreal.

(Courtesy of Robert Michael Poole)

33.39 Street bar housing on Java Island, built in 30 m increments, Amsterdam.
(Alison Comford-Matheso © Acmphoto | Dreamstime.com)



33.40 Ground plan, Jian Wai SOHO complex, Beijing, with housing towers rimming lower offices and retail structures.
(Courtesy of Riken Yamamoto & Field Shop)

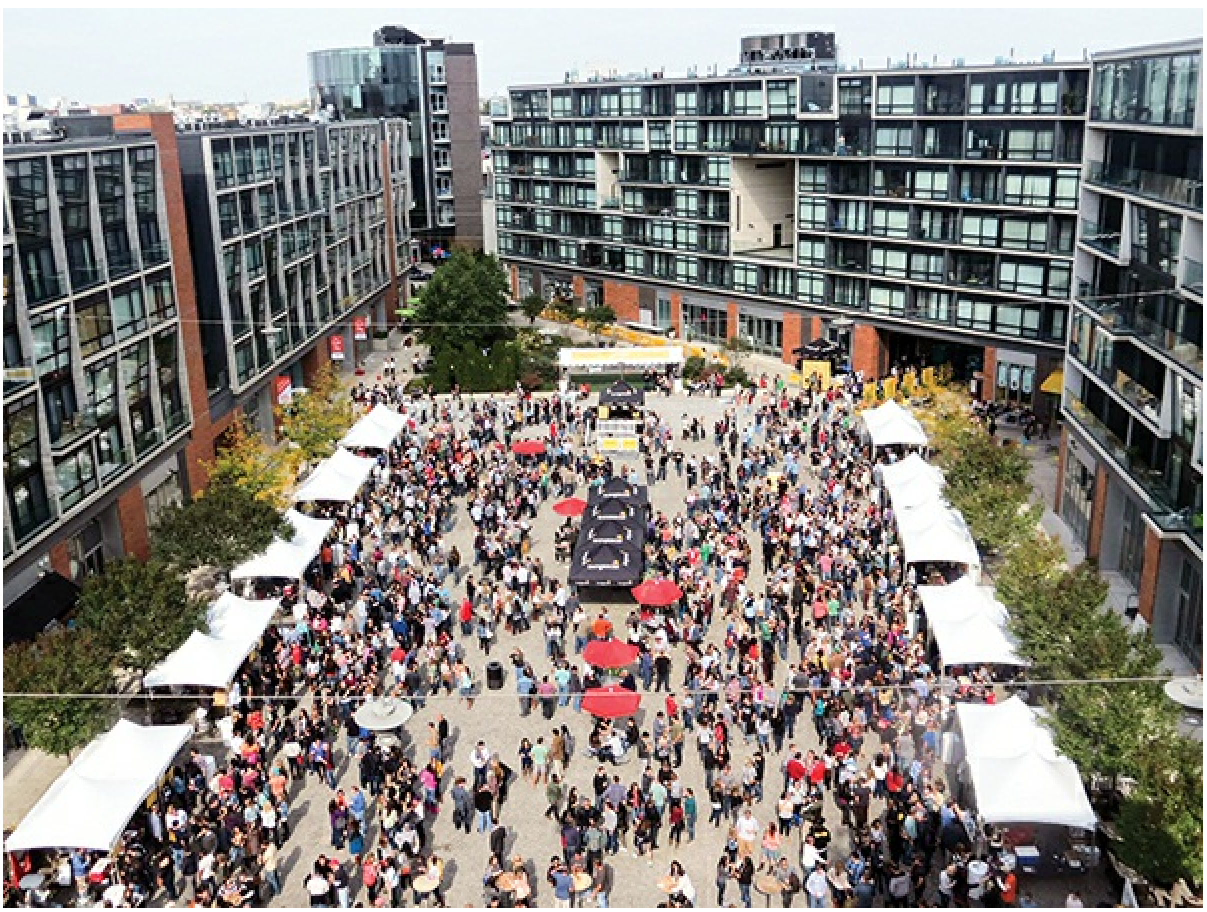


33.41 Ground-level spaces, Jian Wai SOHO complex, Beijing.
(Courtesy of Institute for Transportation and Development Policy)

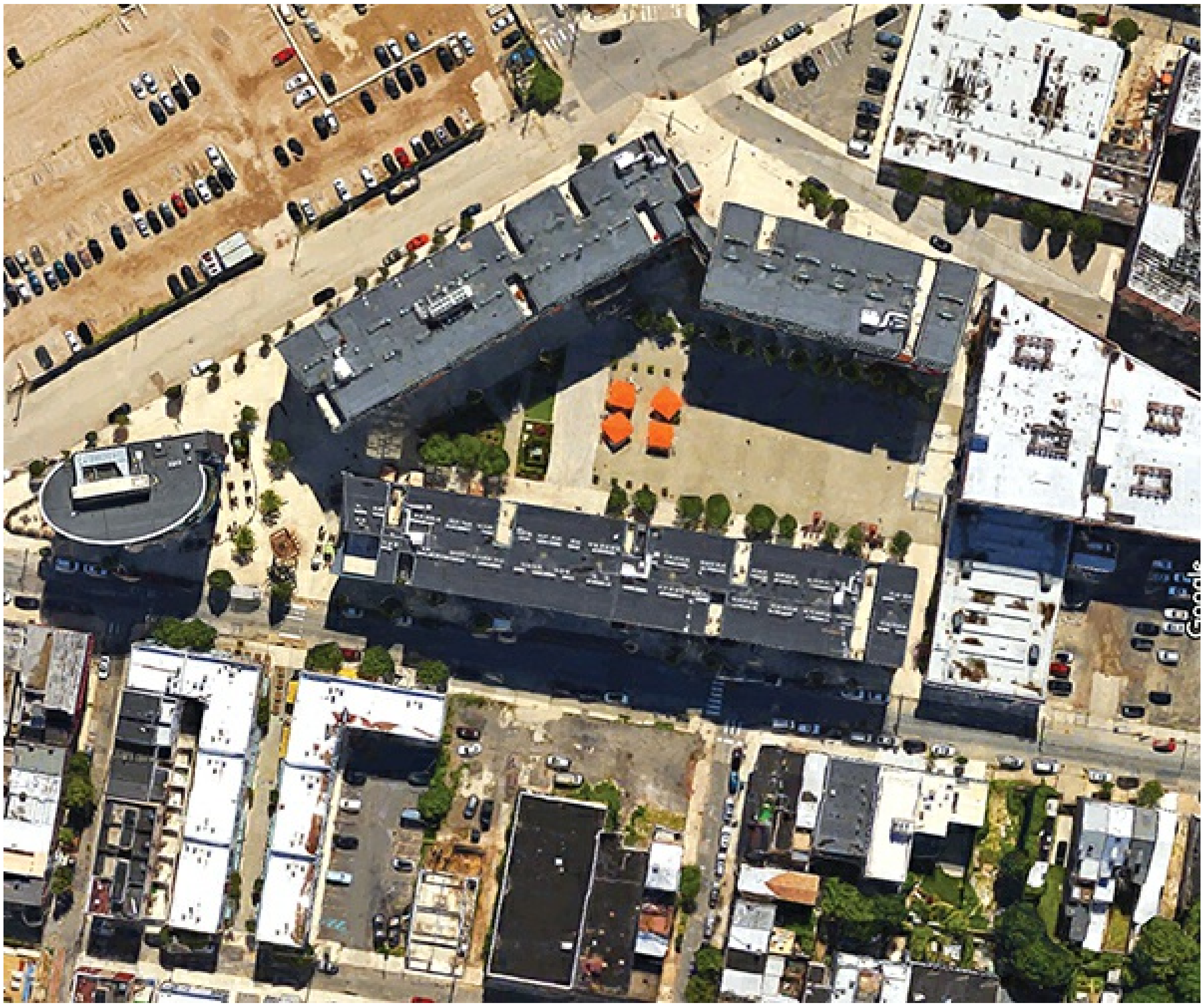
Some of the disadvantages of the double-loaded corridor can be overcome by adopting the skip-floor system, where elevators stop ever second or third level. From the elevator, apartments are reached via corridors, or galleries, or “walkways in the sky,” generally on one side of the building. One advantage is that elevator service is improved, since there are fewer stops. Floors above and below the corridor levels enjoy cross ventilation, and units may be two stories with internal stairways connecting the floors. The architect Le Corbusier was a fervent advocate of this type of unit and incorporated it in his Unité d’Habitation structures in Marseille, Nantes-Rezé, Berlin-Westend, Briey, and Firminy. Excellent examples of skip-stop configurations may be found in Toronto, at Roosevelt Island in New York, and at the Piazza in Philadelphia. The

Piazza is a distinct improvement on Le Corbusier's structure, providing light into the streets in the sky and public spaces that look out onto the large courtyard that has become the center of its emerging neighborhood.

Innovative projects in Montreal and Europe have demonstrated that it is also possible economically to cluster apartments in 6- to 12-story buildings around hydraulic elevators, limiting the number of units on each floor to a handful. Most of the units can have cross ventilation. Even though elevator service is slower, residents strongly prefer such buildings to their double-loaded-corridor counterparts. Given the choice, most apartment dwellers prefer to have only a few immediate neighbors rather than dozens along a corridor.



33.42 Skip-floor access to apartments provides most apartments with through-ventilation at the Piazza at Schmidts, Northern Liberties, Philadelphia.
(Tower Realty)



33.43 Aerial view, the Piazza at Schmidts, Northern Liberties, Philadelphia.
(Google Earth)

In Hong Kong and throughout Asia, the tall residential tower is rapidly becoming the standard housing form. It originated as a way to minimize the footprint of buildings because of high foundation costs, and as a response to stringent building codes that require natural light and ventilation to all rooms, including bathrooms and kitchens. Hong Kong tower blocks are often cross- or T-shaped with many crenellations, some occupied by balconies or landings to stairways. Typical wings extend outward from the core, limited by the maximum distances that unit entrances may be located away from fire stairs. Often these residential towers are built over podiums of 3 to 8 stories which provide car parking,

shops, children’s play areas, common spaces, and rooftop gardens. When grouped together with their podiums joined, they become self-contained neighborhoods, serving everyday needs just a short walk from apartment doors.

The tall apartment has advantages in addition to its usefulness at high densities. Tenants acquire some anonymity and social freedom, if that is what they seek, and they may be lifted up high enough to enjoy fine views and cleaner, cooler air. Where there are amenities such as waterfronts, residential towers avoid blocking the views to the water for those located several blocks behind. The city of Vancouver has limited the girth of residential buildings along English Bay and False Creek North to 20 m (65 ft), to allow views between them to the water. The result is a remarkable procession of slender glass towers, some with only one or two apartments per floor. These advantages have not been lost in New York City, one of the few cities without height limits, where dozens of tall thin towers (TTTs) are rising in residential areas and along waterfronts.

One of the difficulties of TTTs is providing parking below their footprint. Creating an adequate garage space usually requires grouping the parking for several structures. An alternative is the use of mechanical parking systems, where vehicles are taken by elevator to storage slots. In Japan such systems are common, and one such structure was recently completed in Philadelphia. In New York, a recently built tall tower lifts automobiles to the apartment floor of their owner—the ultimate in having the automobile next to your door!

Apartments are also generally more secure than ground-access housing, particularly if there is 24-hour control at the entrance. Moreover, at the densities that high apartments are generally built at, it is possible to supply special services: exercise rooms, swimming pools, squash courts, and other special recreational spaces; child care facilities; convenience stores; even catering, if they are attached to a hotel. Indeed, apartments are becoming more like hotels, even as all-suite and extended-stay hotels now look more like apartments.

33.44 Tower spacing requirements in Vancouver assure that housing units in tall buildings have distant views.
(© Leo Bruce Hempell/ Dreamstime.com)

Mixed Housing Forms

Different housing types can, of course, be mixed within individual buildings, or next to each other on sites. The lower floors of an apartment structure can function as townhouses, providing entranceways and yards, with the upper floors reached by elevators and corridors. To optimize the use of elevators, the lower three floors of a building may be treated as a walk-up structure, with upper floors served by bridges from an adjacent high-rise building, as is the pattern at Peabody Terrace at Harvard University. Vancouver requires continuous housing along streets, which is

accomplished by mixing low-rise townhouses with tall towers. Row houses and walkup apartments for rent can easily be mixed on the same site since they are of similar scale. They appeal to different groups, and thereby broaden the occupant mix. But attention must be paid to social differences on the site as well—children's play areas or basketball courts that may be too noisy for some residents, or singles apartments areas may disturb families in the late night hours.

In New York, where a preference for tall towers has emerged and public bodies insist on continuous streetscapes, a hybrid form of housing has emerged with street bar housing of 6–10 stories topped by 30–40-story towers. The same elevators serve both; the low-rise structures generally accommodate the smaller units along double-loaded corridors, while two to four units are organized around each tower elevator floor.

33.45 Hybrid housing where the lower three floors function as walk-up apartments and units above are served by skip-floor elevators in the tall towers, Peabody Terrace, Harvard University, Cambridge, Massachusetts.

(Courtesy of Bruce T. Martin)

33.46 Vancouver requires that townhouses line the street with towers set back behind, to

provide street activity and human scale.
(Gary Hack)

Live-Work Housing

Housing mixed with workspaces—live-work housing—is also becoming a widespread phenomenon, as more and more occupations can be practiced from the home. They are also a practical solution for families with young children, allowing one or both of the parents to work within the home. Accessory offices attached to homes are becoming accepted in many American suburbs, although the number of outside employees is sometimes limited, and provision must be made for off-street parking. With the opportunity to plan for home-based occupations at the outset, as was done in Celebration, Florida, housing sites can be planned with secondary entrances for the offices, and screened driveways can serve for visitor or employee parking.

Loft housing in or near downtown has become the fastest-growing housing form in most American cities. The demand is fueled by the increased numbers of child-free households who want to be within walking range of their workplaces, cultural opportunities, and amenities, but a significant number of households moving into lofts report one or more members who work out of home offices. The increased ceiling heights, typically 10 ft (3 m), glazed exterior walls, and open organization of lofts allow buildings of much greater depths to be used for housing—50 ft (16 m) or more, as opposed to typical apartment depths of 30 to 35 ft (9 to 10.5 m). This has been a boon to the conversion of older industrial buildings (from which they take their name) and obsolete office structures, but also has stimulated the construction of a new form of housing with large unencumbered floors. Often they are fitted out by the occupants, placing a premium on flexible mechanical, electrical, and plumbing systems. The

system of “housing supports” devised by N. J. Habraken and his colleagues in Holland, but realized only experimentally, offers the potential of rationalizing such open building systems (Habraken 2000).

33.47 Live-work lofts at 1310 East Union Street, Seattle, Washington.
(Courtesy of Ben Benschneider/Miller Hull Partnership)

33.48 Experimental housing unit that promotes adaptability by careful placement of service cores and exterior facade that is easily changed, units designed by 13 different architects, NEXT21, Osaka, Japan.

(Yositika, UTIDA, Shu-Koh-Sha Architectural and Urban Design Studio/Osaka Gas Co.)

Other Housing Types

A number of emerging housing forms do not easily fit into conventional categories. Congregate housing, or cohousing, is increasing in Europe and the US and can take many forms. The fundamental concept is the desire to integrate many types of households in a single housing complex, sharing common facilities such as large living and entertainment rooms, food preparation and dining rooms, recreation facilities, child care facilities, workshops, and the like. Individual households may have small kitchens and living spaces as well, or they may be dispensed with entirely in favor of common space. The programs are as varied as the groups themselves, and usually they are created with cooperative ownership. Formally organized communes in China and Israel, and among religious communities, also adopt the approach of reducing private spaces in favor of shared facilities (McCamant and Durrett 2014).

Extended-care housing is appearing with increasing frequency as the populations of many developed countries age. Usually it involves providing a range of housing types on a site, from fully independent living in cottages or attached housing to apartments with small kitchens to full-care nursing home facilities. There will be on-site medical facilities, usually provided as part of the package of services available to all residents. They will typically share common spaces and recreation facilities, and may have the option of eating in a dining room on the site rather than dining in their units. As residents age and need greater care, they have the option of moving to facilities with higher levels of assistance. The site planning challenge is to create subcommunities on the site, where residents of each level of care can enjoy the company of others, while putting common facilities within easy reach of all.

33.49 Common space, cohousing area, Stichting Vrijburcht, Amsterdam-IJburg, Netherlands. (Courtesy of Stichting Vrijburcht/Digidaan photo)

The future will surely require greater diversity in housing, new social arrangements, new forms of ownership and tenure, and the ability to adapt housing to meet rapidly changing demographics. The challenge to the site planner is organizing housing projects so that they continue to serve their residents.

Promoting Affordable Housing

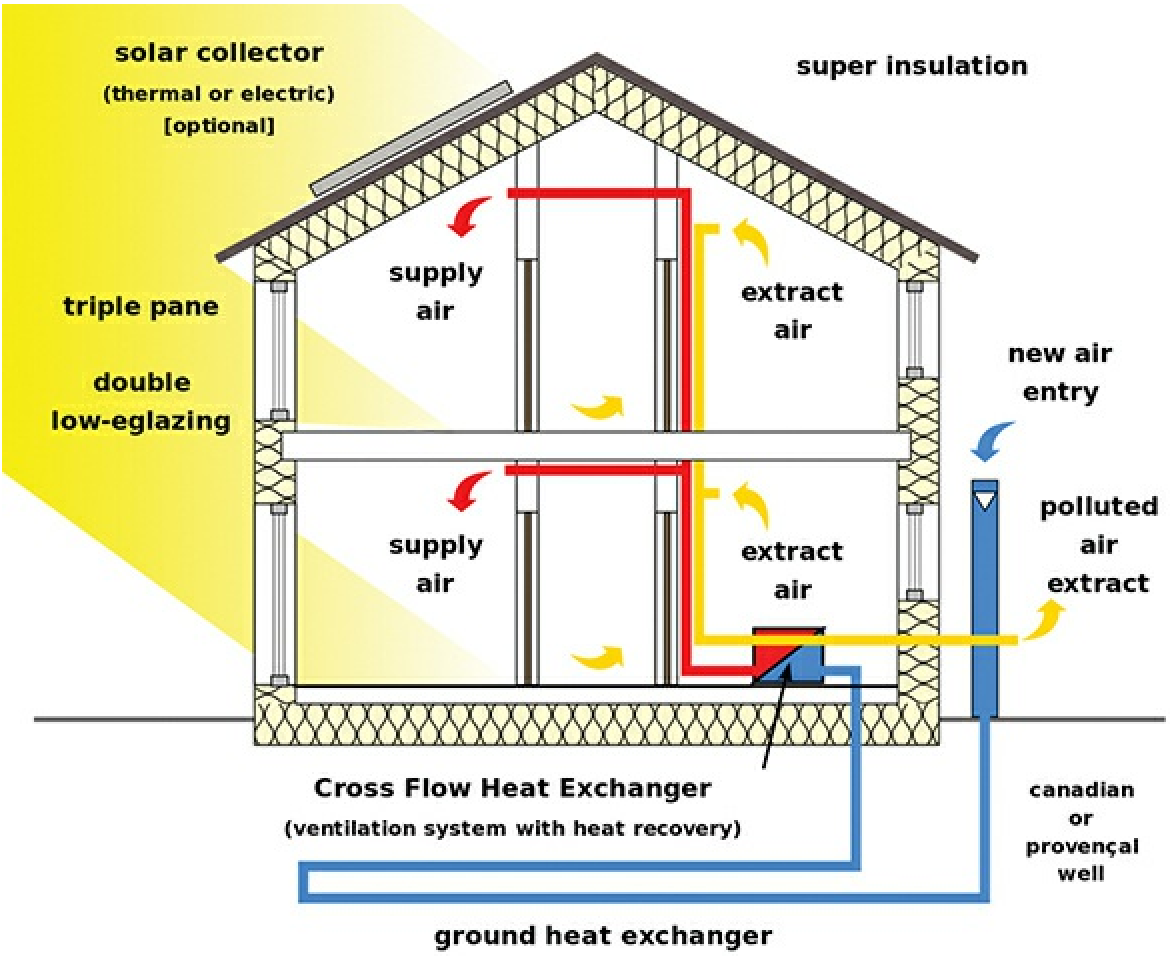
Housing affordability is not linked inextricably to site planning, since any of the housing forms just discussed can be built as starter homes on a modest budget, or inflated in size and finishes for a more extravagant price. There are, however, a number of strategies that can help assure that housing on a site is accessible to a broad range of incomes. One begins with the site program: it can provide for a mix of units aimed at a range of incomes, and use cross subsidies from the higher-priced (or rental rate) units to assure that there are affordable accommodations. An increasing number of governments require that a proportion of units be set aside for households below a certain income; others provide tax relief or preferential financing in exchange for affordable units. The units themselves may not differ greatly from the market rate units, although they may be slightly smaller in size and have less expensive finishes. Mixing units for different income groups requires a delicate balance and, in the case of rental units, careful selection of tenants to assure that residents are compatible.

A second strategy is to provide modest-sized accommodations as starter homes, designed and sited so that they can be added to over time as the income of the residents permits. Typical houses in Levittown, New York in 1963 were 750 sq ft (70 m2); over the next decade an average of 200 sq ft (18.6 m2) were added to each by finishing attics, adding rooms to the house, and converting garages to living spaces. This is a common strategy in developing countries, where very modest accommodations are provided within an enclosure wall, allowing for space to be added over time without intruding on neighbors. For single-family housing, minimizing the size of lots through zero lot lines and party wall units can result in higher densities and lower prices.

Keeping structures low so that less costly building technologies can be employed is a third approach. In North America, stick-built wood frame construction, typically limited to three and a half stories, is generally 20–30% less costly than mid-rise masonry bearing wall with concrete plank construction that can rise 6–8 stories, and at least 50% less costly than high-rise buildings. The economics of building will of course vary among

cities, and in locations with a construction industry skilled in high-rise construction the gap may be narrower. Higher densities may be needed to offset high land prices, but if affordability is a goal, it is worth exploring lower-height solutions before planning the site for high-rise structures.

Finally, innovative building technology combined with site planning can directly affect the ongoing operating and maintenance costs of housing. Orienting housing to maximize passive solar gain in winter, or, in hot climates, so that large glass areas are shaded, can impact heating and air conditioning costs. Passive air movement in buildings, through operable windows or ventilation systems that capture breezes, can lower costs further. These are among the techniques common in *Passive House* (Passivhaus or *Mason Passive*) building systems. The Passive House organization sets several criteria to qualify for use of the name: space heating demand should not exceed 15 kWh annually or 10 W (peak demand) per m2 of usable building space; space cooling energy consumption should roughly equal the heat demand figures, with a climate-dependence allowance for dehumidification; primary energy demand (for appliances, heating, and domestic electricity) should not exceed 120 kWh annually for all domestic applications per m2 of living space; spaces should be sufficiently airtight to restrict air changes to no more than 0.6 per hour at 50 Pascals pressure; and indoor temperatures should not exceed 25°C more than 10% of the hours in any given year to assure thermal comfort. In the US, Passive House structures consume 86% less energy for heating than typical ones of the same type in their area and 46% less for cooling, a considerable saving for owners and occupants. By 2014 over 1 million m2 (10.8 million sq ft) of residential space constructed across the globe met Passive House standards, including individual houses, low- and high-rise apartments, and special-purpose housing such as dormitories and institutions.



33.50 Passive House scheme for single-family houses.
(Passivhaus/Creative Commons)

33.51 Algenhaus demonstration project at the 2013 International Building Exposition (IBA) in Hamburg, illustrating how Passive House principles can be applied to mid-rise housing.
(Energieexperten/Creative Commons)

Saving energy is not the only way to reduce operating cost to make housing more affordable. Reduction of water use through xeriscape, providing low-maintenance landscape, promotion of voluntary associations that take responsibility for maintenance, and reduction of unused parking spaces by providing car share services are only a few of the possibilities for reducing annual costs. Affordability will be an essential issue in the future, and is an area wide open for innovation.

34 | Shopping

Goods and services are exchanged in shopping areas, but the significance of these places goes far beyond the commercial functions they serve. They are the locations for social encounters and important public events in the lives of cities. They help frame the identity of cities—think of Fifth Avenue or Tribeca in New York, North Michigan Avenue in Chicago, the Ginza, Omote-Sando Avenue and Harijuku in Tokyo, Mayfair in London, Boulevard Haussmann in Paris, the Galleria Vittorio Emanuele II in Milan, or other commercial high streets and complexes people instantly identify with cities. Shopping areas are the places to see and be seen, for residents and visitors alike. They are a source of pride for a town or city, conveying status by the quality of shops but also creating a sense of belonging through shared experience. Much of this is, of course, the product of image makers, advertisers, and media, intended to attract tourists and encourage locals to part with their resources. But for urban residents shopping areas are among the few common grounds for everyday life. And they are particularly important places in rapidly developing cities, where they provide the venues for interaction, events, and contact among recently arrived residents.

The physical form and design of shopping areas can have a large impact on their performance. Most people arrive at a shopping area with only a general sense of what they wish to buy, and what they return home with will be greatly affected by what they are exposed to and how it is presented. There are magnets that draw people to shopping places, and other stores or outlets that feed off their presence. Shoppers may be persuaded to stay longer in a place by the mix of opportunities—places to rest or eat, recreation areas for their children, entertainment areas—or they may be put off by the crush of people, boredom of offerings, long walks

needed to get from store to store, lack of weather protection, or a dingy environment. A great deal is known about shoppers' behavior by those who plan commercial areas, much of it not captured in guides or texts.


Café Restaurant

34.1 Galleria Vittorio Emanuele II at the Duomo, Milan, Italy.
(Gary Hack)

34.2 Multilevel retail complex at Eaton Centre, Toronto.
(Courtesy of Toronto Tourism)

Shopping Programs

All else being equal, the larger the shopping area, the greater the distance from which it draws its patronage. Of course, all else is never equal, and the attractiveness of shopping areas is influenced by the mix of outlets, prestige, advertising, image, accessibility, and history; but the scale of a shopping area remains an important underlying factor that determines the distance shoppers will travel to it. Larger centers offer a greater variety of retail opportunities, and tend to accumulate their patrons from large areas. *Gravity models* can be used to predict the sphere of influence of shopping areas. By analogy to Newton's Law, they assert that the trade area of a center is directly proportional to its mass (floor area is one good surrogate). A center that is twice the size of a nearby center will attract the majority of customers until a point two-thirds of the distance between them (Reilly 1931). While it is possible to overcome scale and distance with unique offerings, those planning commercial centers overlook the gravitational pull of size at their peril. One strategy by developers is to oversize shopping centers on the urbanizing fringe to meet the future demand, hoping to discourage others from building a competing center a few kilometers down the road.

Various names have evolved to describe conventional types of shopping areas, differentiating them by size and type. At the most local level is the *convenience center*, which may include a late-hour store selling milk, sundries, and snacks, and perhaps beside it a dry cleaner or small pharmacy. One step up in size is the *community shopping center*,

sometimes called a *neighborhood center*, anchored by a large supermarket, super drugstore, discount store, small department store (or some combination) and containing a range of apparel, home improvement, and other shops, and one or two eating places. *Regional shopping centers* cover the full range of retail outlets and are generally anchored by at least two mass market or discount department stores. They cater to all ages, with fashion outlets, gift and home improvement stores, electronics and toy stores, and incorporating a score of restaurants and possibly a food court and cinema area. *Superregional centers*, the largest of the planned commercial areas, will be based on multiple department stores, fashion outlets and every imaginable specialty store, entertainment centers, and even outlets selling automobiles and other high-value items.

One of the difficulties of creating very large shop-ping centers has been the instability of large department store chains as anchors. Department stores have fallen on tough times in North America, their market eroded by brand name boutiques at one end and large discount retailers at the other. Department stores remain popular in many other parts of the world, particularly Asia (where the trading group owning the center sometimes also controls the supply chain), but even in these areas, successful department stores have largely reinvented themselves as a collection of brand name boutiques. The loss of an *anchor store* can be devastating for a center that depended upon it to draw customers, and with consolidations and reductions of the number of department stores, there are no obvious replacements. In recent years, developers have sought alternatives that have broad drawing power, but they do not put their fate in the hands of one or two anchors.

Table 34.1 | Types of shopping places

Various sources.

Type	Focus	Typical size	Anchor	Anchor ratio	Primary trade area
Convenience	Daily needs	2,000–5,000 sq ft	Convenience store	30–	1 mi

center		(200–500 m2)		100%	(1.5 km)
Community center	Weekly needs	30,000–150,000 sq ft (3,000–15,000 m2)	Supermarket, drugstore	40–60%	3–5 mi (5–8 km)
Regional center	General shopping	400,000–800,000 sq ft (40,000–80,000 m2)	Multiple department stores	50–70%	5–15 mi (8–22 km)
Superregional center	General shopping, entertainment	800,000–3,000,000 sq ft (80,000–300,000 m2)	Multiple department stores, entertainment outlet	40–70%	5–25 mi (8–40 km)
Power center	Category shopping	250,000–600,000 sq ft (25,000–60,000 m2)	Multiple category killer outlets	75–90%	5–10 mi (8–16 km)
Outlet center	Off-price branded merchandise	200,000–500,000 sq ft (20,000–50,000 m2)	High-visibility brand outlets	10–30%	20–50 mi (30–75 km)
Entertainment center	Food, movies, entertainment	50,000–200,000 sq ft (5,000–20,000 m2)	Multiscreen cinema	30–50%	5–10 mi (8–16 km)
Fashion center	High-end clothing, home furnishings	80,000–250,000 sq ft (8,000–25,000 m2)	High-visibility brand stores	10–30%	5–15 mi (8–22 km)

One formula has been the creation of a *power center*, composed of five to ten or more *category killers*—large outlets that dominate their business (books, linens, children’s toys, outdoors equipment, etc.). Another approach is the creation of high-end *fashion centers*, aggregating dozens of brand name retailers and creating an aura of exclusivity in the environment provided. At the opposite extreme, *outlet centers* thrive by pulling together many clearance outlets of brand name merchants, who will sell their low-priced brands to customers who may be put off by the prices in their flagship stores. Other forms of *specialty centers* may be based on collections of restaurants or a large collection of cinema screens, while collateral retail opportunities appeal to those attracted.

These categories have been created for the convenience of investors and retailers and too often lead to formulaic responses, with one shopping center largely indistinguishable from another and retail chains spread evenly across the landscape. The most interesting shopping areas grow in a more organic fashion—a local shopping street filled with a mix of mostly unique local outlets with a sprinkling of chain stores; a specialty shopping district (focused on clothing boutiques or antiques, art galleries, books, restaurants, etc.) that has evolved over time, sometimes as an offshoot of one successful business; ethnic shopping areas unified by a common heritage and usually centered on food (the most persistent of all ethnic traits); entertainment districts based on restaurants and performance venues.

It proves surprisingly difficult to reproduce the richness of organic shopping areas in new development. Many local retail shops survive because their capital costs have long been amortized, and the shopkeepers may own the real estate where they are located (rents on upper stories may even be subsidizing the retail operations). Other shops can exist only at a scale where the owners and their family can cover the hours they are open; expanding to another location or getting larger will alter the basic economics of the enterprise. Still other retail uses can only exist in cheap space, such as startup restaurants, and will require subsidy in a new development. All of this may conflict with a developer's need to show secure-credit tenants to potential lenders and investors. Nonetheless, with some creativity in structuring the economics of a development, it may be possible to program a mix of tenants that rises above the banal base of tenants with nationally recognized credit.

Planning Principles

Exposure

A successful shopping area depends on the visibility of shops and merchandise—capturing the *moving eyeballs*, as retailers often say. The eyes may be in motion in vehicles passing by a retail outlet, or in pedestrians flowing by a shop. In either case, something that is attractive to the potential shopper needs to be visible, and it needs to be obvious how to enter the store or find its parking area. Thus the first principle of planning retail areas is to expose the shopping opportunities to the maximum number of potential buyers—with an emphasis on the right kinds of buyers, not necessarily the most eyeballs. For some kinds of outlets (e.g., restaurants that depend on repeat clientele) this may not require a great deal of exposure; for others, it may mean simply making visible a well-known logo or marquee; while for those that depend on constantly attracting new buyers (e.g., shoe stores, dress shops) or impulse buyers, the merchandise may need to be put in front of the shoppers' eyes. Planners of retail areas may need to differentiate the level of exposure to cater to varying types of enterprises.

34.3 The Hollywood and Highland shopping and entertainment complex relies upon its visibility on Hollywood Boulevard to attract visitors to Los Angeles.
(Courtesy of Hollywood & Highland)

34.4 The Prudential arcade shops in Boston are patronized by thousands of pedestrians who pass them each day walking to work, home, conventions, and entertainment.
(Gary Hack)

Flows

A favorable location, anchor tenants, advertising, and events deliver potential shoppers to a commercial area, but the site planner needs to ensure that they reach the individual shops. The key is creating a system of flows through a site, attracting people effortlessly from one area to another, ensuring that they pass by those outlets that require direct visibility and directing them to out-of-the-way destinations by signage and other devices.

Assuming there are two prime destinations, as in many shopping centers, the route between them should be lined by stores that might not attract shop-pers independently. An often-cited guideline is that major destinations should not be more than 600 ft (280 m) apart to avoid shopper fatigue, although this can be lengthened if there are many interesting things along the way. Historic shopping streets in European cities are often much longer—Copenhagen’s pedestrian shopping street, Strøget, extends for more than 1 km (3,000 ft) between the City Hall and Kongens Nytorv, but it changes its retail character at least five times along the way. Destinations need to be visible to entice people to keep moving. Two-sided retail areas —whether on a street or a pedestrian route—are greatly preferred since they add to the density of attractions along the way.

Like a river, the pedestrian stream can have eddies with pockets of retail outlets a short distance off the main path (although visible from it), or may have parallel streams intersecting from time to time with the main stream. While the Ginza in Tokyo is thought of as one major street lined with department stores, it is actually a district with several smaller parallel streets offering the kind of space that restaurants, boutiques, and smaller outlets require.

34.5 Strøget in Copenhagen changes character frequently along its length.
(Dan/flickr/Creative Commons)

34.6 Dining and entertainment opportunities on the top floors of Horton Center, San Diego, draw shoppers through the vertical mall.
(Gary Hack)

34.7 Royal Arcade in Melbourne, Australia, connecting the rail station with the downtown business district.
(Gary Hack)

Creating two or more levels of shopping intensifies the number of shops within easy walking range. However, enticing shoppers to climb stairs or escalators to upper levels is difficult, and stores located there need to be visible and enticing enough to overcome the resistance of gravity. Many *multilevel retail areas* (and Japanese department stores) put eating areas at the top to encourage shoppers to navigate the height of the complex. At Horton Plaza in San Diego, rooftop food and beverage outlets have become the magnet that draws shoppers through the vertical mall. It is easier to encourage shoppers to move down than up, and another strategy is to get shoppers to enter at upper levels—such as by creating entrances

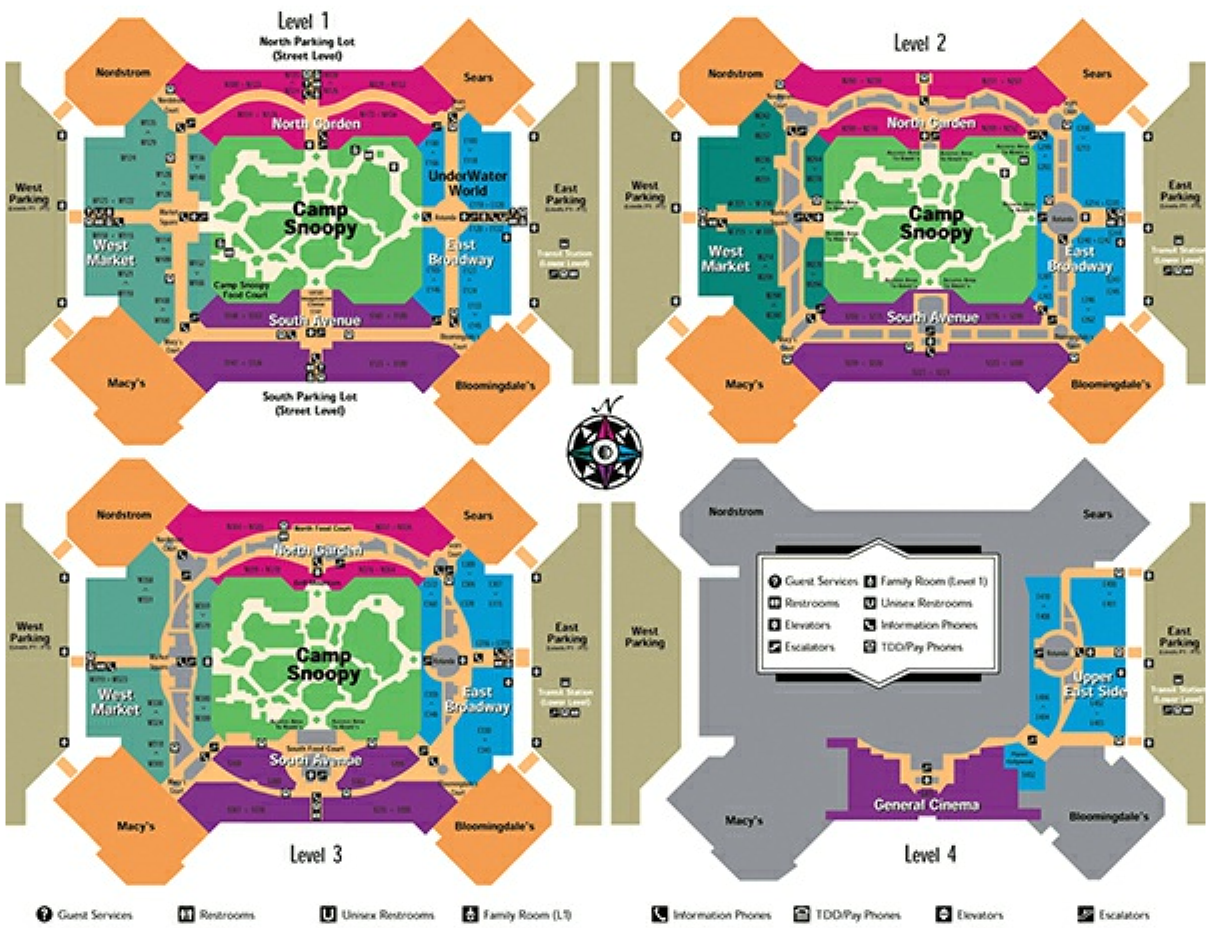
from upper stories of parking garages. One rule of thumb is that in a two-floor retail area, 60% of the shoppers should enter on the second level, to balance out the resistance to moving upward.

Connections to destinations beyond the retail area can also help encourage flows. The heavily traveled route from Flinders Station to the central business district in Melbourne, Australia has stimulated the creation of a lacework of arcades, shopping streets, and complexes all capitalizing on the pedestrian flows. In Boston, Massachusetts, the Prudential Center retail area is highly successful without any anchor tenants because over 50,000 pedestrians move through the retail arcades every day to destinations beyond. Open-ended retail streets make visible the connections both within and outside the retail area.

Attracting and Retaining Shoppers

Encouraging flows provides exposure to shops, which merchants work hard to convert into sales. But the probability of success also increases when shoppers spend longer periods of time in the retail area. This is influenced by the mix of uses, programmed activities, and amenities provided. Superregional malls often become virtual theme parks, doubling the average time shoppers spend in them. The Mall of America in Bloomington, Minnesota is built around several enclosed amusement parks, where parents can keep their children entertained while they shop. Its precursor, the West Edmonton Mall in Edmonton, Alberta, also has an amusement park with rides for children and adults, as well as a beach covered by a large glazed roof (and a hotel overlooking it), a submarine ride, musically programmed fountains, streets with sidewalk cafés, and a practice rink for the local professional hockey team, used as a skating rink in all seasons. The center provides coat- and parcel-checking services to encourage visitors to stay longer, and has become the highest-ranked

visitor attraction in its region. Not to be outdone, the Global Mall in the new Tianfu district of Chengdu, China, has a vast water entertainment complex ringed by hotels, shops, and entertainment venues. These are extreme cases only possible with mega retail complexes, but smaller centers often include botanical gardens, performance venues, public facilities such as libraries and post offices, large movie or digital screens, television production sets, and a host of other diversions intended to hold potential customers.



34.8

Diagrams of the four-floor Mall of America, Bloomington, Minnesota.
(Mall of America)

34.9

Nickelodeon Universe (which replaced Camp Snoopy) amusement park, Mall of America, Bloomington, Minnesota.
(Mall of America)

34.10

Water park at West Edmonton Mall, Edmonton, Alberta.
(Jody Robbins/West Edmonton Mall)

In many retail areas merchants collectively organize programs of events and activities designed to draw people into the retail area, while building community attachment. These can take an infinite variety of forms that include programmed entertainment, children’s activities, displays, decorative planting, farmer’s markets, craft or flea markets, holiday displays and markets, film screenings, and art shows, changing throughout the year. Semiprogrammed events such as street musicians, jugglers, mimes, and human sculptures can also add life and interest to a shopping area. Street fairs and seasonal festivals can draw large crowds to a commercial area, and a portion of a parking area on off days may become the location of an antique auto show or community garage sale. The point for planners is that every shared space in a shopping area—streets, alleys, malls, squares, and parking areas—needs to be designed so that it can be

used in multiple ways. This involves getting the forms and dimensions right, and providing the necessary electrical supplies, water, lighting, and surfaces to anchor temporary structures and displays.

Servicing Shopping Areas

Merchants are constantly receiving goods to restock their shelves and replenish inventories. With just-in-time supply chains, the amount of inventory is closely matched to sales, lowering the amount of floor area that needs to be devoted to storage, but this also means more frequent deliveries. Many businesses also sell via the Internet, generating outgoing merchandise that must be picked up. And a substantial amount of waste may be generated by a business—particularly restaurants and retailers that receive goods in bulk—which must be compacted, stored, and removed. Every retail enterprise has its own rhythm of receiving and dispatching materials, which is difficult to generalize. Since retail outlets change more often than the buildings they are located in, service areas need to be designed for a variety of tenants.

The simplest arrangement for loading is from vehicles parked along the street. This may be the only option if there aren't rear alleyways or loading zones. Traditionally in many US cities, goods were moved from trucks to basement storage areas via elevators or hatches with stairways, but this has proved cumbersome and unnecessary in most new street-oriented retail areas. Trucks unloading at the curb present an obvious conflict with parking for customers, and their presence on auto-free streets detracts from pedestrian enjoyment of the space outside shops. A workable solution is to restrict truck unloading to hours before shops open (before 10 am in many cities), and to schedule garbage pickup for hours after shops have closed.

Locating service areas at the rear of shops or in service courtyards is

distinctly preferable. Unless the stores are very large, it makes sense to share loading docks, with service corridors providing access to the rear of each outlet. This allows the number of loading docks to be minimized, and space can be dedicated to garbage storage and recycling pickup. Locating and planning loading areas are among the most contentious issues in designing a site. Neighbors will worry about truck traffic, especially large trucks idling while waiting to unload or backing into loading areas; about the noise, odors, and pollution generated; and about the sight of loading docks and the hazards of rodents nesting in areas where garbage is stored. These issues are especially critical in mixed-use areas with residents nearby. There are solutions to each, but the loading area must be carefully planned and managed.

A loading area that can be fully enclosed behind a roll-down door is the ideal solution. Many cities, however, do not allow back-in operations, and a three-point turning radius for a large (17 m, 55 ft) semitrailer truck requires an area of at least 28 by 28 m (90 by 90 ft). This may be appropriate for a large shopping center or in suburban areas where land is plentiful, but is rarely possible in smaller urban retail areas. A costly but effective alternative is a turntable, which allows trucks to be reoriented before unloading. In very large mixed-use centers, an underground truck tunnel may be possible, or service areas may occupy portions of the ground level if retail uses are elevated one level aboveground (as in many Hong Kong podium-type developments).

Regardless of the configuration, loading docks need to be carefully managed. Deliveries need to be scheduled, and hours may need to be restricted for sites bordering on residential areas (e.g., no deliveries before 6 am or after 10 pm). Compactors can be helpful in reducing waste volumes. Trucks need to be required to turn off engines when stopped. And in some instances—particularly for multioutlet stores—it makes sense to break down the bulk of shipments in a remote location, allowing smaller vehicles to make the final delivery.

34.11 Independent blocks connected by upper-level pedestrian ways, Redmond Town Center, Redmond, Washington.
(Google Earth)

Parking

On many shopping sites, parking occupies most of the land. Planners recognize that a great deal is to be gained by innovative approaches to the location and design of parking areas, once a dusty subject governed by local regulations and department store demands.

Innovation begins with a close look at the amount of parking needed, which varies across the day, the week, and the year. When reduced to standards, in North America suburban shopping centers are typically expected to have 4–5 parking spaces per 1,000 retail sq ft (3.7–4.7 spaces per 100 m2). About 80% of this is for short-term shoppers, with the balance dedicated to employees and other long-term users. These standards

are based on a number of assumptions: the fraction of shoppers that arrive by car (100%), the number of shoppers in each vehicle, the appropriate design day (typically the 15th highest shopping day of the year), the highest peak accumulations on the design day, and other factors. Modify any of these assumptions and the resulting parking requirements will also vary. As an example, the amount of parking needed can be reduced by almost 20% by moving employee and other long-term parking off site during peak times of the year. Establishing bus routes to the center or incorporating a mass transit stop on the site can dramatically reduce the needed parking. In some cases, such as street-oriented retail where most people arrive on foot, a small number of metered parking spaces at the curb may be enough to satisfy the demand.

34.12 View of Redmond Town Center with upper-level connections, Redmond, Washington. (Gary Hack)

Parking accommodated in structures obviously requires a smaller footprint than parking in surface lots. In most situations, multistory garages only make sense if the land is valuable enough to offset the cost of structures—if it costs $50 per sq ft ($490 per m2) to build a parking structure and if three stories can be built, then it only makes sense to construct parking garages if the land value exceeds $150 per sq ft ($1,470 per m2). However, on any commercial site, parking areas should be considered as a land bank for future development and planned accordingly. Internal roadways should be established through the parking areas, and the dimensions of each area should be adequate to allow new uses to be developed on it, or to construct a multilevel parking structure replacing surface parking. Over time, shopping areas can then evolve into mixed-use areas of a shopping district. An excellent example of this approach to planning for future development may be seen at Redmond Town Center in suburban Seattle.

Flexibility

Shopping areas change more quickly than most other uses in the city. Retail shops grow stale and need to be refreshed; inventing new merchandise is essential to continued consumption; retailing techniques change as do the business organizations; and the demographics and development patterns around retail areas change, forcing shopping areas to adapt. Retail investments are amortized over relatively short time periods, typically 15–30 years, and once debt is discharged shopping areas are ripe for reinvestment. Of course, every retail use has its own logic of longevity—restaurants turn over very quickly, anchor stores are more durable (but subject to business consolidation), and specialty shops fall between, with some lasting a full generation. When the form of a shopping area is not capable of accommodating change, it can become a drag on all its

enterprises.

There are a number of strategies for dealing with change in shopping areas. The most obvious is locking in a market so that it is not easily eroded. Adding housing and workplaces to a shopping area assures a nearby market of consumers. If not at the outset, it may still be possible to provide future sites for these uses, such as through the conversion of parking areas. A second strategy is creating a hierarchy of shopping opportunities by intelligent land use planning of large sites. One of the principal motivations in developing the new town of Columbia, Maryland was to create a stable pattern of commercial centers. Its developer, the Rouse Companies, had seen too many of its retail centers eroded by larger new competing centers constructed a few miles down the road. A third strategy is deliberately planning for obsolescence. Rather than letting sites sit idle in a developing shopping area, *pop-up outlets* can be encouraged, or outdoor markets scheduled to draw people to the center. Later these can remain as incubators, or be replaced by more permanent structures as the market is proven.

Shopping areas need to be thought of as ever-changing places, where tradition and newness coexist and become embedded in the minds of their patrons.

Shopping Prototypes

Open-Air Markets

The oldest and simplest form of shopping area is the outdoor market. It dates from antiquity, and outdoor souqs and bazaars remain in cities throughout the world, but the outdoor market remains surprisingly relevant even in the most modern of cities. The past few decades have seen an explosion of green markets, farmer's markets, flea markets, antiques markets, flower markets, crafts fairs, night markets, and festival marketplaces. Holiday markets, such as the Christmas markets in most European cities, often occupy main public spaces (the Grand Place in Brussels, Piazza Navona in Rome, and Dilworth Plaza in Philadelphia, as examples). In addition, many older cities have one or more covered marketplaces that have experienced a revival as they have been discovered by a new generation of young urbanites.

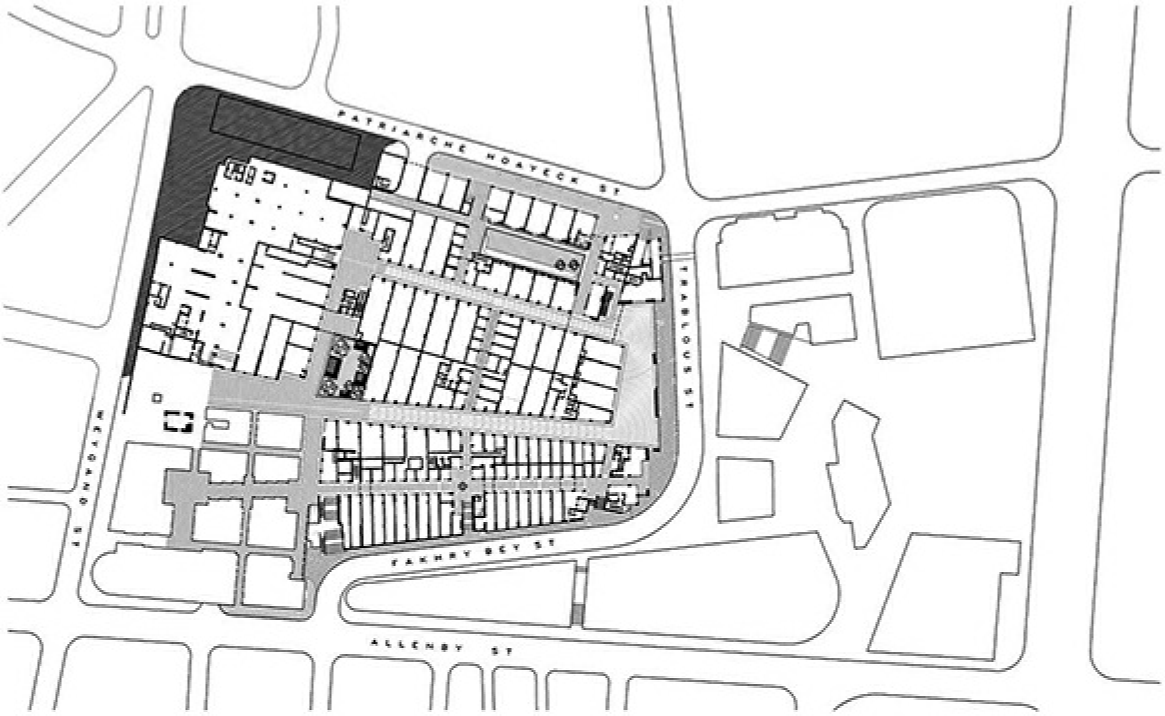
The wide range of open-air markets makes it difficult to generalize about size, layout, and facilities. A temporary weekend market may require nothing more than a weather-protected folding table and place to park the truck that arrived with the items to be sold. A more organized layout allocates bays of 14 by 30 ft (4 by 9 m) where small trucks can back up to and supply a vendor stand. Permanent vendor structures, such as those found in the flower market in Paris or Amsterdam's tulip market, are elaborate structures, capable of being locked at night so that the inventory need not be removed. The most rudimentary markets require electrical services to each stall, with water and waste removal facilities provided at points on the perimeter. Large public markets generally provide refrigeration facilities (small unites for each vendor or large shared rooms) to allow meats, dairy products, vegetables, and flowers to be stored for long periods.

34.13 Roanoke Farmers Market, with back-in stalls for vendors, Roanoke, Virginia.
(Courtesy of Julie Stone)

34.14 Dairy hall, Queen Victoria Market, Melbourne, Australia.
(Gary Hack)

34.15 Pike Place Market mixes temporary and permanent stalls, Seattle, Washington.
(Gary Hack)

The best *public markets* develop longstanding loyalties between merchants and their customers, and become social centers as well as places for transactions. They evolve over time, with merchants adding more permanent fixtures as their clientele grows. A proportion of the stalls may be permanently assigned, while other areas are reserved for daily or weekly usage. Market associations or municipal authorities commonly prescribe the hours of operation, character of tenant improvements allowed, size and type of signage, and type of merchandise that may be sold. The restrictions may go further: at Pike Place Market, vendors are limited to a single outlet and cannot be part of a chain of stores. An infamous lawsuit at Faneuil Hall Market in Boston contested the right of the market owner to restrict a merchant to selling fresh greens (specified in his lease), when it was considerably more profitable to shift to pizza and prepared foods; the owner prevailed.



34.16 Plan of new souq, Beirut, Lebanon.
(Courtesy of Studio Rafael Moneo)

34.17 View of new souq, Beirut, Lebanon.
(Courtesy of Solidere)

Several examples illustrate the possibilities. In Beirut, Lebanon, a new clothing and jewelry *souq* has been constructed as part of a larger complex that also includes a cinema, family entertainment center, department store, and food court. It is a modern interpretation of the traditional souq, skylit, with lines of traditional shops. In the Soweto community of Johannesburg, South Africa, a public market has been integrated into the design of a multimodal transportation center, allowing shoppers to purchase foods and sundries while they transfer from express to local buses. Merchants are assigned lockers to store their supplies overnight.

Large public market halls were once the pride of cities and remain important destinations for residents and visitors. The Oxford Covered Market acquired its roof in 1774 and remains today. The Central Market Hall in Budapest, Barcelona’s Mercado Santa Caterina, Reading Terminal

Market in Philadelphia, St. Lawrence Market in Toronto, and the Grand Central Market in Los Angeles are examples of public markets with citywide patronage. Smaller markets such as the waterside Old Market Hall in Helsinki, Byward Market in Ottawa, the Kitchener Market in Kitchener, Ontario, and the Lancaster Central Market in Lancaster, Pennsylvania are known for the specialty products characteristic of their regions. Several public markets, including Covent Garden Market in London, Vinohradský Pavilon in Prague, Faneuil Hall in Boston, and Pike Place in Seattle have been restored to accommodate a wider range of merchants—adding prepared foods, restaurants, crafts, and souvenirs in the main market hall, while surrounding it with boutiques and other shopping opportunities. The difficulty is retaining authentic market functions in the face of a crush of tourists who have little use for lettuce and cuts of beef. Among these, Pike Place has fared the best by being vigilant in its tenant mix, and retaining low-priced space on a lower level for unique businesses—hat blockers and barbershops—as well as fresh seafoods and seasonal fruits and vegetables on the main floor.

34.18 Aerial view of Santa Caterina Market, Barcelona.
(Courtesy of Enric Miralles and Benedetta Tagliabue–EMBT/Roland Halbe photo.)

34.19 Interior, Santa Caterina Market, Barcelona.
(Gary Hack)

Among newly constructed markets, the Granville Island Market in Vancouver is an excellent example of balancing local and tourist opportunities, permanent and temporary merchants, food and other products. It is organized around two-high spaces, with prepared foods concentrated on the water side with tables for those who wish to pause and eat, and produce for the home kitchen located near the entrance to ease loading. Design standards control the general appearance of permanent stalls, but leave considerable room for personalization.

34.20 Granville Island Public Market, Vancouver, Canada.
(Gary Hack)

34.21 Interior space, Granville Island Public Market.
(Gary Hack)

Convenience Shopping Centers

In new development areas, there may be a need for a small cluster of shops for the sale of convenience goods (food, drugs and sundries, and personal services), but not an established pattern of streets where these can locate organically. Creating a convenience center with shared parking is one solution; another is to use the center to establish a pedestrian realm with connections to residential areas that encourage walking. Such centers are usually anchored by a minimart or drug store selling convenience foods, and typically are smaller than 3,000 m2 (30,000 sq ft). They may also include a restaurant, fast food service, dry cleaner, beauty parlor, medical

or dental office, insurance agent, and other goods and services catering to local residents. In places where most people arrive by car, such centers typically require four parking spaces per 1,000 sq ft (100 m2) of gross leasable space, because of the rapid turnover of parkers, but in areas with a large fraction of customers arriving on foot, the parking can be correspondingly reduced.

The challenge in convenience centers is making them truly convenient for people on quick trips for a few items, while not favoring motorists over pedestrians. Many chains prefer parking at the front of the store, visible from the street, which forces walk-in patrons to navigate through parked cars to reach the entrance. There are other solutions: the entrances can be placed on the side and connected to the sidewalk, or a small courtyard can be created allowing several shops to share a pedestrian space, while each has direct access to a parking area. Windows on the street should be mandated, and buildings should hold the corner of blocks if at all possible, so that entrances can provide access from two directions. Convenience centers are also better if street frontages are lined with upper-floor offices—this is an ideal location for medical, insurance, or other necessary local services. Since an ideal location for a convenience center is near a public transit stop, it may also be a good location for upper-story housing. Mashpee Commons is an excellent example of a convenience center that has been redeveloped to become a town center for its area of Cape Cod.

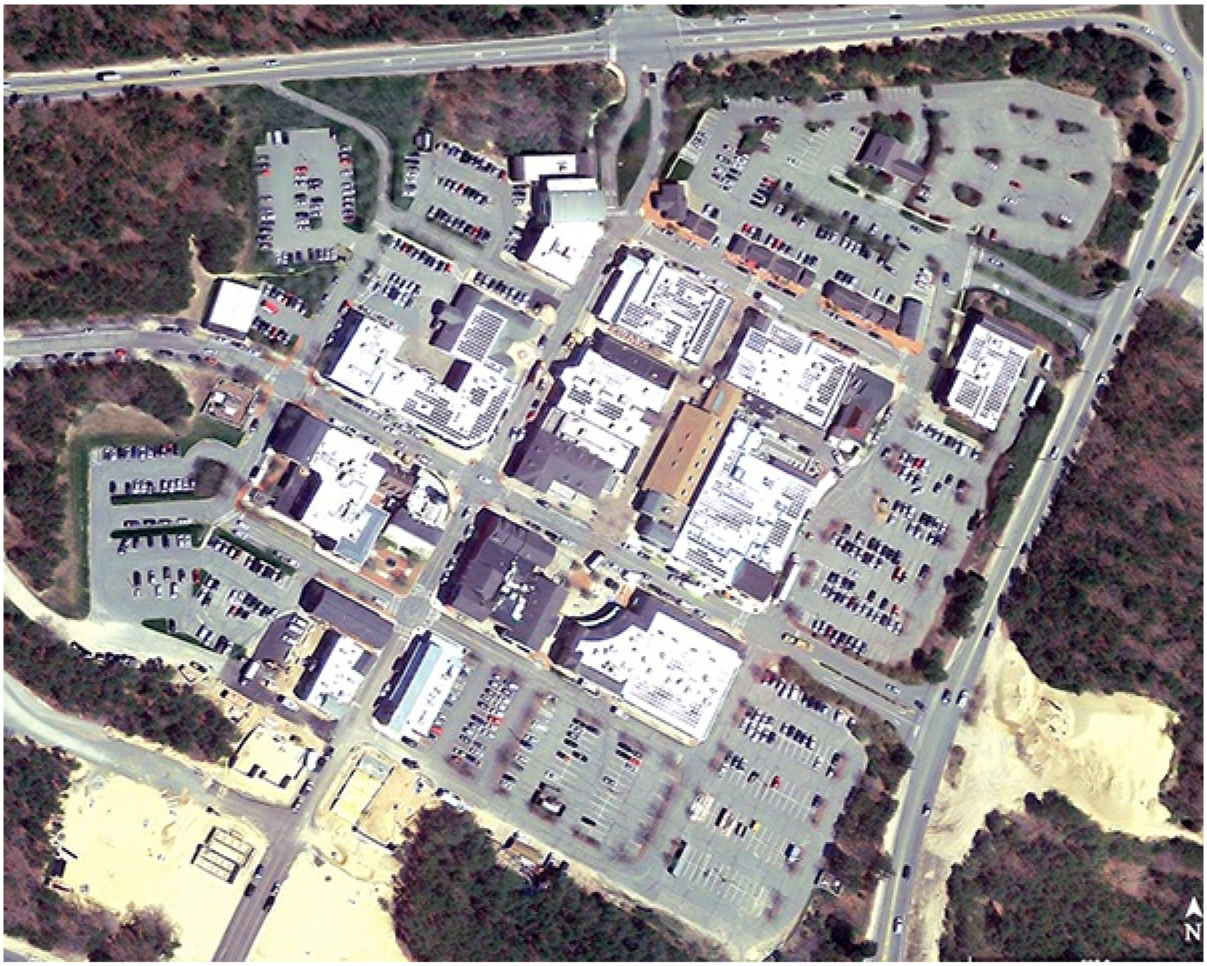
Sidebar 34.1

Mashpee Commons, Mashpee, Massachusetts

Mashpee Commons began its life as the New Seabury Shopping Center, a 62,000 sq ft convenience center anchored by a supermarket. It was redeveloped as an open-air center intended as a new town center for the area, providing sites for a wide array of new retail and public uses. Streets were introduced as frontages for the shops; parking was distributed into a number of small lots ultimately destined to be developed for housing and other uses. Over 25 years it has expanded to 110,000 sq ft, with 110 shops and

businesses. Solar panels have been installed on most of the rooftops, generating 48,000 kWh of energy per year.

Site planners: Duany Plater-Zyberk Associates.



34.22 Aerial view of Mashpee Commons, Mashpee, Massachusetts.
(Google Earth)

34.23 Original shopping center, New Seabury Village.
(Courtesy of Mashpee Commons LP)

34.24 Aerial view of current center.
(Courtesy of Sun Bug Solar)

Sidebar 34.1 (continued)

Mashpee Commons, Mashpee, Massachusetts

34.25 Current view of Mashpee Commons.

(Courtesy of Elizabeth Thomas Photography)

34.26 View of North Street shops, Mashpee Commons.
(John Phelan/Wikimedia Commons)

34.27 Mashpee Commons at night.
(Courtesy of Paul Blackmore/Mashpee Commons)

34.28 Long-range vision for Mashpee Commons includes housing, parks, and other retail uses. (Courtesy of Imai Keller Moore Architects)

Shopping Streets

Shopping streets are the mainstays of commerce in most cities. Many of them grew up in eras when most of their customers arrived on foot or via public transportation, and not surprisingly they prosper in cities where this remains the case. In planning sites, it is often possible to create a new main street or extend a shopping street that currently exists. A look at successful street-oriented shopping can provide lessons for design.

Street-oriented shopping works best when it is scaled to pedestrian capabilities. As shoppers walk along one side of the street, they are drawn into the shopfronts they pass by window displays and the brightly lit

interiors of the shops. Awnings may provide weather protection and draw the shopper closer, and tall trees will offer shade on a hot summer day. In good weather, merchants may move displays out into the street, or restaurants may appropriate sidewalk space for outdoor seating. But there is another view as well: across the street it will be the awnings, signs, and second floors that are most visible, with street traffic partly blocking the views of the sidewalk-level shop windows. Smart merchants will create upper-level displays meant to entice shoppers across the street. If pedestrian flows are constant, shoppers may wish to step out of the flow, rest, or carry on a conversation. Benches located in small eddies off the flow will offer a respite for a few moments.

34.29 Germantown Avenue, the shopping street of the Chestnut Hill neighborhood, Philadelphia.
(Gary Hack)

34.30 Shopping street, City Center, Reston, Virginia.
(Gary Hack)

With the pedestrian in mind, there are infinite ways to design a good shopping street. Ideally, it will be narrow enough that shoppers are not deterred from crossing—no more than two moving lanes of traffic in each direction, or three lanes on a one-directional street. Streets that are no more than 50 ft (15 m) between building faces can easily be designed as a unified shopping area; this can be stretched to 60 ft (18 m), but at 70 ft (21 m) it becomes difficult to entice shoppers to the opposite side. Sidewalks will be wide enough, at least 6 ft (1.8 m), to accommodate two people side by side while passing another, with additional space to handle outdoor displays by merchants or sidewalk cafés (see chapter 24). Blocks should be short enough that pedestrians can regularly navigate from side to side.

Continuity is an important factor in successful shopping streets. Areas that are broken up by driveways for hotels, entrances to parking areas, large lobbies for office buildings, or broad facades of banks or other

service institutions will lower the critical temperature of the street for shopping. If there is a choice, it is better to create narrow and deep retail spaces than broad and shallow, since it increases the opportunities along the pedestrian’s route. Along Broadway in New York, shops often occupy narrow frontages on the street which entice people in; shoppers are then transported on escalators to large merchandising spaces above or below ground. It may be possible to wrap portions of larger shops behind shallow shops, much as movie houses limited the width of their passageways to the street while creating grand spaces behind adjacent shops. Use of corners is also critical, since they signal the character of the street; banks and other “dead” frontages should be avoided there.

Arcaded streets have been created in a variety of places, providing weather protection while scaling the street to pedestrians. In Bern, Switzerland, these obviate the need for snow clearance, and many of the street-level arcades are heated by underground piping. Piazza San Marco in Venice is ringed by a two-story colonnaded space, as is the Plaza Mayor in Madrid. In San Miguel de Allende and many other Mexican cities, broad arcades offer a cool environment for shoppers, and many of these spaces are wide enough to accommodate outdoor dining in the shade of the colonnade. Traditional streets in South China cities, such as Guangzhou, are lined by shop houses with covered pedestrian passageways. This pattern has been institutionalized in Taipei for new buildings along major streets, but often they are not managed well, with the unfortunate result that the pedestrian area is often overcrowded with parked motorbikes. Successful arcaded streets offer patterns that can be emulated, as they have been in the center of the new community of Celebration, Florida.

However, arcades are often not ideal for shopping, since the covered areas are generally darker than the street space and shops are less visible. In the US, deeply recessed retail spaces have become anathema to most businesses. Some of the reservations are lessened if the colonnade is two stories or more in height, but this diminishes its value for weather protection.

34.31 Arcade along Piazza San Marco, Venice, Italy.
(Gary Hack)

34.32 Arcade along Main Street, Celebration, Florida.
(Gary Hack)

34.33 Parking at the rear of shops, connected to Main Street, Celebration, Florida.
(Gary Hack)

Accommodating parking is an important issue for street-oriented shopping. Parking at the curb may satisfy part of the need, but it needs to be restricted to short-turnover parkers lest employees and others capture all the spaces before the shoppers arrive. For high-end retailing, valet parking at the curb may be a solution. In a new development, it may be possible to locate parking below the retail spaces, accessible from cross streets so as to avoid gaps in the line of stores. The most common solution is to locate parking areas behind the retail frontage, either in open lots or in parking structures. With people arriving from the rear, a sure way to kill street-oriented shopping is to allow direct access into shops from the parking area, as this removes the incentive to walk along the street. Rather, a passageway or arcade should be created to bring customers to the street; this is an opportunity to locate small shops along the passage as well. The

same applies to underground parking (or parking above the shops): shoppers should be discharged on the street rather than deposited directly into a store. This makes sense from a security perspective as well, and allows parking areas to be used outside of shop hours.

Arcades

In many warm-weather cities, there is a tradition of draping fabric shades across streets to protect shoppers from the blazing sun. The great bazaar of Istanbul (begun in 1461) and the Cloth Hall of Isfahan (1585) were organized as a grid of covered streets and courtyards, with hundreds of market stalls. The Istanbul bazaar ultimately grew to 200,000 m2 (2 million sq ft) of shops.

Beginning in the early nineteenth century, cities in rainy and cold climates began to cover streets with glass, creating some of the most intimate and special shopping environments. These evolved into the street-level arcades that may be found today in cities across the globe. Entering all shops from the same level is the characteristic that distinguishes this form, although areas on upper levels may serve as extensions of the shops, or for offices or storage. The passageway is narrow and intimate, usually less than 10 m (32 ft) wide, with the height to the glass at least twice the distance between the shops. In most cases the ends of arcades are not enclosed but offer a respite from the bustling high street environment just outside. The most successful arcades either capitalize on pedestrian desire lines or provide anchors at their ends to draw people along their length, although exclusive collections of shops can become a destination in their own right.

The Burlington Arcade, opened in 1819 in London, remains a remarkable model for the shopping arcade. Located just behind Bond

Street, the 3 m (10 ft) wide pedestrian passageway extends for 177 m (580 ft) between Piccadilly and Burlington Gardens. It is lined with 72 small 2.8 by 4.6 m (10 by 15 ft) two-story shop units, some of which have been combined into double-width shops. Curved glass shopfronts serve as sparkling vitrines for the merchandise, and the mannerist Victorian facades create an environment of exclusivity. The arcade has served an upscale market successfully for almost two centuries.

The Burlington Arcade spurred the construction of many other European arcades, including the Galerie Vivienne in Paris (1826), the Galeries Royales Saint-Hubert in Brussels (1830, the first of seven such galleries in the city), and the Passage in St. Petersburg (1848). Each outdid its predecessor, replacing intimacy with the environment of the grand salon. The idea also migrated to the cities of the new world, and among the best examples is the Royal Arcade in Melbourne, Australia (1869) (see figure 34.7). Many other arcades were constructed in Melbourne to capture the shopping potential of the thousands of commuters who rush from Flinders Station to the Collins Street business district.

The street-level arcade remains an important prototype for organizing shopping areas. At Prudential Center in Boston, windswept outdoor spaces were enclosed by creating an X-shaped pattern of arcades, connecting the main destinations beyond the site—Copley Place, the Hynes Convention Center, and the Back Bay and South End neighborhoods. The width of the arcades (typically 28 ft or 8.5 m) was determined by the spacing of columns in the parking garage below, and their capacity also limited the height of retail uses to a single story. Although larger in scale, the arcades at Prudential Center capture some of the quality of the earlier European arcades. The shopping area is among the most successful of its type in the United States (see figure 34.4).

Many Japanese cities have enclosed back streets to make shopping arcades. Among the most successful is Hondori Street in Hiroshima. An arched glass roof at the fourth-story level covers this 10 m (32 ft) wide street, lined with individual buildings and a great variety of shops ranging

from boutiques to food shops, restaurants, movie houses, and mass market outlets. A number of the stores occupy multiple levels, although each has only one entrance, at street level. Department stores and large electronics stores anchor the ends of the street, located parallel to a main street of banks and institutions, served by trams. Trucks service the individual shops from the pedestrian street during off hours.

34.34 North entrance, Burlington Arcade, London.
(© Andrew Dunn/Wikimedia Commons)

34.35 Covered shopping street, Hondori Street, Hiroshima, Japan.
(Gary Hack)

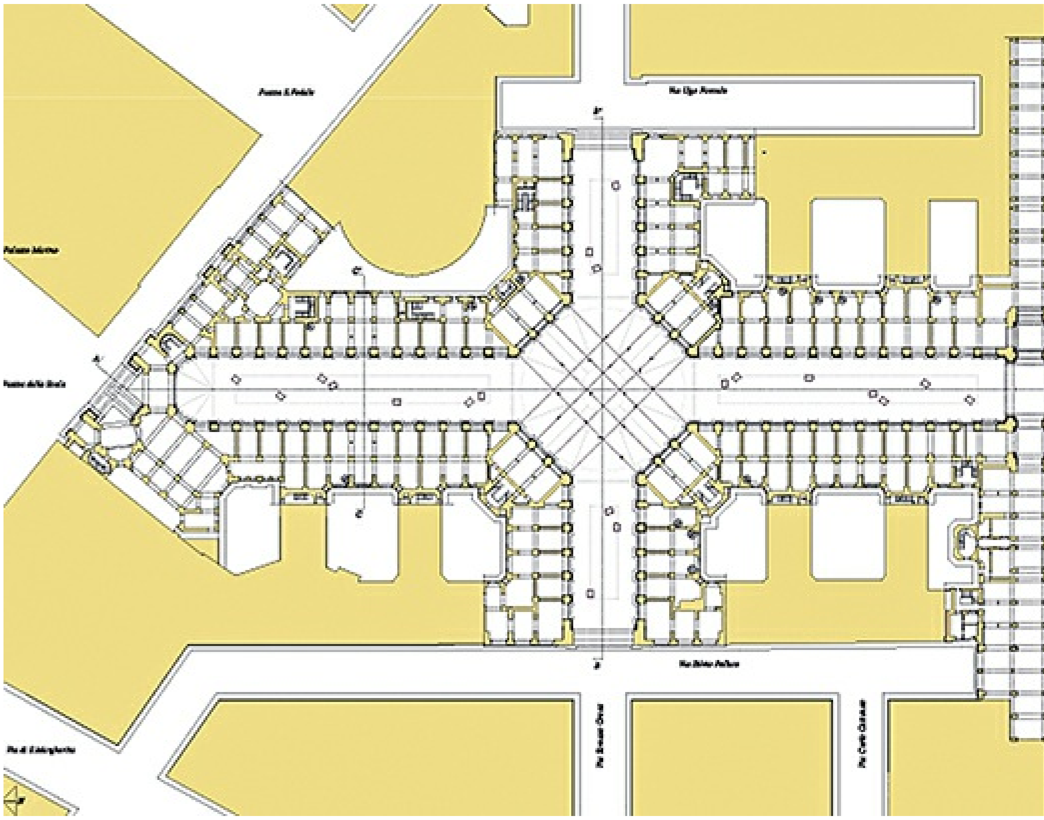
Gallerias

As arcades became ever larger, they evolved into multilevel shopping complexes, sometimes incorporating offices or services on upper floors. Although they are often called arcades, we distinguish gallerias from the street-level arcades just discussed by their multiple levels of shopping (and often offices) and more expansive spaces enclosed under glass (Geist 1982). The Galleria Vittorio Emanuele II in Milan is the best-known

prototype for the galleria, and has been emulated throughout the world. Opened in 1864, it faces Piazza del Duomo, the major public square of the city with its cathedral on one side, and Teatro alla Scala and its smaller square on the other side. Providing 45,000 m2 (484,000 sq ft) of occupied space on seven levels, the 1,260 rooms of the complex house shops on the ground floor and mezzanine level, rented clubrooms, offices, and studios on the third level, and four levels of residential apartments. The generous 14.5 m (48.5 ft) wide public passageways total 1,150 m2 (12,300 sq ft), with portions devoted to sidewalk cafés and displays. Ground- and mezzanine-level shops range from department stores, showrooms, and haute couture to coffeehouses, boutiques, and souvenir shops. The arched glass roof soars 29 m (96 ft) above the pedestrian walkway, and the central dome rises to almost 50 m (164 ft). The scale of this public space makes the Galleria the center of Milan life.

The idea of the shopping galleria spread throughout Europe and the new world during the late nineteenth century. Not to be outdone, Naples built the Galleria Umberto I across from its opera house, consisting of four glazed passageways intersecting at a grand dome even taller than Milan’s. The GUM (formerly New Trade Halls) in Moscow was the most expansive arcade in Europe, occupying a full city block of 90 by 250 m (295 by 820 ft). Three major arcades and three smaller transverse passageways—all glazed above—provide access to over 1,000 shops, organized in 16 blocks. GUM was designed with two levels of shopping throughout, topped by two levels of offices.

In the US, impressive multilevel arcades were constructed in Cleveland and Providence. The Cleveland Arcade, built in 1890, accommodated over 100 shops on two levels, with three levels of offices located above. It was a retail destination, bordered by two 9-story office structures, rather than a passageway from street to street. In recent years, the upper floors of the arcade have been converted into a boutique hotel, with lower levels remaining as specialty shops and services.



34.36

Plan, Galleria Vittorio Emanuele II, Milan.
(Courtesy of Archiventil.com)

34.37

Entrance to Galleria Vittorio Emanuele II from the Duomo, Milan.
(Gary Hack)

34.38

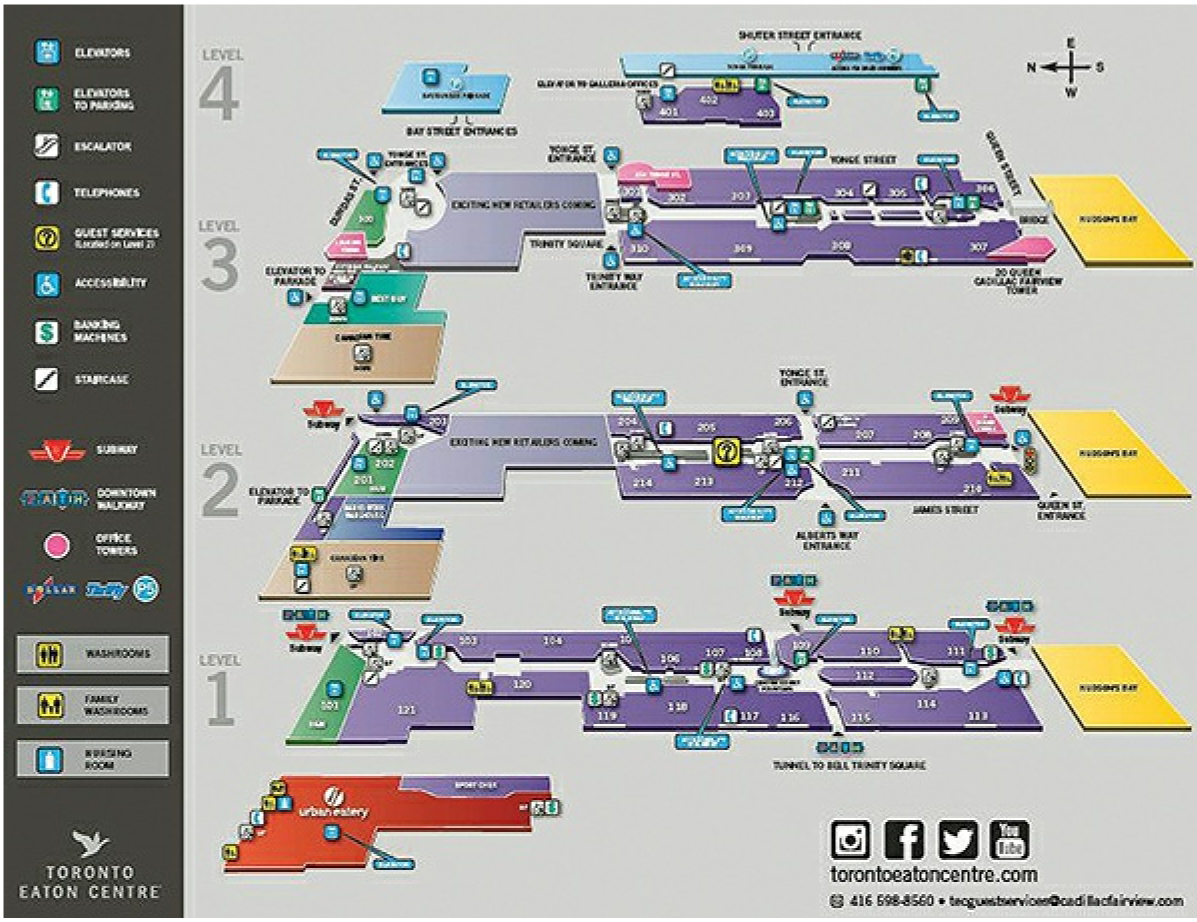
Dining and shopping, Galleria Vittorio Emanuele II, Milan.
(Gary Hack)

34.39

Galleria at GUM Department Store, Moscow.
(Assawin Chomjit/123rf.com)

These impressive structures have provided the model for many contemporary shopping centers. Per-haps the best contemporary galleria is Eaton Centre in Toronto, a massive 145,000 m2 (1,560,000 sq ft) structure with five levels of shopping concourses stretching 275 m (890 ft) and topped by a 28 m (90 ft) high glass-vaulted roof. Shoppers are drawn into the shopping levels from the underground transit concourse (level 1), through street-level entrances (levels 2 and 3), via a bridge to an adjacent department store (level 3), and from elevators serving a 1,650-space parking structure that parallels the center (to levels 3, 4, and 5). The balancing of entrance routes assures activity on all the shopping levels. Its 250 shops run the full gamut from a large department store to mass merchandise outlets to boutiques to restaurants and services to a multiscreen theater complex. Offices line the four upper levels of the

galleria, and two large office buildings and a hotel are directly attached to the complex.



34.40 Diagram of five-level Eaton Centre, Toronto.
(Courtesy of Cadillac Fairview Corporation)

34.41 Garish exterior of Eaton Centre in 2010 reflects the adjacent Yonge Street shopping district, Toronto.
(Maris Luksis/flickr)

34.42 Interior galleria space, Eaton Centre, Toronto.
(Gary Hack)

Community Shopping Centers

At the opposite extreme are planned shopping centers that serve a distinctly local market. Community shopping centers are typically anchored by a supermarket or superstore that combines grocery shopping with a pharmacy and other convenience goods and services. As these outlets have grown in size, they have internalized many of the items that would otherwise have been found in independent stores and now may range from 3,000 to 10,000 m2 (32,000–108,000 sq ft), and half or more of the area may be represented by the anchor store. It will require a base of at least 10,000 residents to support it.

A number of early community shopping centers continue to serve as models of human-scaled locally oriented shopping areas that are the center of community life. Country Club Plaza, opened in 1924 and modeled on a Moorish village of shops and courtyards, was an upscale early development in Kansas City, Missouri. Highland Park Village Shopping Center in Dallas, Texas, built in 1931, followed this lead. While it has been refreshed and upgraded over the years, its charming central space, graced by a fountain, and its Spanish colonial architecture continue to give it special character. River Oaks Shopping Center in Houston, Texas was among the first “modern” centers, constructed in 1937 in the deco style. Its first tenants were food and liquor stores, beauty and barbershops, a drug store, a tailor-cleaner, flower and gift shops, an electric supply store, and women’s clothing outlets. It remains today an important center for the neighborhood, and while a supermarket remains the anchor, it has attracted bookstores, designer furniture stores, art galleries, fashion shops, a movie theater, and no fewer than 18 restaurants and specialty food stores—perhaps a reflection of the changing character of the surrounding area.

34.43 Aerial view, Highland Park Village, one of the earliest community shopping centers, Dallas, Texas.
(Courtesy of Terry Theiss Photography)

With anchors the size of current supermarkets or superstores, which grow ever larger each year, the site planning challenge of community shopping areas is to create a center that is more than a large box with a few shops appended surrounded by a sea of cars. There are several strategies that can help overcome this. One is to create a transit-oriented center, where a significant fraction of shoppers arrives via mass transit or buses or transfer between them. Since those arriving are already on foot in this case, grouping businesses around pedestrian areas is a logical step. An excellent example is Fruitvale Village (sometimes called Fruitvale Transit Village) in Oakland, California, serving a low-income community and planned with their considerable input. Shoppers are drawn into the center from the BART mass transit station and bus loading area, and many may make a stop before walking home or going to their parked vehicles in the park-

and-ride lot. Fruitvale Village illustrates the general principles in planning effective transit-oriented community commercial centers. Mixing uses is essential, so that people coming to or passing through the center can do several things at once—see a doctor, purchase a greeting card, drop off a book at the library, as well as get their daily or weekly supply of groceries. There should be clear walking routes connecting the center with adjacent areas. And the flow should ensure that people pass by the shops en route to their automobiles, or see them while making a transfer between transit modes. There should be places to stop and grab a cup of coffee with a friend you unexpectedly met. It should be designed for all ages, from young children needing a diversion to elderly wishing to watch the passing crowd (and children). Supermarkets that cater to transit passengers and pedestrians typically are smaller in size, often 30,000 sq ft (2,800 m2) or less. And transit-oriented community shopping centers economize on parking: at transit stops in Washington, DC, supermarket operators can get away with 3 parking spaces per 1,000 sq ft (1 space per 30 m2) rather than the 5 that are typical for suburban locations.

European cities offer many examples of fine transit-oriented developments; they have been the prevailing pattern for many years, and every city with a transit or tram system has streets lined with community-oriented shopping. Where larger sites are available at key locations on transit lines, community-scale shopping areas have been constructed. A nice example is the small but successful Sonnenschiff complex, built as part of the Solarsiedlung experiment in Vauban, Freiburg, Germany. Anchored by an organic supermarket, it provides 1,160 m2 (12,500 sq ft) of shopping and 3,800 m2 (40,900 sq ft) of offices for professional services needed by the Vauban community, at the key transit stop for the neighborhood. The development is topped by residential penthouses.

Sidebar 34.2

Fruitvale Village, Oakland, California

Fruitvale Village is a transit-oriented development adjacent to the BART

station, which is also an important transfer point for those taking buses. The 45,000 sq ft (4,200 m2) of retail and restaurant spaces include a supermarket, bank, coffee shop, record shop, beauty salon, bakery, and other uses. In addition, there are 45,000 sq ft (4,200 m2) devoted to offices and neighborhood services, including a library, senior center, child development center, health clinic, and a variety of local services. Rental housing is located on the second and third floors of each of the buildings. Overall, the site contains 250,000 sq ft (23,200 m2) of space, and will be extended through successive phases.

Site planners: McLarand, Vasquez & Partners.

34.44 Plan of Fruitvale Village, Oakland, California.
(Courtesy of McLarand, Vasquez & Partners)

34.45 BART Fruitvale Village transit station.
(Eric Fredericks/Flickr/Creative Commons)

34.46 Shopping and services street.
(Gary Hack)

34.47 Entrance to Fruitvale Village from neighborhood.
(Gary Hack)

34.48 Close connection to shops on adjacent street.
(Gary Hack)

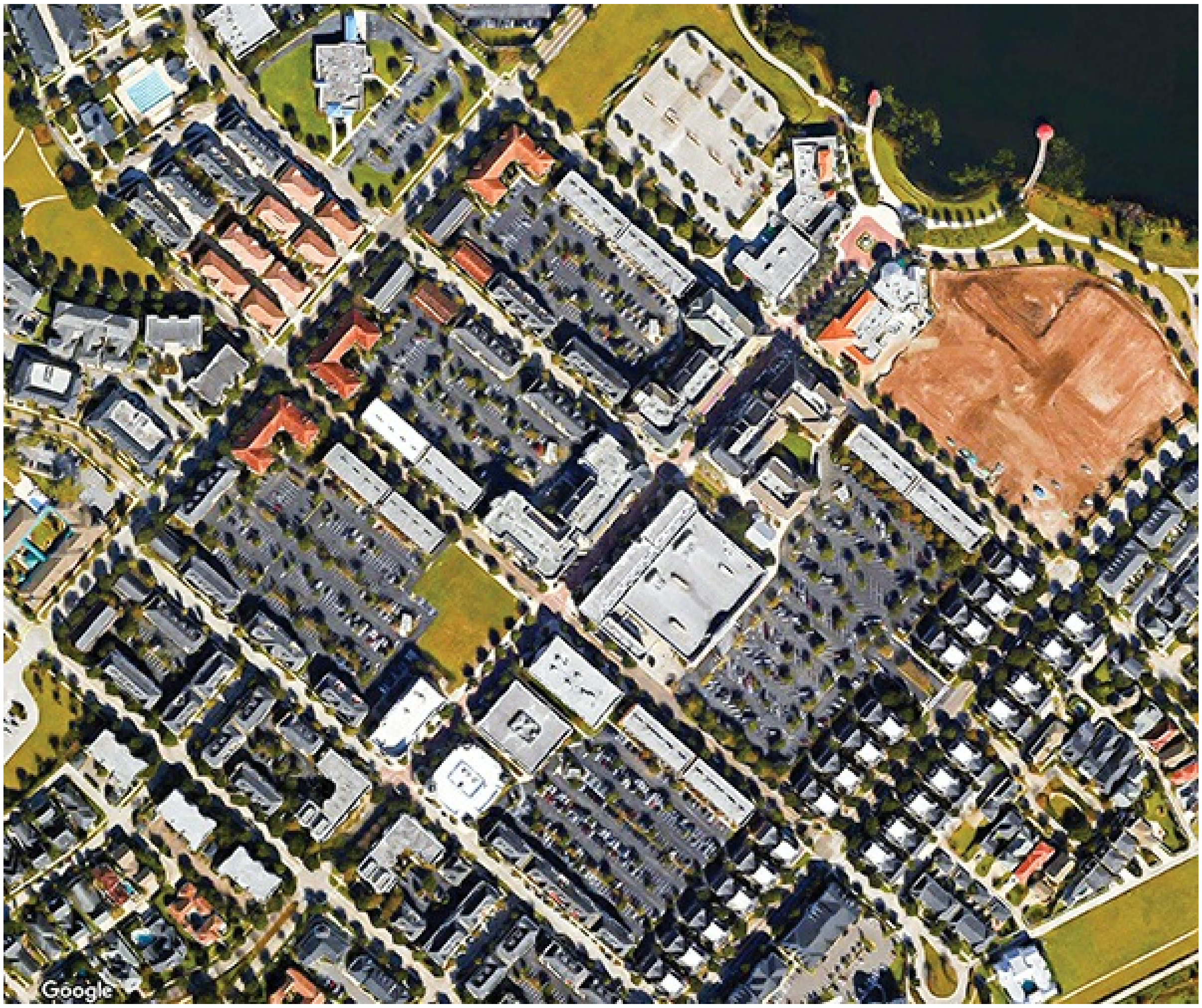
34.49 Stairway to second-level services and housing above, also served by elevator.
(Gary Hack)

A second strategy for community shopping centers is to organize them as a main street for the community with parking areas at the rear. Issues in street-oriented shopping have been discussed previously, but when planned de novo, local shopping streets can achieve a balance of retail, entertainment, services, office, and residential uses that assure synergy between the uses and a 24-hour life for the center. It is important to array the uses so that shoppers are drawn beyond their initial destination. Flows between offices, housing, restaurants, and shopping are the critical planning framework. A good example of how these might be organized is at Baldwin Park Village Center, in Orlando, Florida. This new main street consists of 212,000 sq ft (19,700 m2) of commercial space, including a supermarket, drug store, restaurants, boutiques, and two large bank branches. Layered over the retail uses are 117 apartments and office space. The supermarket, located in the center of the area, has dual entrances to the main street and rear parking area, and is able to serve those who arrive either on foot or by car. Unlike most such centers, this one was built at an early stage in the development of the Baldwin Park community, to establish the commercial presence and help market the development as a full-service community.

What can be done when most people arrive by automobile and there aren't sizable nearby commercial concentrations or high-density residential areas? Creating a multipurpose public space at the center of the shops is a good first step, a place that can be used as a farmer's market, venue for festivals and performances, and other important community events. The Highland Park center in Dallas illustrates just how powerfully such a space can shape a community's identity. Incorporating important civic and religious facilities, such as libraries, community recreation centers, arts centers, and religious structures, in the center will also help establish its importance beyond the commercial uses. This approach was taken in planning the village centers of Columbia, Maryland, and while the commercial uses have met with mixed success—the small supermarkets didn't fare well in competition with megamarkets farther away and have

been replaced by drugstores and other uses—the centers have remained important anchors of community life. Beyond these moves, it is important to tame the parking areas through landscape that protects against heat island effects, and creative planning that allows them to be used for alternative purposes during off periods.

34.50 Sonnenschiff mixed-use center at Vauban transit stop, Freiburg, Germany.
(Gary Hack)



34.51 Aerial view of downtown, Baldwin Park, Florida.
(Google Earth)

34.52 View of Main Street, Baldwin Park, Florida.
(Better Cities & Towns)

Regional Shopping Centers

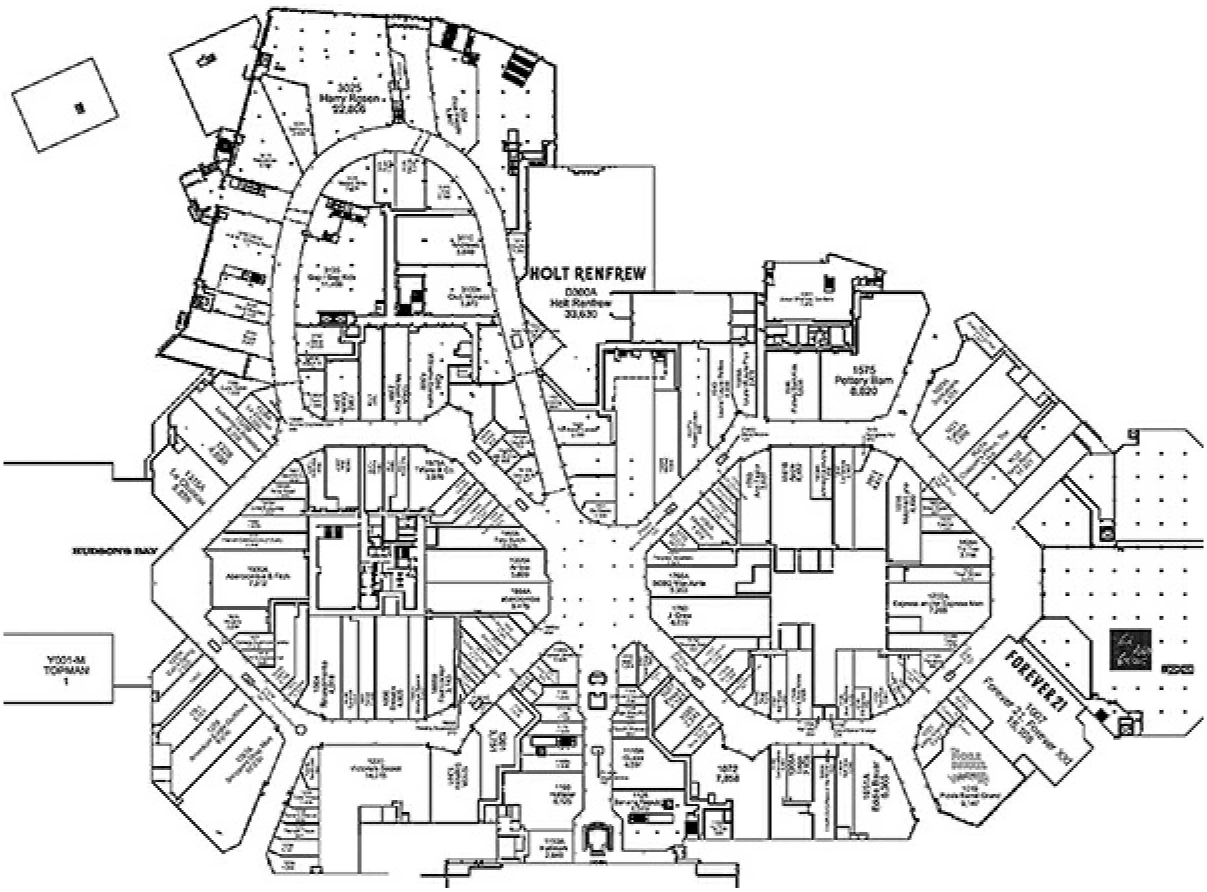
Regional shopping centers, which became known as “malls,” have their origins in the desire of department store chains to expand into the rapidly urbanizing suburbs of American cities during the 1950s. Victor Gruen, who was largely responsible for developing the prototype, saw them as social centers for suburbanites that could function equally in all weather with their covered central spaces. Southdale Center in Edina, Minnesota, opened in 1956, was the first fully enclosed modern shopping center, and

the first to have two levels of retail spaces—a reinvention of the basic principles of the nineteenth-century arcades. At Southdale, about 60% of the shoppers enter at the upper level, a trick achieved by creatively regrading parking areas to alternate between sloping toward and away from the center. Within a decade, virtually every American city had its version of the suburban mall, and they have found their way around the globe wherever cities have the ability to support chains of retail outlets. Indeed, the uniformity of spaces and configurations in shopping centers made possible the growth of international retailing chains, allowing them to roll out the same products and store designs from city to city and across continents.

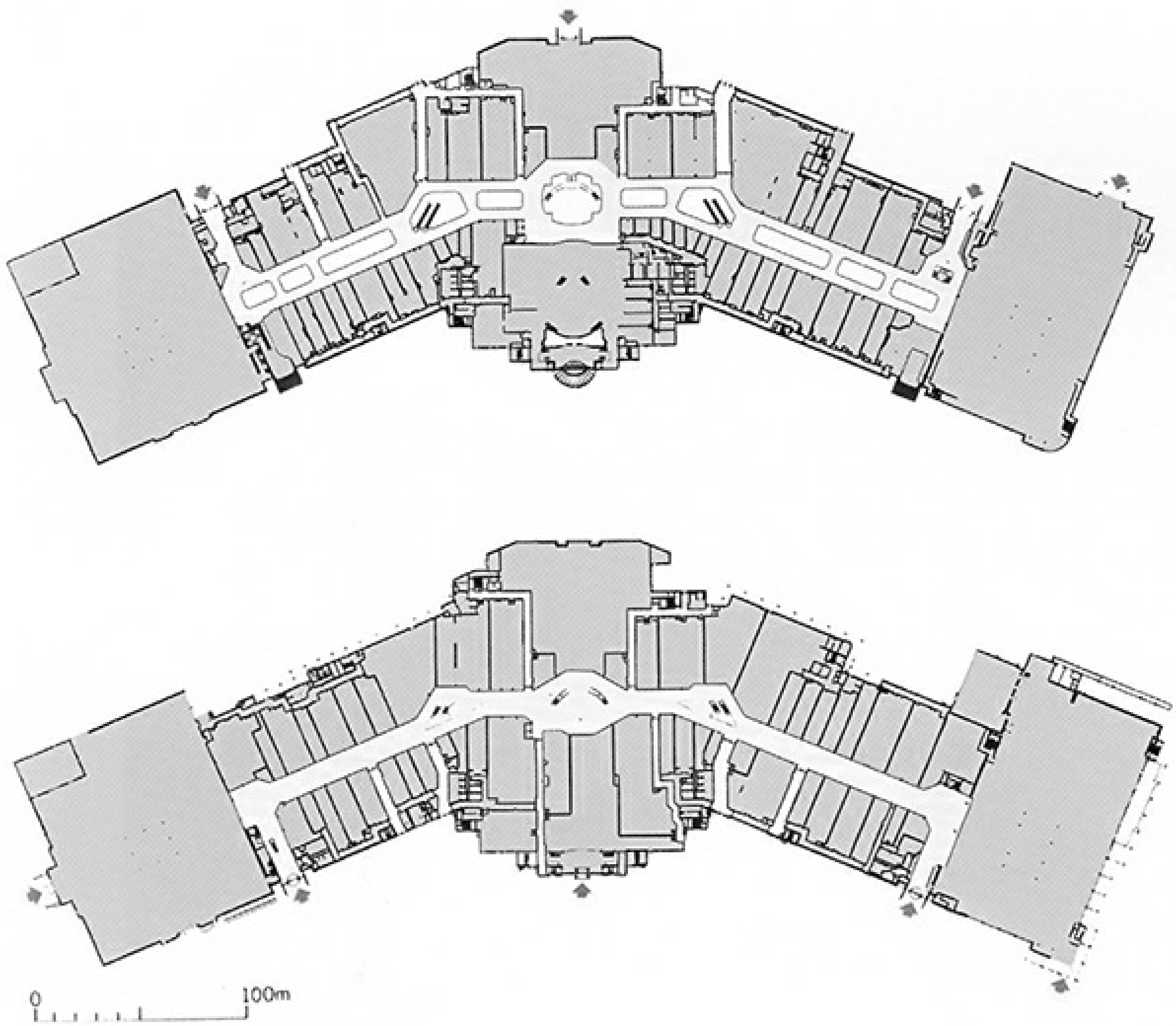
The earliest shopping centers typically had two department stores as anchors, which were placed at the ends of a dumbbell plan with specialty stores between. Soon centers were able to attract three or four anchors, and other configurations were needed—resulting in L or T or X shapes. When the number of anchors climbed to 6 or 8, some centers decided to create parallel connections, creating a *racetrack circulation pattern* or a figure-eight. Others simply grew longer but created kinks in the pattern to limit the perceived distance from end to end. Still other centers adopted multifloor configurations to shorten the distance between anchors. One result of layering was that the mall spaces needed to grow wider so that shopfronts on upper levels were visible to shoppers on the floor below. This, in turn created the opportunity to locate *vending carts* and *sales kiosks* in the center of the wider malls. One delightful accidental discovery was the *food court*, which owes its origins to the fact that one anchor dropped out of the mix just as the large Sherway Gardens Shopping Center was being completed in Toronto. Not wanting a dead spot, the developers installed temporary food vendors and dining tables, and these were an instant success. Today the food court is almost synonymous with the shopping center.

34.53 Aerial view of first enclosed two-level shopping mall, Southdale Center, Edina, Minnesota.
(Victor Gruen/Minnesota Historical Society)

34.54 Interior space, Southdale Center, Edina, Minnesota.
(Bobak Ha’Eri/Wikimedia Commons)



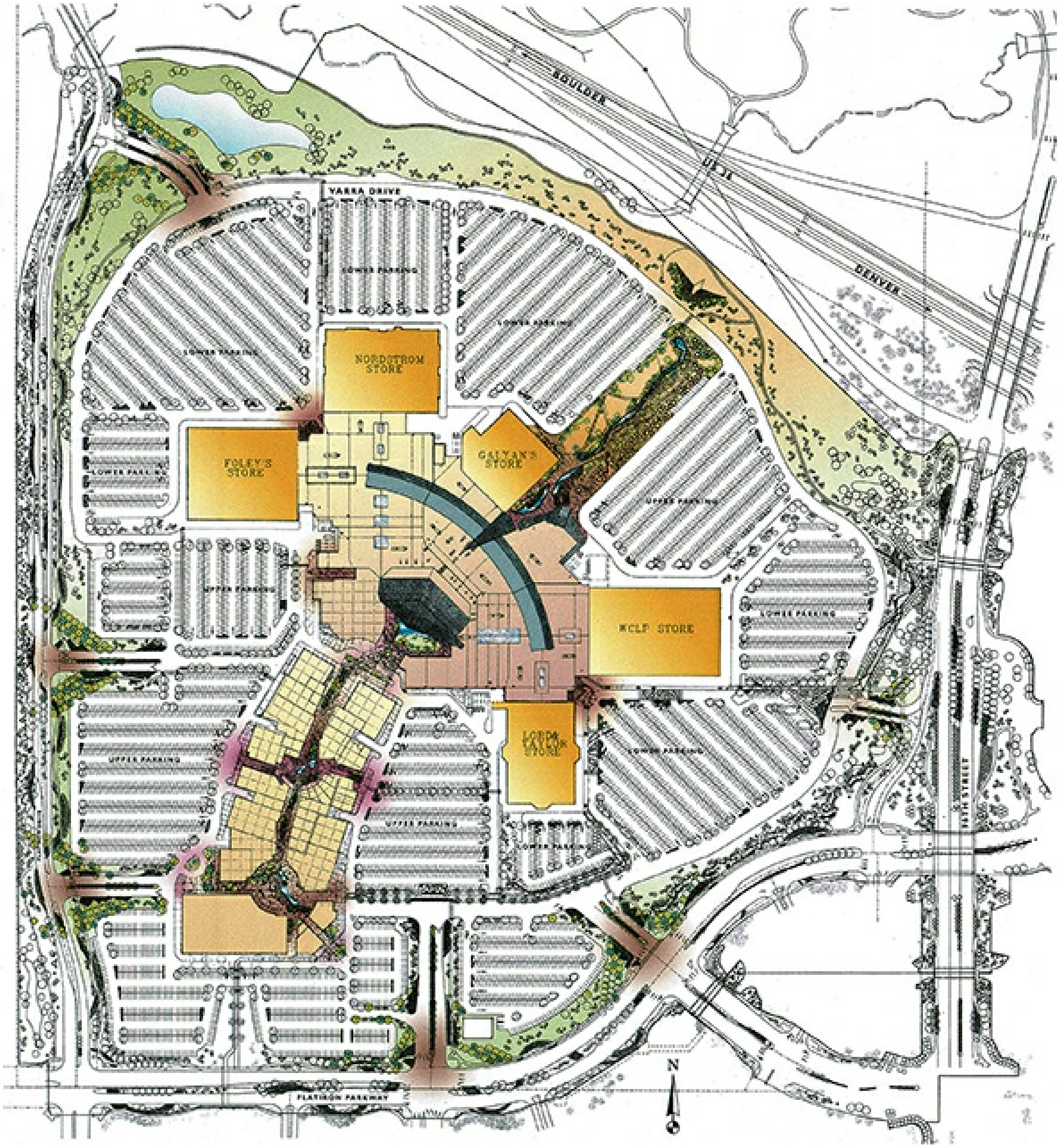
34.55 Figure-eight circulation path at Sherway Gardens, Toronto.
(Courtesy of Cadillac Fairview Corporation)



34.56 Plan, Mall at Cribbs Causeway, Bristol, UK.
(M & G Real Estate Limited)

34.57 Entrance portal and atrium at Mall at Cribbs Causeway, Bristol, UK.

(Valela/Wikimedia Commons)



34.58 Plan, mall with indoor and outdoor components, FlatIron Crossing, Broomfield, Colorado.
(Courtesy of © CallisonRTKL)

Conventional patterns of regional malls channel shoppers through the anchor stores that guard the ends of the pedestrian promenades, or in through minor entrances on the sides, lined with shops. This creates a sense of enclosure and control in the mall spaces, where shoppers have

only retail spaces in view. The merchants may prefer this, but it contributes to a relentless commercial experience of visiting a mall. Newer regional centers strive for a greater sense of welcome by creating a grand entrance pavilion which opens up to the full range of offerings available. A good example of this is The Mall at Cribbs Causeway, in Bristol, England, where a galleria-scale entrance transports visitors into the center of the complex; from there they begin their journey to the two anchor stores and shops between.

With the proliferation of enclosed regional shopping malls in the US, Europe, and Asia, shoppers have become bored with the uniformity of their appearance and the retail outlets they house—seen one, seen ’em all! Creative developers have consciously adopted layouts and materials that make reference to regional themes as a strategy for establishing a unique identity. This began at Horton Plaza in San Diego, which shunned the roof over the public space and reestablished open-air shopping, albeit on many levels, taking advantage of the city’s glorious climate. In Colorado, where the winter climate can be severe, an opposite approach has proved successful: designing regional centers that remind shoppers of the magnificent mountain lodges in the nearby Rockies. Park Meadows in Littleton, Colorado was the first to do this, and it has been followed by FlatIron Crossing, a large regional resort mall in nearby Broomfield. At FlatIron Crossing, the exposed timber structure, natural lighting, wooden floors, roaring fireplaces, and the clustering of shops selling outdoors equipment provide a welcoming and informal environment.

34.59 Materials and spaces attempt to capture regional character, FlatIron Crossing, Broomfield, Colorado.
(Courtesy of © CallisonRTKL)

As regional shopping centers have grown ever larger in size and

pedestrian zones have multiplied in area, designers have needed to find ways to differentiate public areas by varying activities, themes, or character. This is carried to the extreme in the gigantic 482,000 m2 (5.3 million sq ft) West Edmonton Mall, where each area is dominated by an activity—the Galaxyland Amusement Park, the Waterpark, the Sea Lion's rock, the Deep Sea Adventure, Europa Boulevard, the Pirate Ship, the Skating Rink, and on and on (see figure 34.10). The website for the mall offers three-day itineraries for visitors. The Mall of the Americas, by the same developer, applies this idea in a more sophisticated way, differentiating each leg of the mall by form, function, and character. Another strategy for differentiating a center is creating separate but linked areas for each type of opportunity: specialty shopping, home improvement, entertainment and dining, and so on.

The Easton Town Center in suburban Columbus, Ohio adopts a different approach to breaking down the scale of a regional center. The large (750,000 sq ft or 70,000 m2) shopping area is organized as three distinct zones: one devoted to conventional retailing, anchored by a department store and organized as street-oriented shopping; the second largely devoted to food and beverage outlets, distributed around a town square where events are held; and a third, connecting the other two, consisting of a large enclosed cinema-anchored entertainment complex. The variety of spaces, and capacity to expand each area horizontally as the demand materializes, offers the potential for organic growth and change evolving into a true commercial district.

The emergence of *big box branded* (category killer) retailers that prefer to locate in freestanding stores poses a problem in planning regional shopping centers. Frequently they are strung out along arteries leading to planned centers, siphoning off the demand that might otherwise be captured by the center. There is good reason to accommodate them in a regional center, but how can this be done in a way that gives the branded retailer freestanding visibility while gaining synergy by their presence alongside conventional outlets? Cracking this dilemma requires the

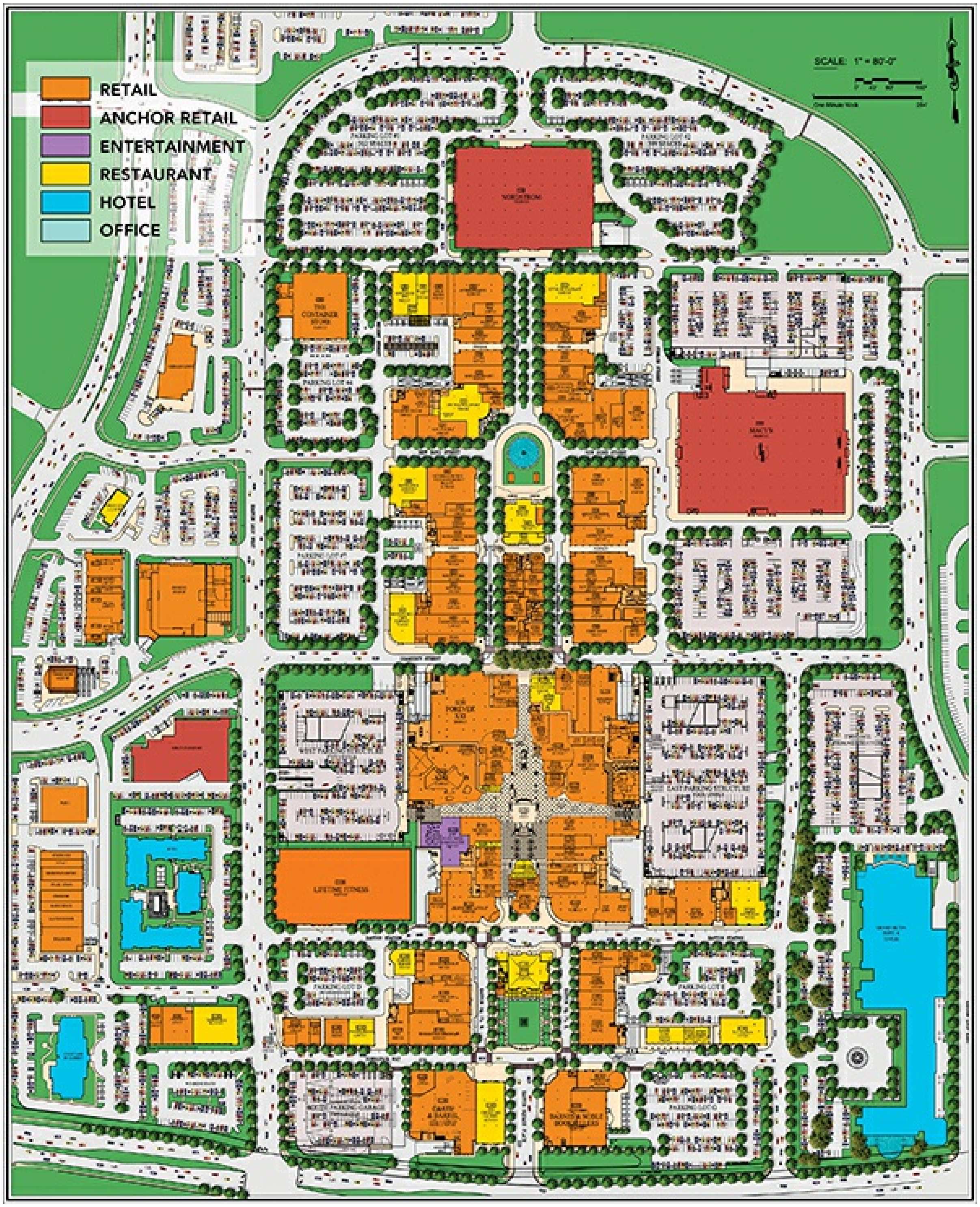
program for regional centers to be rethought as well as their form.

Sidebar 34.3

Easton Town Center, Columbus, Ohio

Easton Town Center was intended to be more than a shopping center, serving as a town center for the surrounding suburban area. Its large commercial areas, totaling 750,000 sq ft (70,000 m2), are organized in three clusters: an area for conventional shops fronting on streets on the north, a food and beverage area centering on the Town Square on the south, and an enclosed entertainment complex between. The area is surrounded by moderate-density housing and offices, providing a built-in clientele for the shopping.

Site planners: DGG.



34.60 Plan of Easton Town Center retail area, Columbus, Ohio. (Courtesy of DDG Architecture and Planning)

34.61 Town Square with eating and beverage places surrounding.
(Gary Hack)

34.62 Street-oriented shopping area.
(Gary Hack)

34.63 Shopping areas with view to entertainment complex.
(Gary Hack)

34.64 Indoor space at entertainment area.
(Gary Hack)

34.65 Street connecting shopping area and adjacent office complex.
(Gary Hack)

34.66 Housing across the street from Town Square.

(Courtesy of Rob Wilson/Easton Commons/Morgan Communities)

Desert Ridge Marketplace in Phoenix, Arizona offers an instructive example of how a new form of regional center can be created by often-competing types of commercial uses. Totaling 1.2 million sq ft (111,480 m2), it combines on one site a specialty mall, power center, and neighborhood center. At the core of the site is The District, focusing on *lifestyle retailing*, entertainment, and restaurants and centered on an outdoor palm-shaded environment. This area includes a cinema, food court, outdoor video screen, live performance stage, rock climbing wall, and children's play area. This is the draw that will entice shoppers from the peripheral areas where large hard goods, health and leisure, and neighborhood convenience stores are clustered. Walkways connect the perimeter shopping to the center, and all areas share the band of parking between the two.

In Europe and Asia, fortunately, it is impossible to emulate the spread-out character of American regional centers. Land is simply too valuable to develop at such low intensities, a larger fraction of customers arrives on foot or by public transport, and public authorities exercise greater control over the siting of regional centers. As a result, multifloor centers are more the rule, as are parking structures and direct connections to transit and adjacent development areas. The challenge is to create public spaces that are memorable, and that entice people to walk or take escalators to shopping levels aboveground.

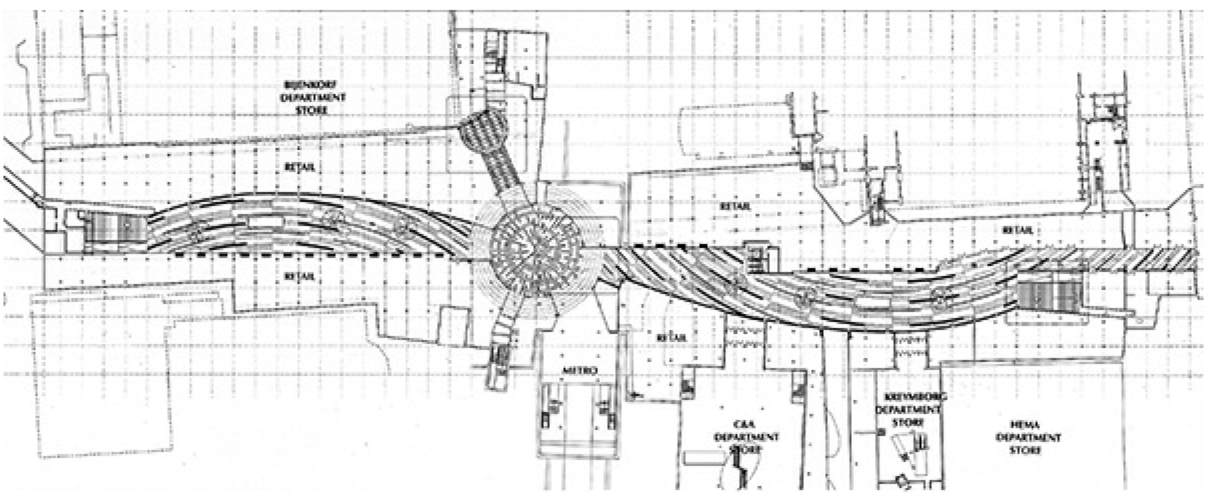
34.67 Aerial view of Desert Ridge Marketplace, Phoenix, Arizona.
(Google Earth)

34.68 Entertainment area at the center of The District, Desert Ridge Marketplace, Phoenix. (Courtesy of Vestar Development)

Some of the best recent examples of regional centers connect to and extend the streets in central areas of cities. The Beursplein in Rotterdam, Netherlands reshaped an existing street as a pedestrian zone, and provides weather-protected access to shops on two levels connecting the city's two main shopping areas. Over 70,000 passengers exit the Metro station located at the center of this street and flow toward the two ends. At the Bullring, in Birmingham, England, a new enclosed street was created, drawing customers from the three axial streets which connect with the high streets of the city. The dumbbell plan of the center includes two department stores and retail shops on three levels, taking advantage of the substantial topographic differences of the site.

In Asia, the pressures to develop high-intensity retail centers are even

greater. At Canal City in Fukuoka, Japan, a new outdoor street has been created connecting the business and entertainment quarters of the city. Taking its cue from the multiple canals that lace through the city, water is the central theme of the four-level central space, which is dotted with dancing water fountains, performance spaces, and public art and lined with 44,000 m2 (474,000 sq ft) of retail space. The ground level along the canal is largely devoted to food and beverages, with upper levels offering a full range of comparison shopping. The five-star hotel and office development that surround the canal street, and its direct connections with the mass transit system, ensure that the center is filled with energy throughout the day and evening.



34.69 Plan of Beursplein belowground shopping concourse, Rotterdam, Netherlands.
(Courtesy of The Jerde Partnership, Inc.)

34.70 View of the Beursplein shopping concourse.
(Gary Hack)

34.71 Central space in Canal City, Fukuoka, Japan.
(Gary Hack)

The formula of diverting potential shoppers through a commercial center, rather than leaving them on city streets, has become the tried and true approach in dense urban locations. The challenge is achieving this without deadening the streets around the complex. It is important to maintain the continuity of retail street frontages. This means identifying outlets that can function with dual entrance conditions. Department stores benefit from the flow between the street and the mall, and restaurants, food stores, and coffeehouses offer good transitional uses between indoor and outdoor walkways.

Entertainment-Based Areas

All shopping is a blend of necessity and entertainment. Of course, shopping areas have long attracted minstrels, human sculptures, street performers, sidewalk artists, vendors, and spectacles of all descriptions—offered free or with only gentle coercion to tip. The creation of festival marketplaces in American cities (a joint production of the Rouse Companies and architect Benjamin Thompson) established a new formula for retailing based on food halls, carefully screened performances, pushcarts, crafts outlets, artisanal products, bars, and restaurants, surrounded by more established merchants. These shopping areas have attracted a large following among tourists and nearby workers, and while the novelty has worn off, they remain important venues in Boston (Faneuil Hall Marketplace), Baltimore (Harborplace), and San Francisco (Ferry Plaza). More recently the idea has taken root in China, spurred by the success of Xintiandi in Shanghai (see chapter 2). Its blend of historical architecture (mostly reconstructed), lively public spaces, outdoor cafés,

top-level restaurants, and unique shops has attracted crowds of young Shanghaiese as well as tourists. Dozens of similar projects are under way in China and other Asian cities. And in Bahrain, the Souk Madinat has been developed around antiques, crafts, traditional clothes and household items, and restaurants.

34.72 Plan of Victoria and Alfred Waterfront, with new retail complex, Cape Town, South Africa.
(City of Cape Town)

The revitalization of waterfront areas has provided a wealth of opportunities to create retail complexes that mix entertainment and shopping. Waterfronts provide an instant attraction, particularly if elements of the working or recreational waterfront are kept in place, and water tempers the climate, particularly in warm-weather cities. They are a wonderful place to spend evenings, and retail programs for waterfront

developments are generally weighted toward restaurants, bars, and nightclubs. One of the most successful waterfront shopping complexes is the Victoria and Alfred Waterfront development in Cape Town, South Africa. Hugging three sides of the city’s former shipping basin, it adapts old buildings for retail and office uses, and a large new two-level mall has been added to accommodate international brands. An outdoor performance venue on the water attracts visitors and entertains restaurant patrons dining on the terraces which face it. The complex is designed for the cool evenings when thousands throng to the waterfront. With its constricted site, most of the parking for the complex is accommodated in parking structures that line the perimeter access road.

Universal CityWalk in Los Angeles was among the first entertainment-based shopping centers in the world created de novo. Located near Universal Studios’ sprawling collection of movie production lots, performance stages, theme parks, and destination resorts, it contains 310,000 sq ft (28,800 m2) devoted to a megaplex cinema and other entertainment venues (comedy club, amphitheater for live performances, motion simulator, night spots, etc.), restaurants, and themed retail establishments, specializing in those with some relevance to movies or entertainment. CityWalk is organized along a three-block pedestrian street, something of a rarity in Los Angeles, stretching from the entrance to the Universal Theme Park to the cinema plaza and its cluster of entertainment spots. The complex topography of the site, and high opportunity costs, makes surface parking difficult, and much of the parking for CityWalk is located above the retail outlets, or provided through valet and off-site service arrangements. CityWalk has been duplicated by Universal in Orlando, Florida and other locations, and has been widely emulated by other developers including Disney.

34.73 Night view of waterfront, with outdoor dining, Victoria and Alfred Waterfront.
(Gary Hack)

34.74 Night view of Ferris wheel and walkways, Victoria and Alfred Waterfront.
(Gary Hack)

The cinema is an important anchor for other entertainment-based retail centers. Sony Center in Berlin is organized around a large public space that is the center of the Berlin Film Festival and a place for live performances year around. A large Sony-sponsored theater complex, a museum devoted to the German cinema, and a film archive reinforce the special character of this place, which is lined with shops and restaurants. The Denver Pavilions, in Denver, Colorado, is also anchored by a large cinema complex. This 347,000 sq ft (33,000 m2) complex contains a mixture of restaurants and entertainment venues, along with leisure and lifestyle merchants like Nike that cater to the city’s attachment to outdoor living and professional sports.

34.75 Universal CityWalk, three blocks of entertainment and food, Los Angeles, California. (Courtesy of Visit California)

The Kansas City Power and Light District is an eight-block area, once the theater district of the city, that had largely become a scene of parking lots and blighted buildings. It is being redeveloped as a restaurant, nightlife, movie, and performing arts area. The construction of the Sprint Center, an arena for basketball and other events, provides a draw to the

area, which has been capitalized upon by the construction of the College Basketball Hall of Fame, bowling alleys, brew pubs, a dozen restaurants, and commercial spaces. Kansas City Live, a large covered space at the center of a key block, has become a venue for outdoor performances, and the streets in the area have been upgraded to make them pedestrian-friendly. The Kansas City Music Hall, a magnificent art deco structure next to the district, has been lovingly restored and serves as a performing arts center; the Empire Theater has been adapted to become a six-screen digital cinema. Hotels are opening in the area, which promises to become the city's hot spot for visitors and locals.

34.76 Vision for Kansas City Power and Light District, Kansas City, Missouri.
(Courtesy of The Jerde Partnership Inc./William Cornelli)

34.77 Pregame rally for Big 12 Championships, in the plaza beside Sprint Arena, Kansas City Power and Light District.
(Courtesy of Chris Crum Photography/KC Power and Light District)

The best entertainment retail districts, as in Kansas City, make the most of local historic resources, old structures, and the archive of memories about a city's past. They are at their best when they retain an edgy quality. As the area around Pike Place Market in Seattle was being upgraded into a restaurant district, the rallying cry was "don't fix it up too much!" The French Quarter of New Orleans draws tourists from around the world; while it is safe and respectable to walk the streets and browse in the bars and shops, one does not want to look too closely at all the activities in the area. Japanese cities have succeeded in retaining restaurant and bar districts, *hanamachi*, usually near stations, which titillate but do not offend. The Kagurazaka (geisha district) and Kabukicho (red-light) areas near Shinjuku Station in Tokyo come to mind. Entertainment districts are the antidote to the sanitized shopping areas that contemporary malls have become. A new generation of consumers is seeking a better mix of authenticity and opportunity

35 | Workplaces

Workplaces are the second most important places in our lives—and for careerists, geeks, and those totally absorbed by their work, may even overshadow their homes. Work occurs in offices, factories, warehouses, research facilities, and institutions, but also in homes, shopping places, even public spaces such as libraries and parks. Much of the workaday world is custom-designed to fit the business or organization it supports. No two factories are the same, and there is wide variation in the site demands of other types of workplaces. We cannot cover all of these here, but confine our discussion to the most common repetitive forms of buildings and sites devoted to production and services.

The Changing Nature of Work

There are many ways we could typologize the workforce to help us understand the types of environments and estimate the amount of space that are needed for it. At the highest level, The International Labour Organization has created a three-digit system for classifying *occupations* which provides a useful way of comparing employment internationally, nationally, and between organizations (http://www.ilo.org/public/english/bureau/stat/isco/isco88/index.htm.

These categories may be a good checklist in preparing the program for a site, although organizations that will occupy the space may have their own employment categories, managed by their human resources departments. At the simplest level we often distinguish between *white-collar workers*, who are housed largely in office environments, and *blue-collar workers*, the service and factory workers who spend their days in places of production. In recent years, *no-collar workers* have emerged as a third category—creative workers who work in design and artistic fields, who combine conceptual work with making products. These categories oversimplify the type of work people do, but they allow us to think about generic types of space and environments.

Every occupation is facing major changes today, the result of automation, artificial intelligence, networks for collaboration, and global *supply chains*. Many occupations that existed a decade or two ago are becoming extinct as automation replaces assembly workers on the factory floor, checkout clerks at the grocery market, and stock brokers taking orders for investment houses. Jobs are being outsourced or moved abroad, benefiting lower-cost production countries but displacing workers in more developed countries. The number of software engineers and app designers has expanded dramatically, partially offsetting this loss, and workers who remain in production roles have had to learn new skills to master their new tasks. *Artificial intelligence* breakthroughs will accelerate this progress by eliminating many service workers and call centers and by simplifying diagnostic tasks. All of this change is the result of ubiquitous networks, cloud computing and data storage, and the expanded bandwidth that supports virtual presence in the work environment and beyond. Most sophisticated products today are designed, manufactured, and assembled in multiple countries, and organizations mirror their supply chains and sales patterns across national boundaries.

What do these changes mean for the planning of sites and environments for work? The obvious answer is the need for *high-capacity information networks* that can be upgraded regularly without disrupting current

activities. *Adaptability* is a second characteristic—businesses, products, processes, and the types of employees change rapidly, and large open workspaces are generally preferred over smaller cubicle spaces. Adapting industrial loft buildings is one route to providing the flexibility that will be needed in the future for office or custom production work. *Organizations* are becoming *flatter*, more *lattice-like* with *less hierarchy*, and collaboration is the watchword of the day. Organization charts are changed at lightning speed to fit the urgency of the business cycle, which also favors flexible environments. Allowing for a changeable future is the third imperative.

A fourth important thrust shaping the economic landscape of workplaces is the reduction of inventories, with *just-in-time supply chains* and global production arrangements. This is most evident in the manufacturing sector, where components may originate in several countries and products may be assembled in several places before reaching their final destination. But it also results in massive *logistics warehouses* that distribute to a wide area. The basic frame of an automobile may be created in Japan, then shipped to Europe for addition of interiors and finishes, allowing deliveries within a week or two of customers' orders. The equivalent in the service sector is the large number of organizations that collaborate in carrying out an assignment using networked staff from various offices, or assembling them temporarily in one place.

Many businesses must now compete internationally, and attracting talent from a global pool becomes the key to business (or sometimes governmental) success. This places a premium on environments that promote loyalty by satisfying needs beyond the desk or workstation—offering places to enjoy lunches, workout areas for exercising or outdoor areas for team sports, even places for cultural enrichment. The best work environments deal with employees as valued participants, and planning sites with this in mind plays an important role in supporting them.

35.1 District Hall, Boston innovation district.
(Gary Hack)

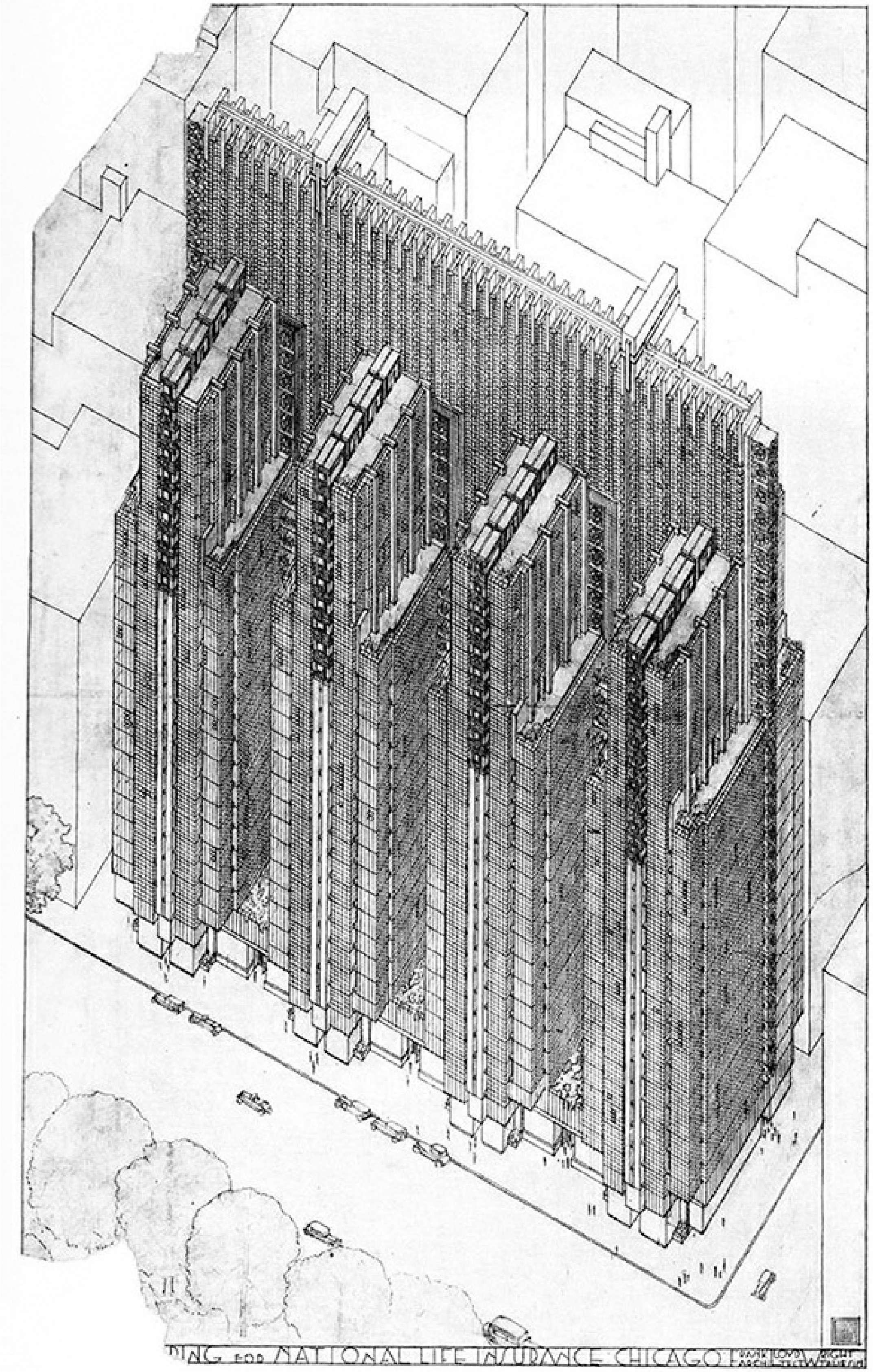
Finally, in many countries a new class of employees has emerged—the *freelancer*. Self-employed or moving between organizations, their permanent base may be in their home or in a shared work space, their conference room may be the corner coffee shop, and their file cabinet is the cloud. In the US over 25% of employees are freelancers, by choice or not, including some of the most innovative and skilled workers. Cities across the globe are creating facilities to promote freelance work, including co-working spaces and places for collaboration. Boston's District Hall, in the heart of its innovation district, is a fine example.

We will return to each of these themes as we consider the most common types of workplaces.

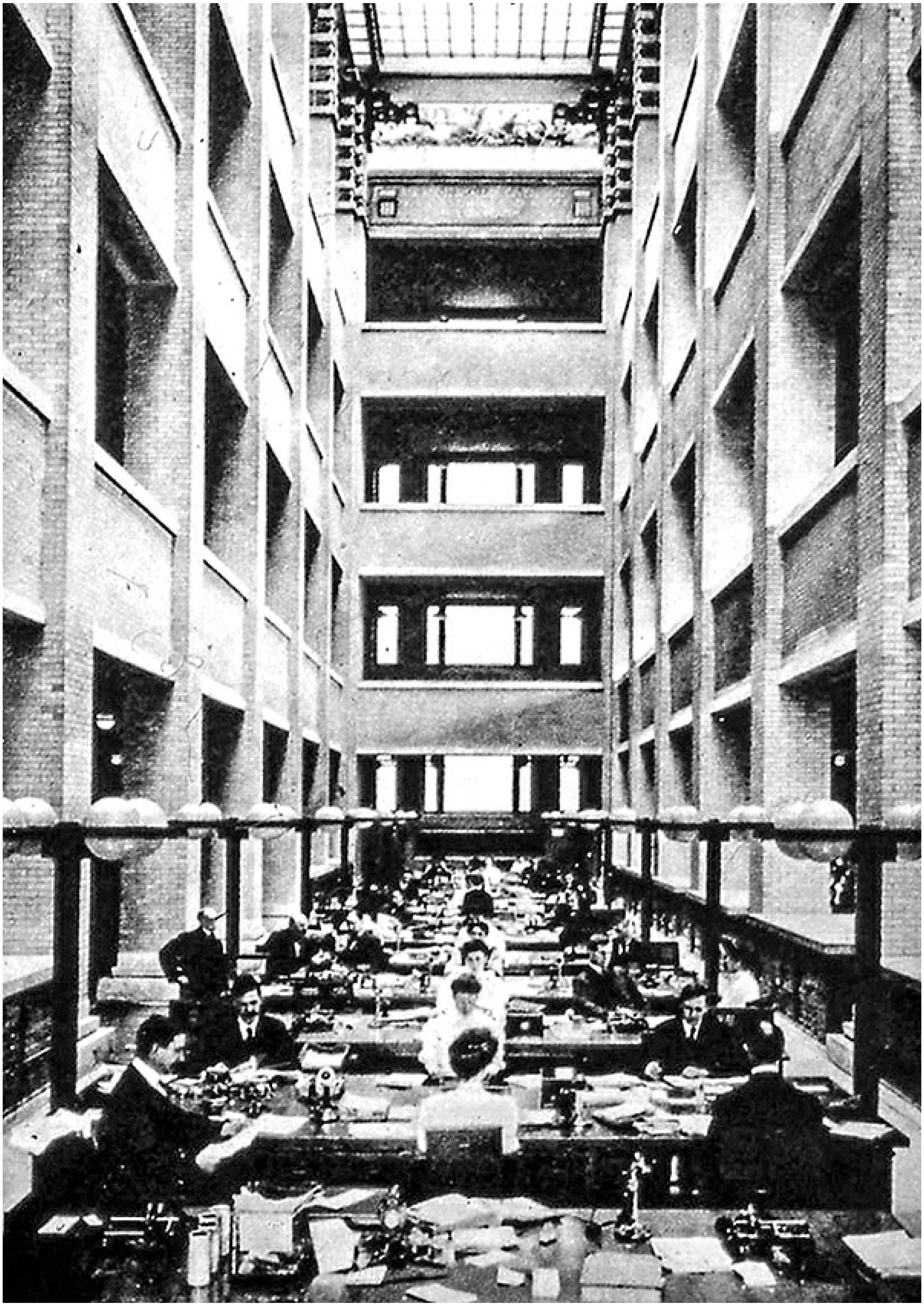
Offices

Buildings and sites for administrative offices are a product of the early twentieth century, when large industrial corporations grew up and differentiated their headquarters from their manufacturing functions. The first office buildings were typically located on the factory grounds, but as companies grew and created multiple manufacturing locations, being close to financial markets and attracting skilled managerial talent led to relocating administrative offices to central business districts. The emergence of large banks, insurance companies, law firms, and other service enterprises further concentrated office space in the largest cities, with iconic structures owned by brand-name companies being built side by side with speculative rental buildings owned by real estate investors. The growth of governments had a parallel trajectory, initially focusing on the construction of large civic centers that combined legislative, judicial, and administrative functions, but by the 1920s in the US creating separate structures to house the growing bureaucracies.

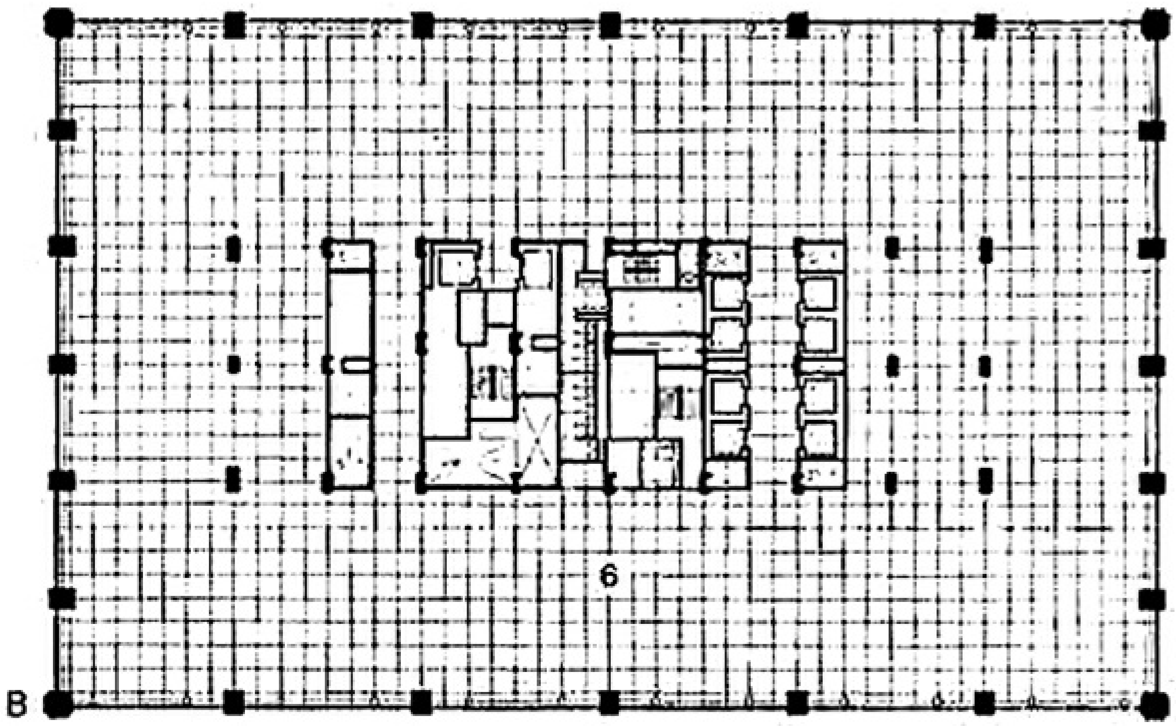
35.2 Glass facade, Reliance Co. Building, Chicago, Burnham and Root, 1890.
(Gary Hack)


DING FOR NATIONAL LIFE INSURANCE CHICAGO

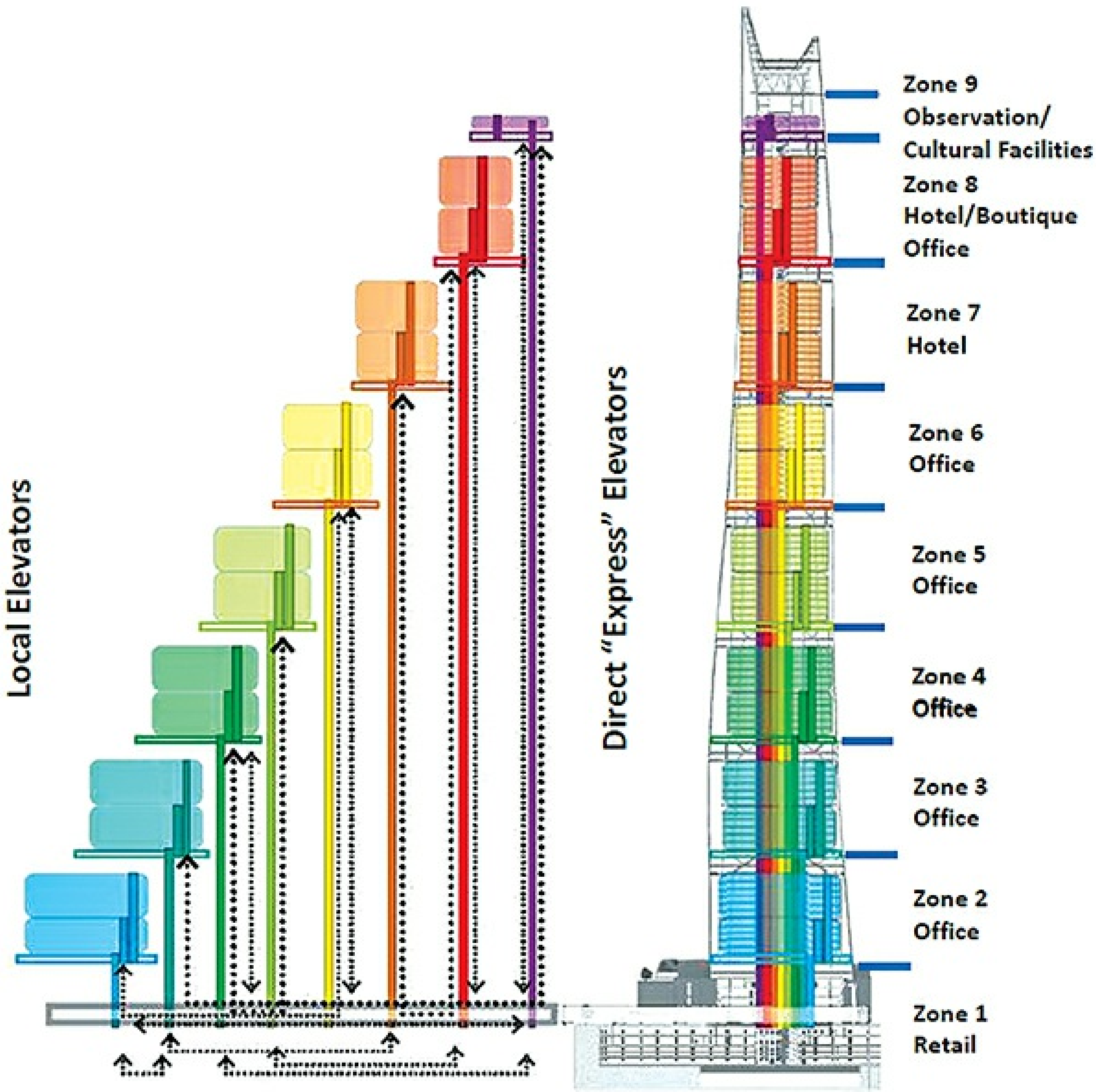
35.3 Proposal for National Life Insurance Company headquarters, Chicago.
(Frank Lloyd Wright, 1924)



35.4 Interior atrium, Larkin Administration Building, Buffalo, New York, Frank Lloyd Wright, 1904.
(Library of Congress)



35.5 Typical office floor plan (office floor plates are smaller on higher floors), John Hancock Center, Chicago.
(Roger Sherman/Skidmore Owings and Merrill)

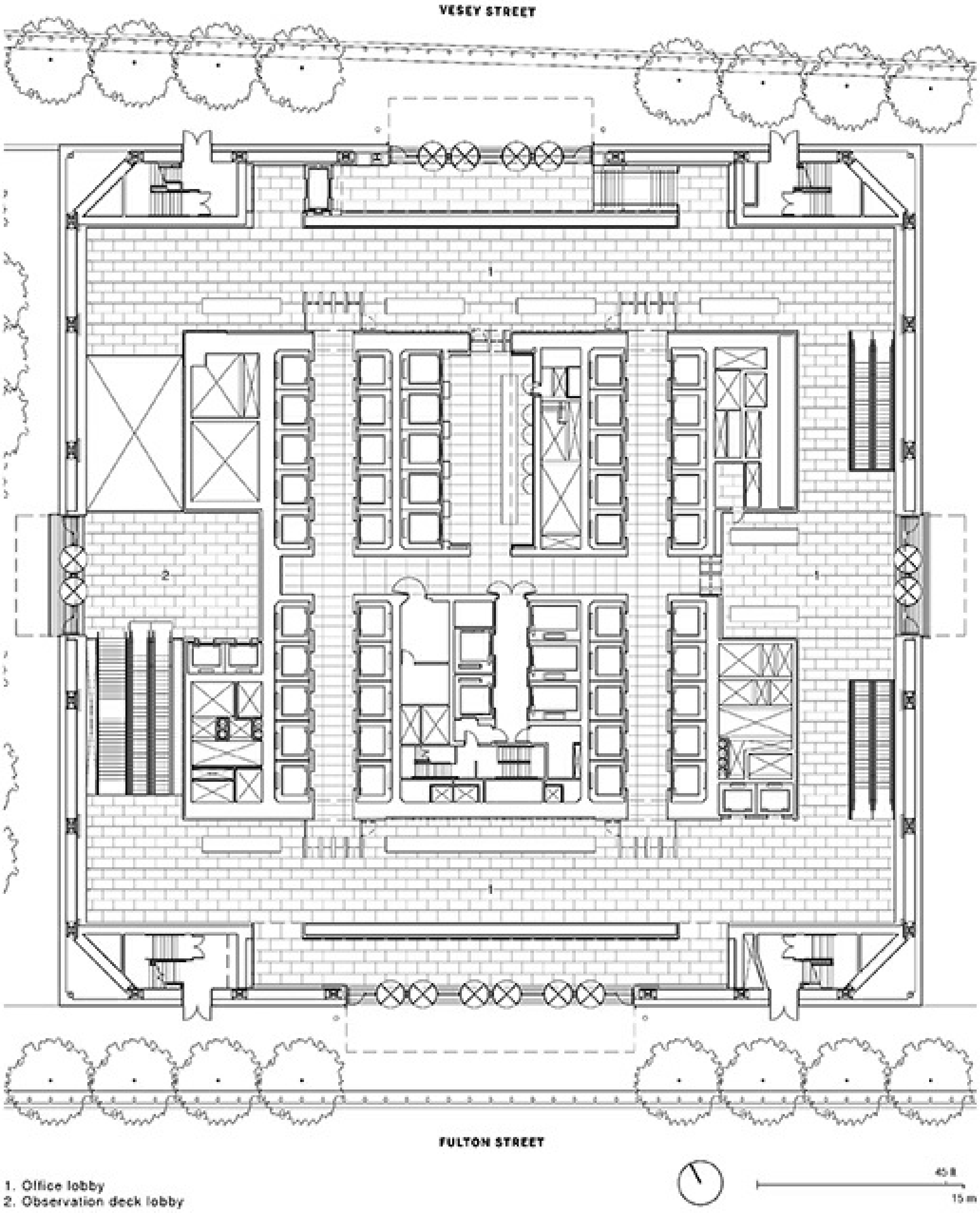


35.6 Use of multiple sky lobbies, Shanghai Center, Shanghai.
(Mitsubishi)

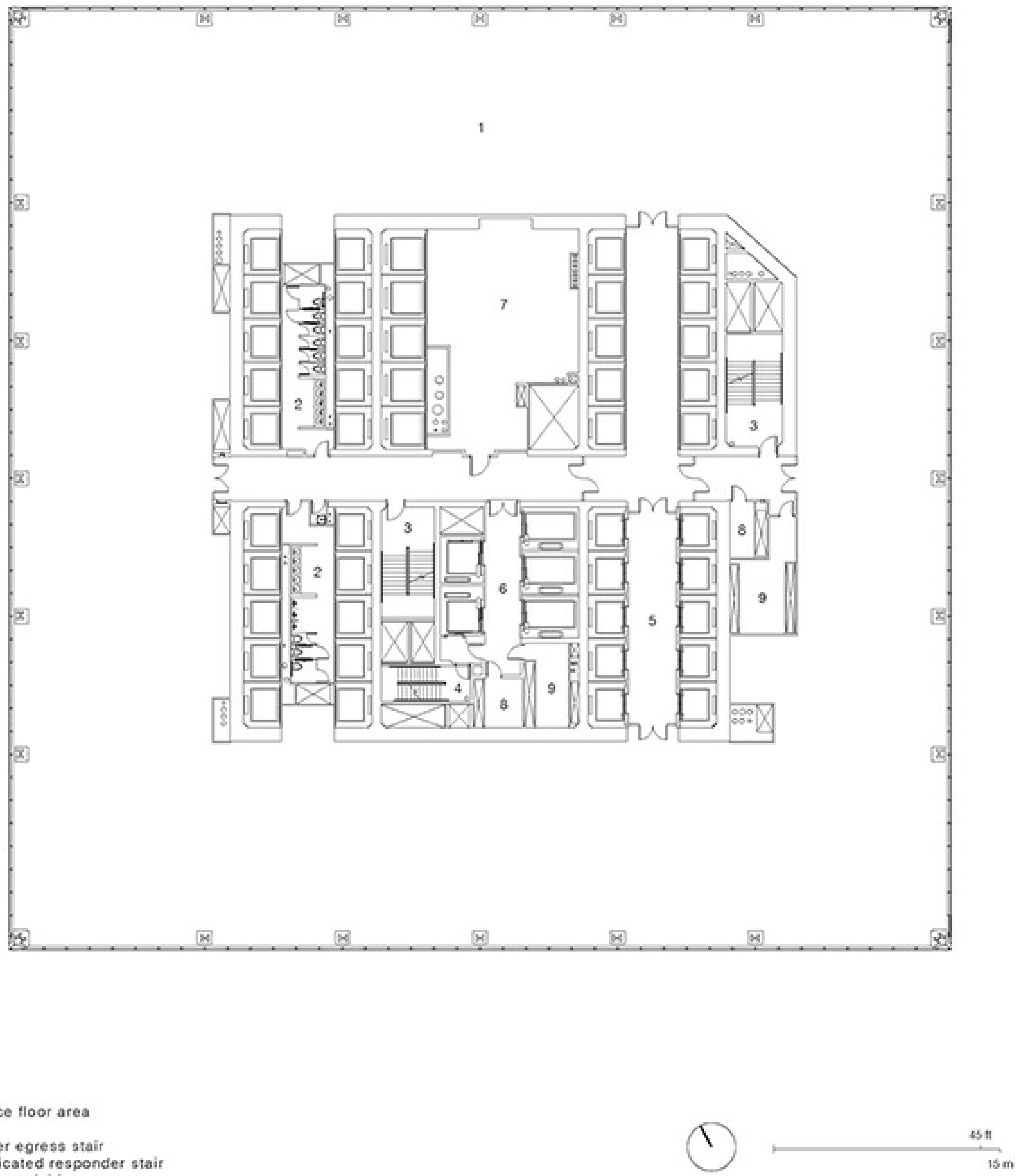
The size and form of office buildings is the product of the social organization of work and the environmental needs of employees. The earliest office buildings were a warren of individual offices, with rooms often shared by managers and their assistants. As clerical employment grew and *Taylorism* became the management ethos, dividing office activities into repetitive tasks, larger open office areas were required. An

early preoccupation was assuring adequate daylight and ventilation to the work desk, which encouraged more glass on the skins of buildings. Innovative early twentieth-century structures added *atriums* as a source of light and shaped buildings to minimize the distance from desk to windows.

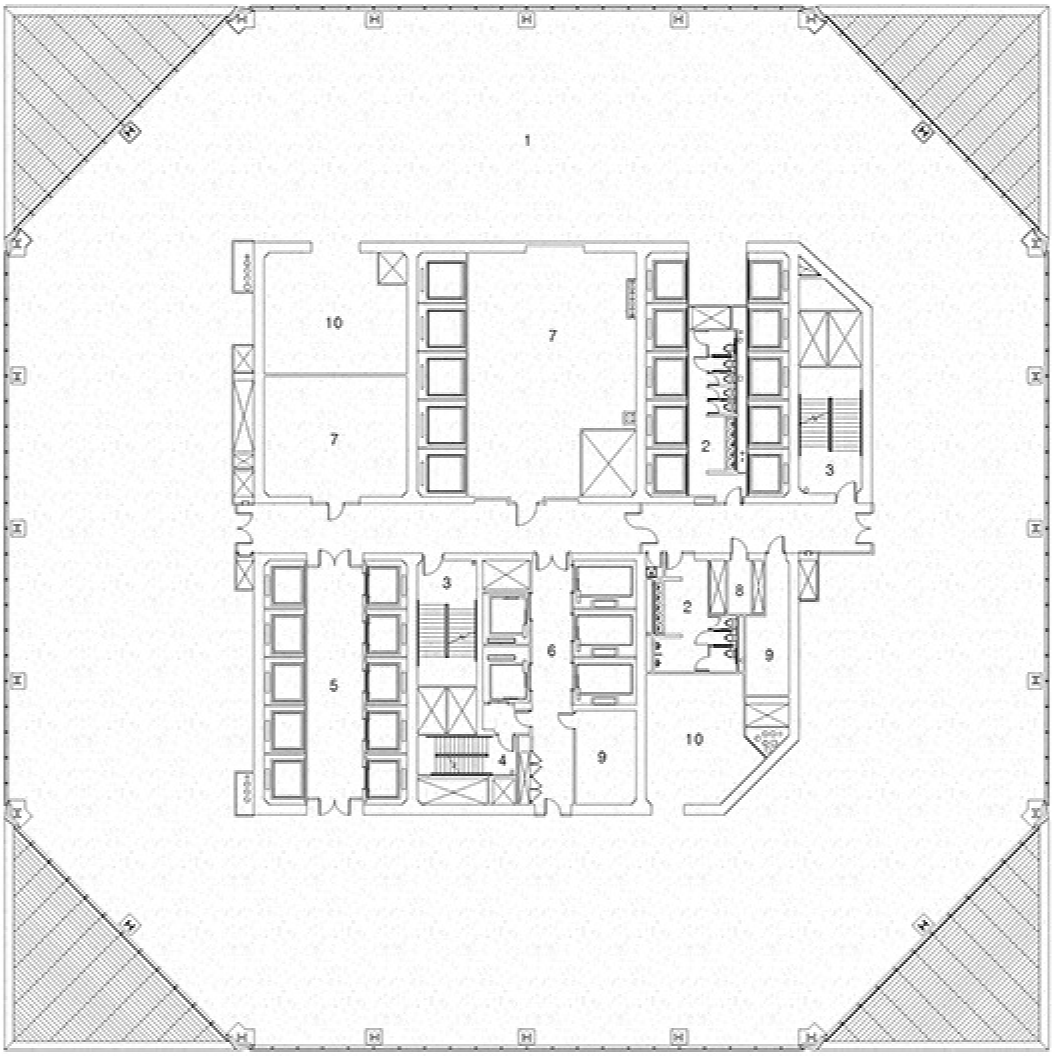
By midcentury, the form of commercial office buildings had become largely formulaic, especially for leased space. Typically, a floor area of 2,300–2,800 m2 (25,000–30,000 sq ft) surrounds a central core with elevators, fire stairs, and washrooms, providing office space deep enough to accommodate private offices on the window side and secretarial, service, and meeting spaces on the inside. Dimensions from the windows to the core are routinely 12.8 m (42 ft) for tenants using primarily private offices, and 14.3 m (47 ft) for users with extensive open work spaces. The result is a rectangular structure appropriately named the *dollar bill shape* (or euro, or yen), typically 42 by 60 m (140 by 200 ft), for low-rise buildings. However, as a structure increases in height the total area of the lower floors also increases, with the added size of the core. While elevators can rise to well over 100 stories, they are typically zoned to serve a limited range of floors. If cars to each zone need to originate at the ground level, the accumulation of elevators leaves little room for occupied space in the lower levels. Very tall buildings typically employ a number of strategies to improve on this—using *double-deck elevators*, which reduces by almost half their footprint, and *sky lobbies*, which allow high-zone elevators to be stacked above low-zone elevators, among others (Al-Kodmany 2015).



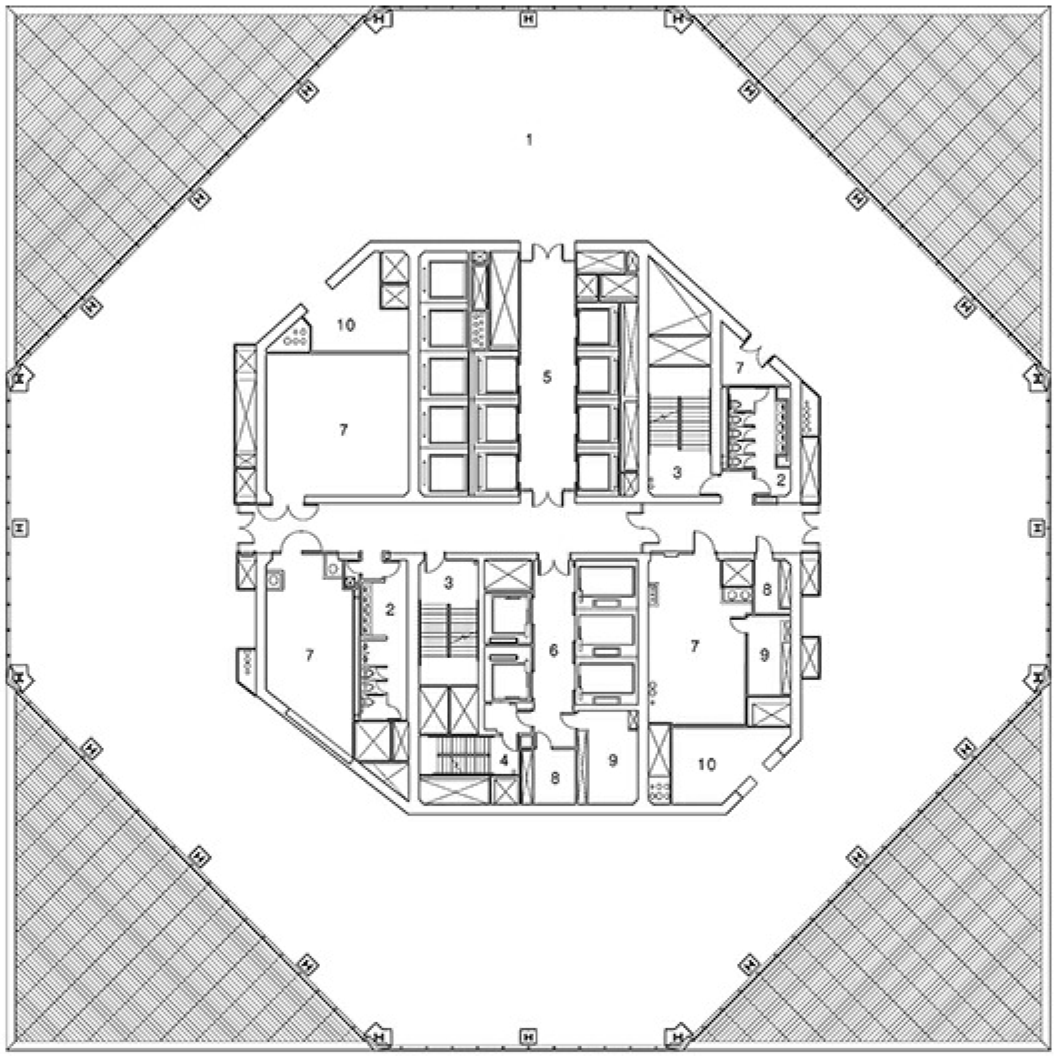
1. Office lobby
2. Observation deck lobby



1. Office floor area
2. WC
3. Tower egress stair
4. Dedicated responder stair
5. Elevator lobby
6. Service vestibule
7. Mechanical room
8. Telecom room
9. Electrical room



1. Office floor area
2. WC
3. Tower egress stair
4. Dedicated responder stair
5. Elevator lobby
6. Service vestibule
7. Mechanical room
8. Telecom room
9. Electrical room
10. Tenant space



1. Office floor area
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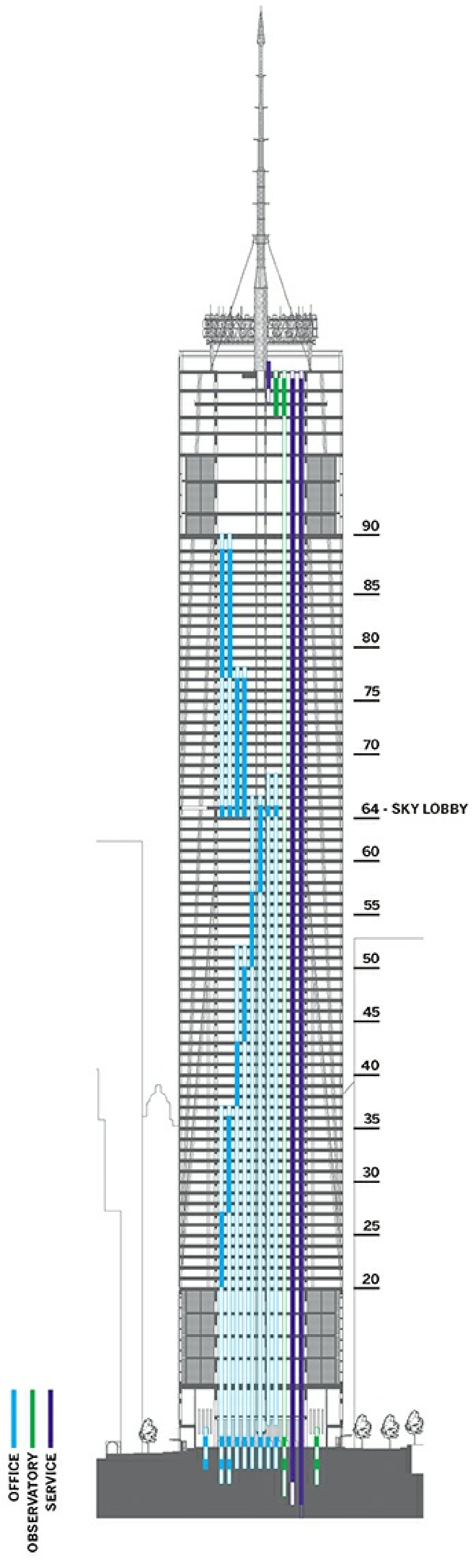
90
85
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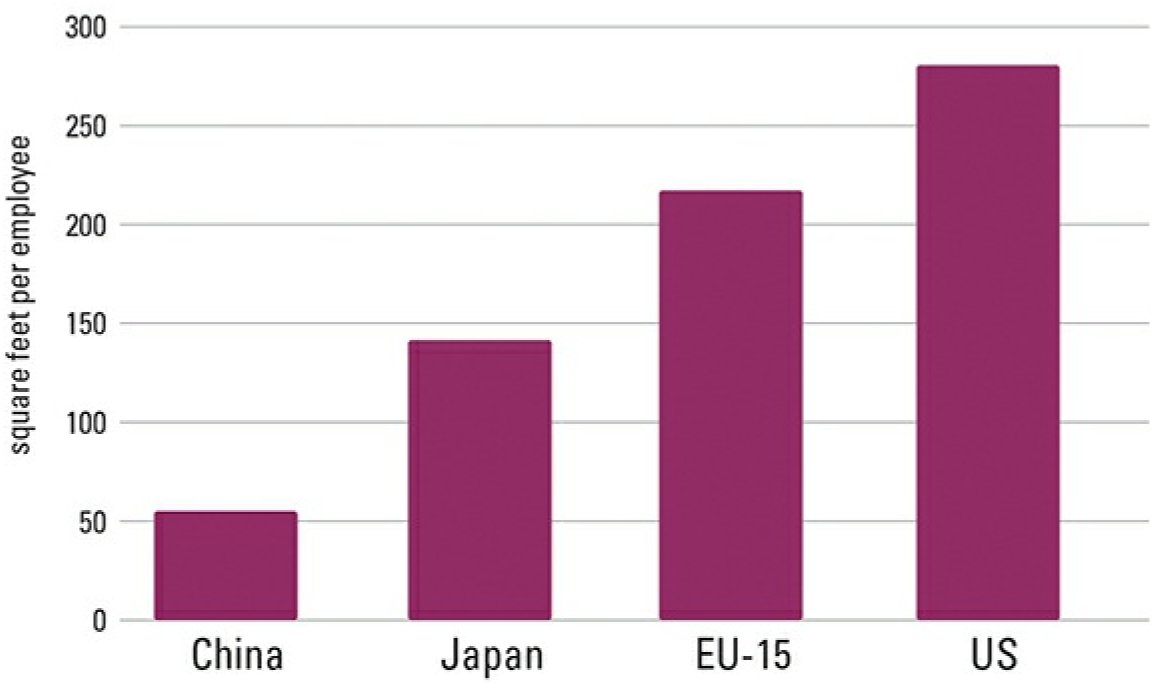
OFFICE
OBSERVATORY
SERVICE

35.7 (facing page) Floor plans, One World Trade Center, New York.
(Courtesy of © Skidmore Owings and Merrill)

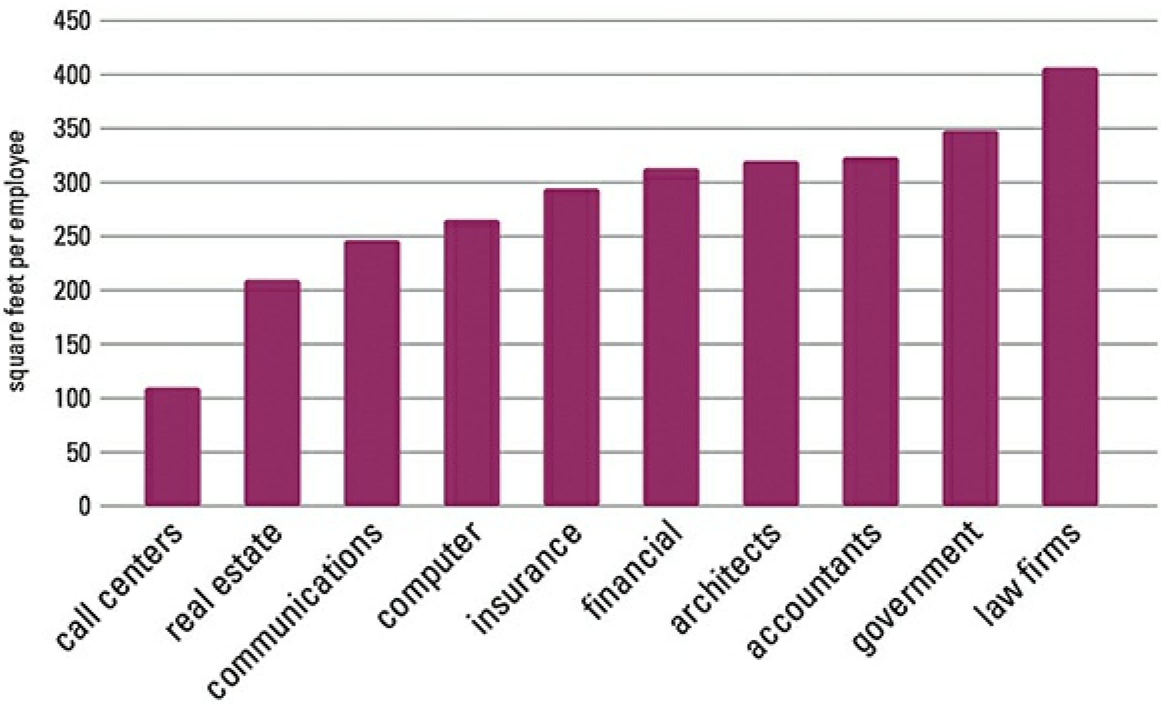
In the US, each employee in an office requires an average of 275 sq ft (25.5 m2) of office space, or slightly over 300 sq ft (28 m2) of leasable space, accounting for areas like elevator lobbies that are unusable for work. Cultural and economic factors play a role in shaping the size and form of office structures. The density of occupancy varies considerably from country to country. It is highest in Asia and lowest in the US with Europe falling between, reflecting the cost of building or renting office space per employee but also differing patterns of organization. In Asia, open office arrangements are common; sometimes a work group with half a dozen or more employees occupies a single long work space. The arrangement would be considered uncomfortably close for most US workers, and not sufficiently respectful of hierarchy in much of Europe. Each industry has its own preferred pattern of work, and space needs vary considerably. While call centers cram employees into minimal cubicles and may average only 100 sq ft (9.3 m2) for each worker, law firms require a more generous average of 400 sq ft (37 m2). Regulations also play a role. In Germany, all office spaces must have direct views of the outdoors, which results in narrow structures, often only 12–14 m (40–46 ft) in width (van Meel 2000). Wings of these dimensions can be linked by atriums to create larger buildings. In the US and Canada, setback requirements, minimum landscape standards, or open space requirements may limit the dimensions of office space that can be built on a site.

35.8 Office space per US worker in 2013.
(Adam Tecza/Herman Miller/CoStar)



35.9 Office space per person internationally, 2007.
(Adam Tecza/World Business Council for Sustainable Development)

35.10 Work group sharing common work space, Japan.
(Paco Alcantara)



35.11 US median square feet per worker by industry.
(Adam Tecza/Herman Miller/CoStar)

Connection to green surroundings has been a seminal idea in the location and planning of sites for offices in the US. In many US cities, half the office space created over the past several decades has been in suburban locations. Often this is in the form of *office parks* (or *business parks*), consisting of low- or mid-rise structures, typically 75,000–200,000 sq ft (7,000–18,500 m2) in area, surrounded by parking and landscape. Parking areas tend to dominate the sites, since the area required to store automobiles of workers roughly equals the built space for employees if all are commuting alone. Typical FARs for suburban office parks are between 0.25 and 0.33. There are several options to increase densities, including the construction of parking garages above or below ground. As a general rule, the land value needs to be higher than the additional cost of creating a parking structure to justify such a move.

Office parks can be deadly dull places to work if they lack lunchtime opportunities, convenience stores, or after-work recreation opportunities. Adding even modest outdoor gathering places that have been landscaped with care can provide a welcome respite, and organizing pedestrian walkways to connect structures can encourage social relationships. In higher-density areas, more extensive landscaped outdoor spaces may be possible if automobiles are stored in parking garages. The International Finance Center in Chengdu restores the meaning of an office park by literally locating offices in a park.

35.12 Pleasanton Center office park, Pleasanton, California.
(Courtesy of LBA Realty/Cannon Design)

35.13 Office buildings in a park, International Finance Center, Tianfu New District, Chengdu, China.
(Gary Hack)

35.14 Park setting, International Finance Center, Tianfu New District.
(Gary Hack)

Where a substantial proportion of workers can reach office parks by transit, it is possible to increase densities and create an urban fabric of streets, squares, and office structures. Info-Park in Budapest, aimed at high tech offices and research firms, is a fine example. Its block structure

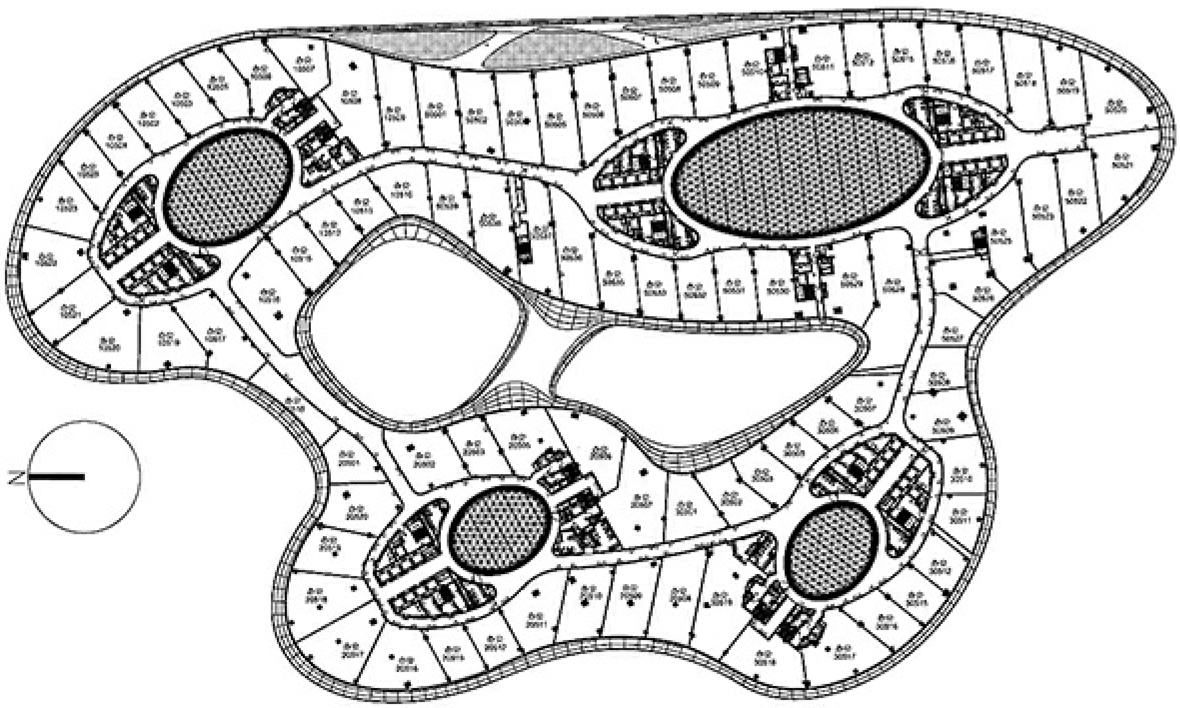
accommodates atriums and wing structures, ensuring that there is sunlight close to every workspace. While parking is provided at a rate of 1 space for each 50 m2, many of the spaces are on streets and in small surface lots intended for visitors. Structures are 6–8 stories high, and a green public plaza serves as the centerpiece of the development.

35.15 Info-Park research and office park, Budapest, Hungary.
(Courtesy of Glassdoor.com)

35.16 Public square, Info-Park, Budapest.
(Courtesy of irodacsoport.hu)

35.17 SOHO Galaxy linked office-retail complex, Beijing, China.
(Courtesy of Hufton and Crow)

35.18 Interior courtyard, SOHO Galaxy, Beijing.
(Gary Hack)

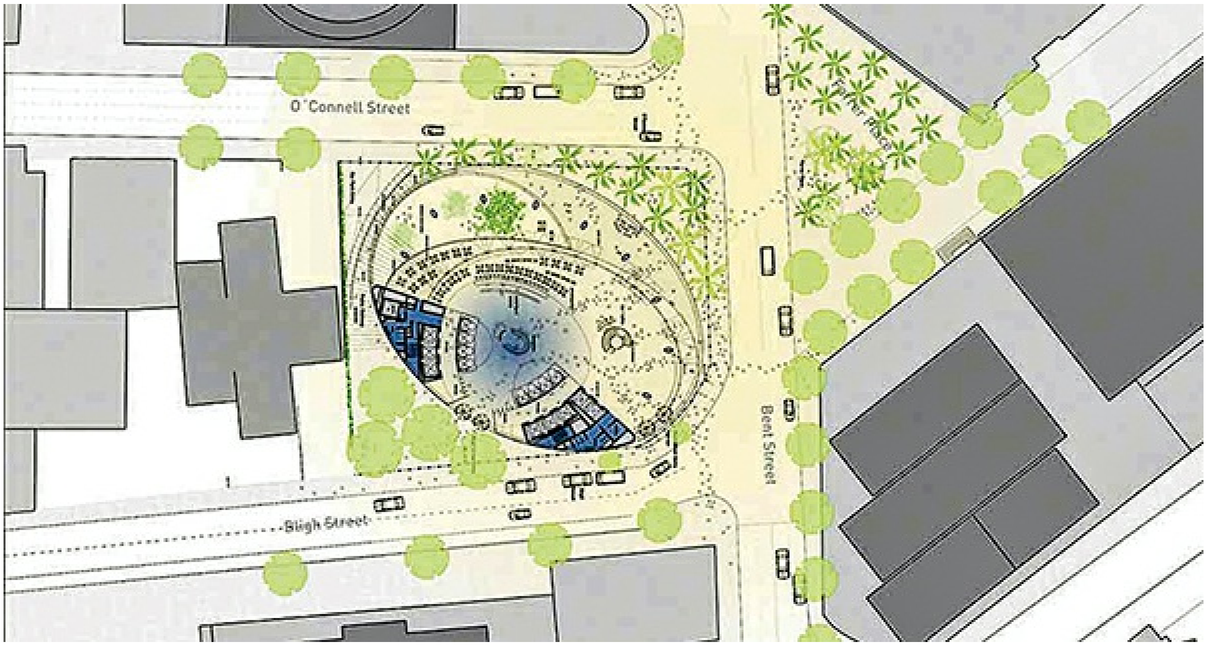


35.19 Layout of floor 5 office spaces, SOHO Galaxy, Beijing, China.
(SOHO Galaxy)

Single-purpose office buildings continue to be a staple of urban development and have grown in size, particularly in urban centers. They have also sought to respond to the changing nature of office work. While large tenants continue to occupy full or multiple floors of buildings on long leases, there is a growing demand for smaller spaces for professional service organizations, including startups. Such firms may begin with a few employees and expand rapidly or combine with other firms, and will prefer buildings that offer the opportunity to add spaces as they grow. This has led to new prototypes for office buildings, with shared spaces for startups and modularized spaces for firms that have found their footing, often about 150 m2 (1,600 sq ft). An excellent example is the SOHO Galaxy complex in Beijing, composed of four towers with atriums that maximize the exterior perimeter to allow for modular spaces. Rentable units range from about 140 to 250 m2 (1,500–2,700 sq ft) on most of the floors, with larger units on the top floors. Many have been combined to form larger spaces.

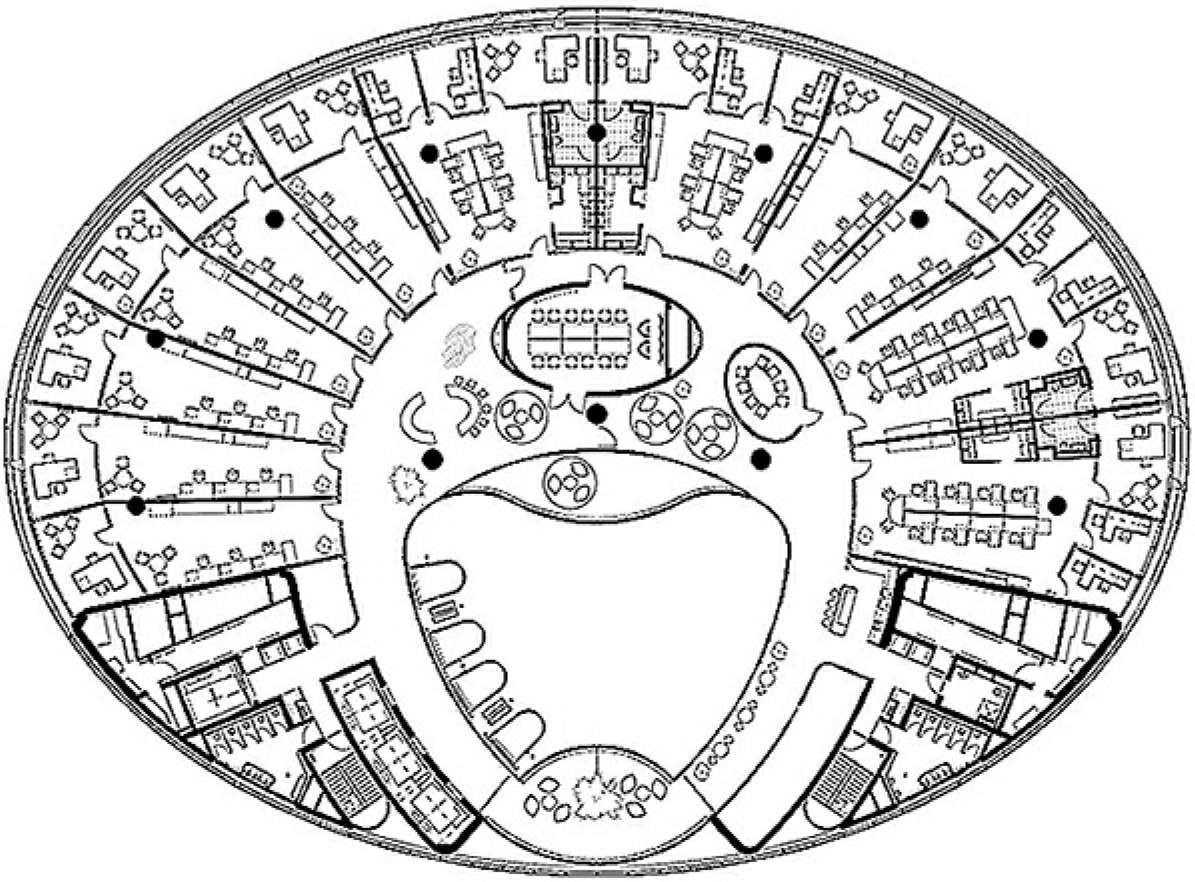
Because of its prime location, this complex also includes three levels of retail space at the base, making for a lively courtyard throughout the day.

35.20 Office tower, 1 Bligh Street, Sydney, Australia.
(Gary Hack)



35.21 Site plan, 1 Bligh Street, Sydney.

(Courtesy of architectus)



35.22 Plan with modular spaces, 1 Bligh Street, Sydney.
(Courtesy of architectus)

35.23 Interior atrium, 1 Bligh Street, Sydney.
(Photo courtesy of Cbus Property, DEXUS Property Group and DEXUS Wholesale Property Fund, co-owners)

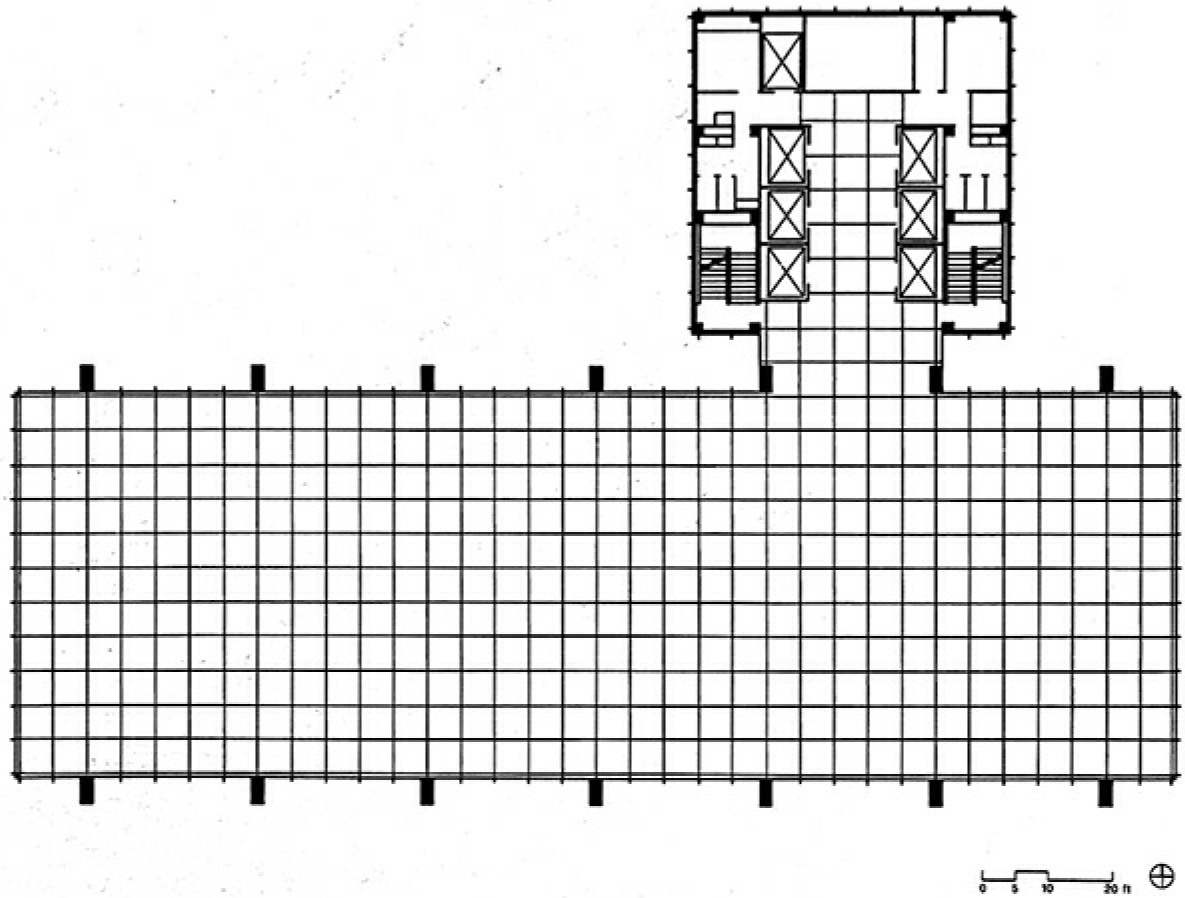
In urban centers more of the opportunities are found in smaller sites, but it is possible to use the atrium form to create modularized spaces, particularly on corner sites. Contemporary office developers wish to offer a range of opportunities including full-floor, open-floor, and modular occupancy. A stellar example is 1 Bligh Street in central Sydney, Australia. The oval-shaped tower, approximately 43 by 60 m (140 by 200 ft), is lifted up to create public space at the ground level and separated from surrounding buildings. An atrium opens up the interior, so that no office is more than 13 m (40 ft) from natural light. Elevators, both enclosed and exposed, and other services are clustered to one side of the floors to allow the floors to be developed as work modules or left open for open office arrangements. 1 Bligh Street and SOHO Galaxy demonstrate just how far the office prototype has evolved since its invention in Chicago.

Corporate Campuses

Headquarters offices and other purpose-built structures housing a single organization often have served as the testing ground for innovations in the arrangement of commercial office space. By removing the access core from the center of the space, the Inland Steel headquarters building in downtown Chicago, constructed in 1956, created large floor areas suitable for open office arrangements—well before such arrangements were commonly adopted. The flexibility provided by its large unobstructed spaces has allowed the structure to adapt to many subsequent tenants, including the architectural firm that designed it. At the Deere and Co. headquarters on a bucolic site outside Moline, Illinois, the company reversed the traditional arrangement, locating work areas for secretarial staff adjacent to the windows, with enclosed glazed offices for higher-level staff and conference rooms placed adjacent to the core. The complex also includes separate structures for a museum of the history of farm implements and a research and development center with large floors combining offices and workshops. This combination of administrative, research, conference, and promotional spaces is now typical of headquarters complexes. They are showplaces that symbolize a company's identity as well as housing its workaday world.


NEWSPAPERS

35.24 Inland Steel Building, now 30 Monroe Street, Chicago.
(Courtesy of Eric Allix Rogers)



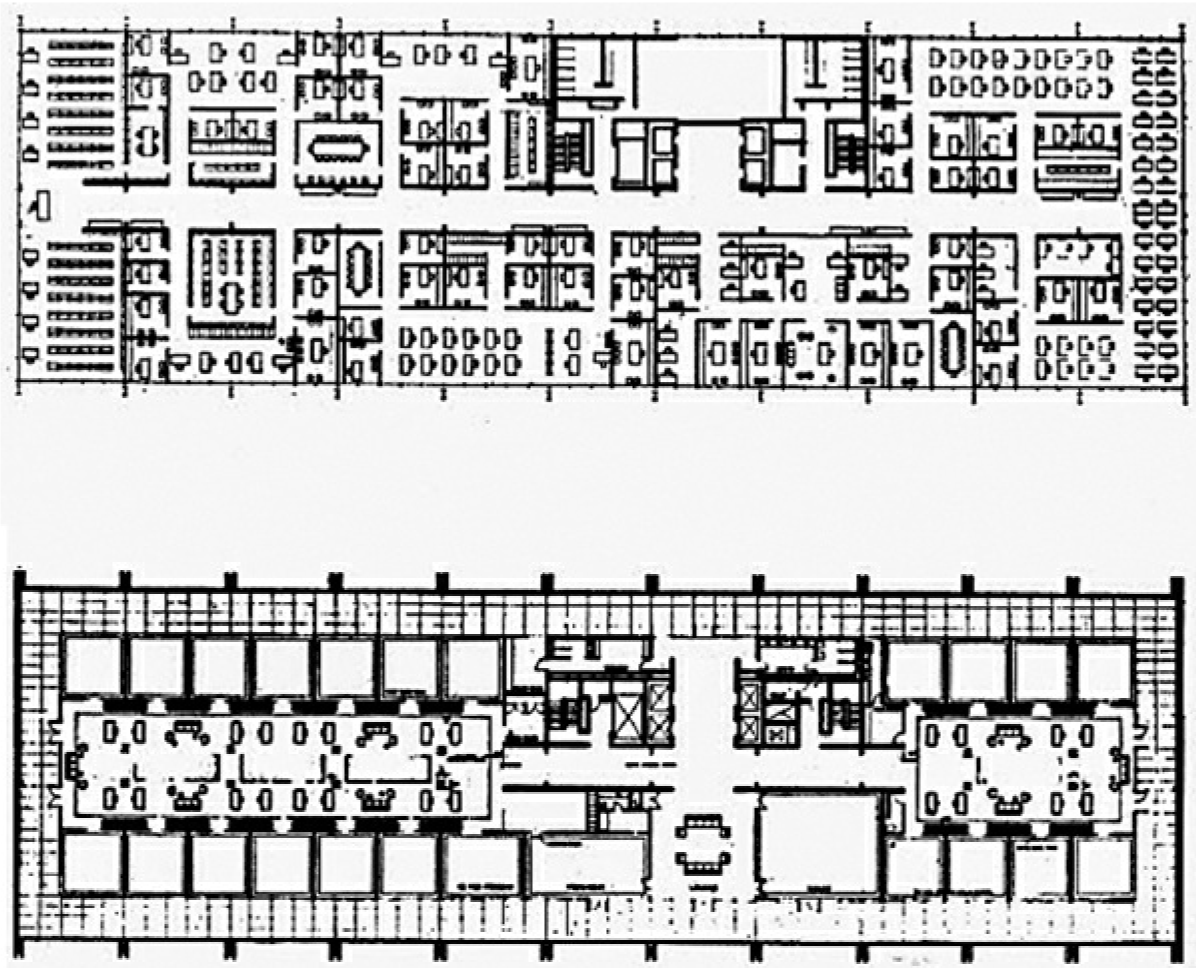
35.25 Typical floor plan, Inland Steel Building, Chicago.
(Skidmore Owings and Merrill)

Corporations seek to create an ecology of space and interaction that is consistent with their ethos. Nike’s world headquarters in Beaverton, Oregon is an entire campus devoted to innovation, fitness, health and culture, incorporating spaces for many of the sports it manufactures equipment for. Technology firms seek to foster informal interaction that may spark new ideas, often resulting in spaces that look disordered to outsiders but engage employees in constant dialogue and playful interaction. Facebook’s West Campus, in Menlo Park, California is a

single-floor continuous open space, roughly 280 by 1,500 ft (85 by 457 m) elevated over parking, built to accommodate constant flux and change. The entire range of activity is visible to each employee, and the office of the chairman is in the center of the space. The 9 ac (3.6 ha) green roof provides a half mile (0.8 km) walking or jogging loop, 400 mature trees, white boards, WiFi, and plenty of places to sit for relaxation or al fresco work. This green roof represents 40% of the 22 ac (9.9 ha) site.

35.26 Aerial view, Deere and Company headquarters, Moline, Illinois.
(Google Earth)

35.27 View of headquarters building, Deere and Company, Moline.
(Courtesy of John Deere)



35.28 Floor plan with open office areas along windows, Deere and Company headquarters, Moline.
(Eero Saarinen Associates)

A similar approach of horizontal connections has been the theme of Google's rapidly expanding campus in Mountain View, California. The corporation has added buildings as needed and currently occupies dozens of structures adjacent to Charleston Road. At the center of its campus it constructed the Googleplex (Buildings 40–43) in 2004–2006, clustering research and office spaces around an outdoor open space that is also fronted by a restaurant, child care facilities, and other shared activities. The ground level is considered the public zone, and secure spaces are connected by second-level bridges between the structures. Solar panels cover most of the roof spaces, generating 30% of the electricity required by

the Googleplex. Google’s proposed Charleston East structure is a more radical departure from its past buildings. Organized as a matrix of work spaces, walkways, and open areas, it seeks to create an ecology of work and interaction, programmed and informal spaces. The entire complex will be covered by a fabric structure, largely open to the outdoors and the adjacent park.

Sidebar 35.1

Nike World Headquarters, Beaverton, Oregon

The campus is the headquarters of the world’s largest sporting goods company. Built over 30 years on a site of 213 acres (86 ha), the site has 22 buildings (each named after a sports legend—the Michael Jordan Building, Tiger Woods Building, Ronaldo Field, etc.) housing 8,000 employees. It encompasses the complete product cycle—research on ergonomics, design of products, prototype manufacturing and testing, sales management, and corporate administration. At its center are two playing fields for team sports surrounded by gymnasiums, workout spaces for corporate employees, tennis courts, track and field facilities, and a running trail looping around the perimeter of the site. As a respite from the physical activity, a manmade lake provides a centerpiece for the administrative complex, and a performing arts center serves multiple functions throughout the day and evening. Like many corporate campuses, the site is not open to the public and has security gates at its three main entrances. The original plan for the site installed a ring road on the perimeter behind berms and the jogging loop, providing access to parking areas. As the campus has expanded over the years, parking lots have been replaced by structures, allowing a second layer of buildings to be added. Many of the parking structures incorporate solar panels on their roofs, as do new structures. The flexibility provided by this arrangement will allow more than 2.3 million sq ft (214,000 m2) be added to the campus over the coming years, and allows for future expansion beyond that.

35.29 Aerial view of Nike campus, Beaverton, Oregon.
(Google Earth)

35.30 Aerial view of lake at center of Nike campus.
(Nike Inc.)

35.31 Women's soccer on central green, Nike campus.
(Anon.)

35.32 Gymnasium and multipurpose playing field, Nike campus.
(Nike Inc.)

35.33 Lake and Nolan Ryan Building, Nike Campus.
(Courtesy of TVA Architects)

35.34 Plan for future expansion on Nike campus.
(Nike Inc.)

Perhaps the most remarkable recent example of an innovative headquarters is Apple’s new structure in Cupertino, California, which integrates office, research, and development activities in a single continuous four-story building surrounded by landscape. Its image is as precise and refined as the products it markets. The structure of over 1 million sq ft (93,000 m2) will house 12,000 employees in flexible space devoted to administrative, research, and development and service activities. The central space, which houses two layers of parking and service facilities, has an outdoor courtyard for dining, socialization, and relaxation. The idea of the complex is to put all employees within walking distance of their colleagues—on an “infinite loop” that is over 1 mi (1.6 km) in length on each floor. However flexible it is inside, it is hard to contemplate how it can be expanded beyond its current form, and Apple has already taken space on other nearby sites to accommodate activities that don’t fit into its headquarters.

35.35 Aerial view, Facebook West Campus, Menlo Park, California.

(Courtesy of Jeff Hall Photography)

35.36 Interior view, Facebook offices, Menlo Park.

(© Spencer Lowell/Trunk Archive)

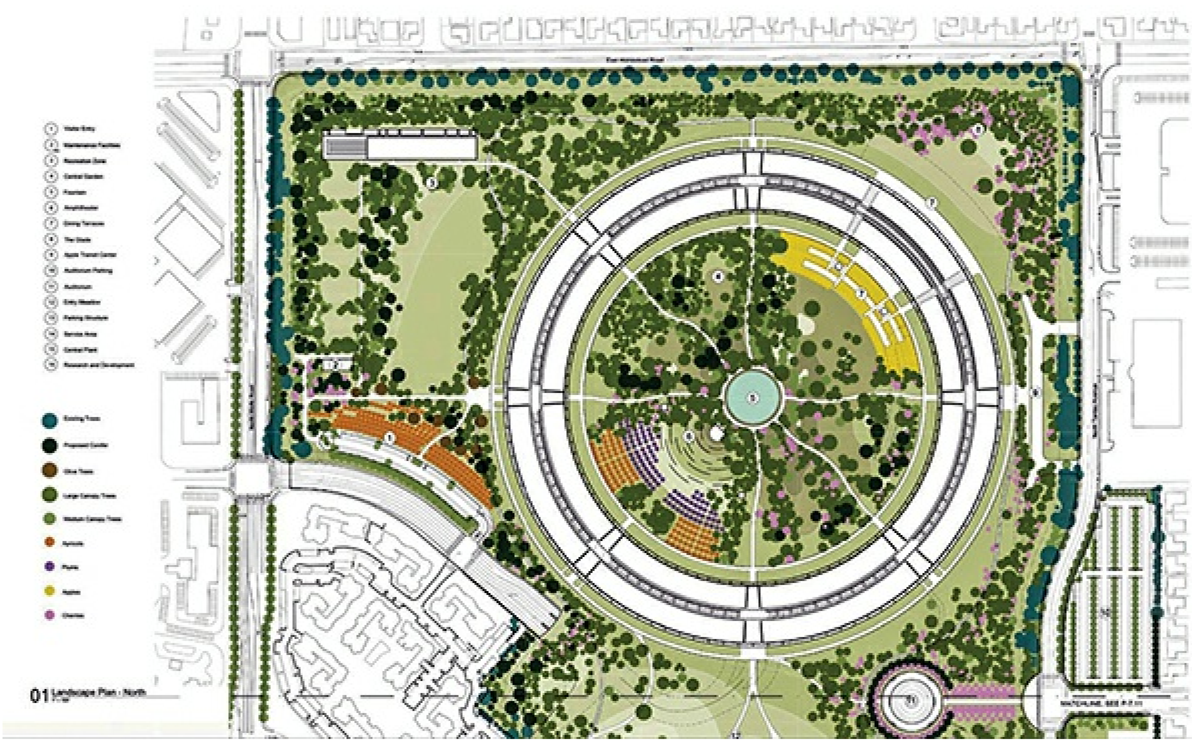
35.37 Site plan, Google headquarters buildings, Mountain View, California.
(Courtesy of © BIG—Bjarke Ingels Group/Heatherwick Studio)

35.38 Aerial view, Googleplex complex, Google Mountain

View campus.
(Clive Williamson Architects/Austin McKinley photograph/Wikimedia Commons)

35.39 Plan, proposed Charleston East building, Google Mountain View campus.
(Courtesy of © BIG—Bjarke Ingels Group/Heatherwick Studio)

35.40 View of proposed Charleston East building, Google Mountain View campus.
(Courtesy of © BIG—Bjarke Ingels Group/Heatherwick Studio)



35.41 Site and landscape plan, Apple headquarters, Cupertino, California.

(City of Cupertino/Foster + Partners)

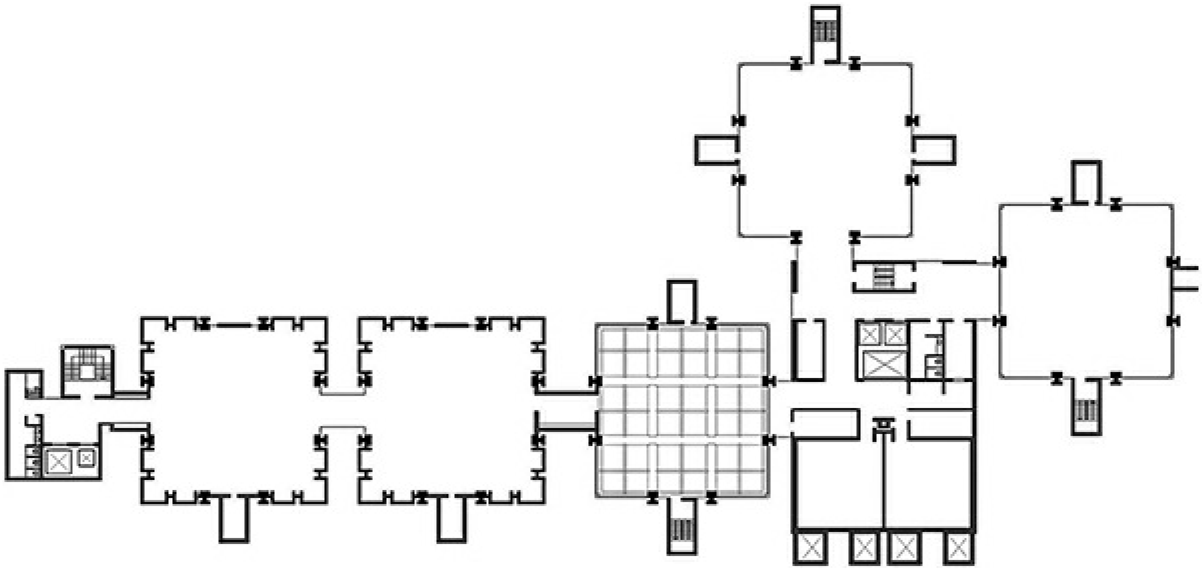
35.42 Aerial view, Apple headquarters, Cupertino.
(Apple, Inc.)

Laboratories

Many corporations and institutions require specialized laboratories for their ongoing operations or research and development efforts. Among large research hospitals, as an example, the amount of space devoted to basic and applied research can easily exceed patient care space. Pharmaceutical companies depend on new discoveries for their advancement, and the

thrust in applied genetics has stimulated thousands of startup companies that require research space. Dry labs, which conduct research through data obtained elsewhere, can function adequately in office space, but wet labs require bench space and highly specialized equipment. The nature of research changes quickly as the result of new discoveries, and lab spaces need to be adapted to capitalize on the new directions. The Richards Medical Research lab, heralded as a new paradigm for the design of medical research space when it was built in 1962 at the University of Pennsylvania, quickly became obsolete as the direction of medical research shifted from chemical to biological research. The lesson is to create buildings and sites that accommodate the fast-moving fields they house.

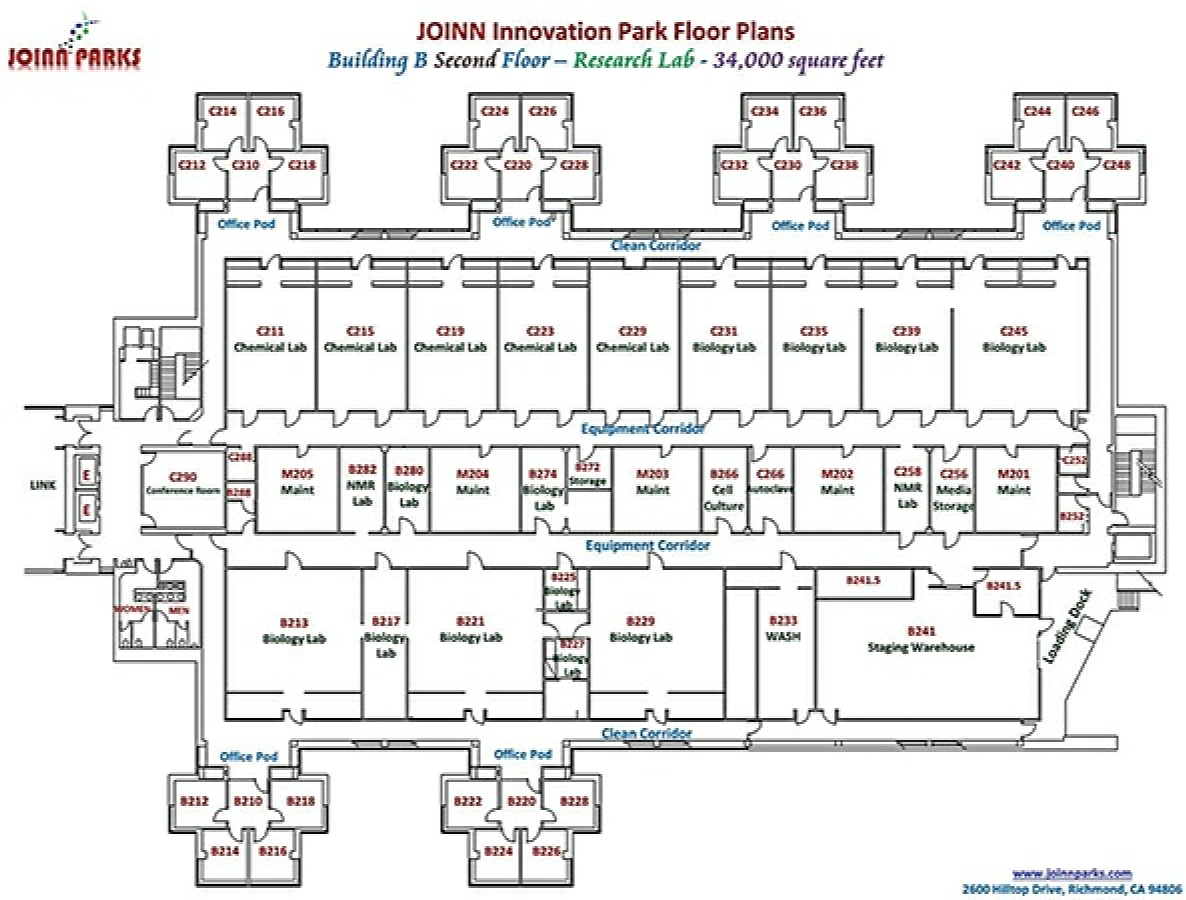
While the Richards lab emphasized exterior light and views for each workbench, contemporary wet labs require large amounts of space for specialized equipment, clean rooms, animal laboratories, and other purposes that can exceed the area allocated to bench research. For many kinds of research, artificial lighting and ventilation are preferable to natural sources, to avoid fluctuation of temperature and humidity. The result is "fat" buildings, with access to labs from corridors located on the perimeter of the building and large areas of "flex" space on the interior. Buildings can be 30–37 m (100–120 ft) deep, with floor areas of 3,250–3,700 m2 (35,000–40,000 sq ft). Spaces for each of the sciences will, of course, vary: physics spaces have less laboratory area and more offices, engineering research spaces may require high floors with heavy load capacity for the construction of prototypes, and so on. Academic buildings that combine research and teaching will add other dimensions.



35.43 Research space and vertical service cores, Richards Medical Research Building, University of Pennsylvania, Philadelphia.
(Louis I. Kahn Collection, Courtesy of The Architectural Archives, University of Pennsylvania)

35.44 Exterior view of Richards Medical Research Building, University of Pennsylvania.
(Louis I. Kahn/Smallbones/Wikimedia Commons)

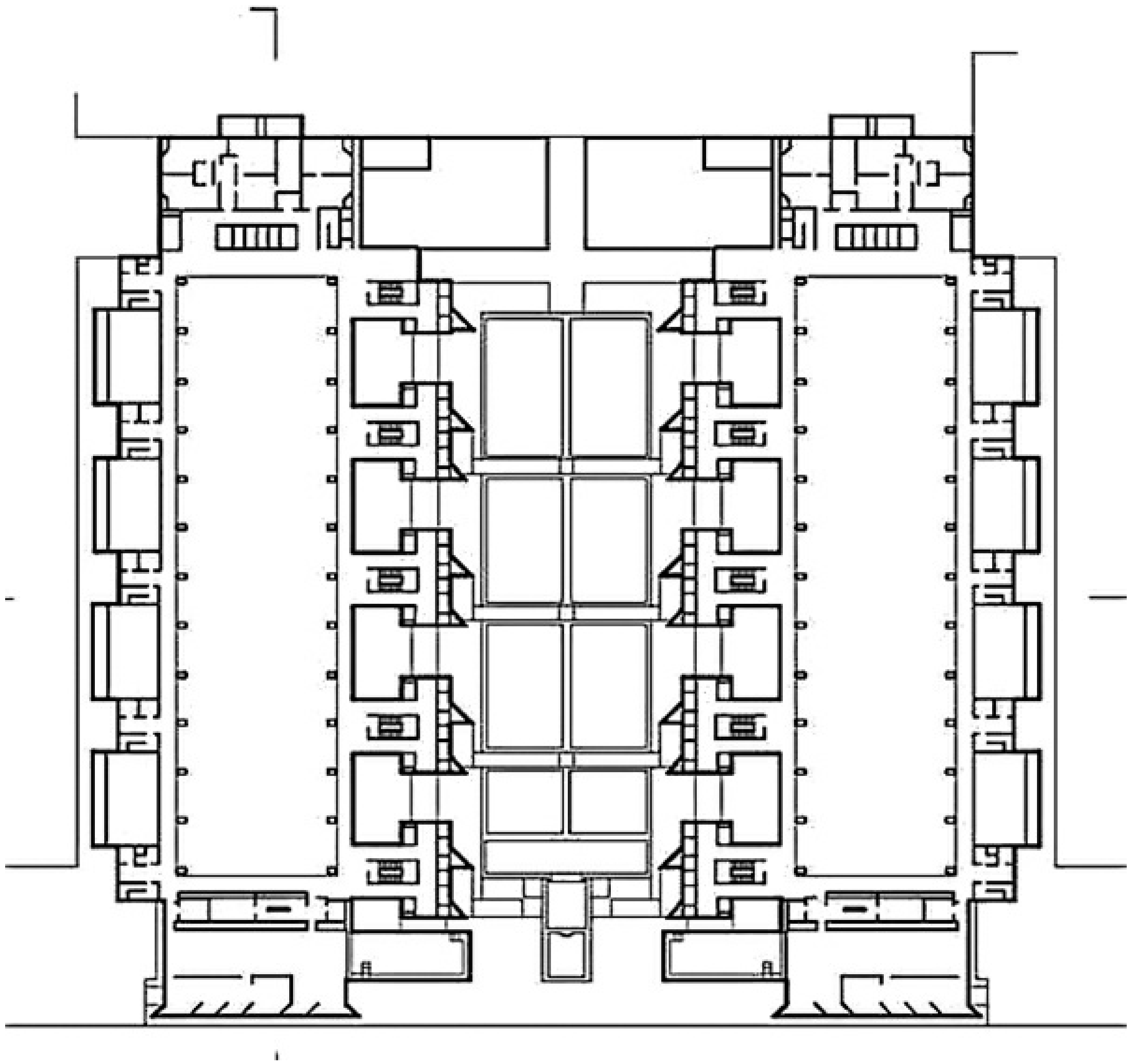
Learning from his Richards laboratory experience, the architect Louis I. Kahn reversed the pattern in his groundbreaking plan for the Salk Research Laboratory in La Jolla, California. Here flexible laboratory space was placed in the interior of the two long research structures, with areas for offices lining the central open space and the opposite sides of the building. Along the central axis, there is a remarkable view to the adjacent bluffs and the Pacific Ocean. Because the site was constrained, there was a difficult choice about how to manage future expansion, eventually resolved by a new master plan which replaced surface parking lots at the entrance with a parking structure, making room for two future research buildings.



35.45 Floor plan, research accelerator, JOINN Innovation Park, Richmond, California.

(Courtesy of JOINN Parks)

Land was not a constraining factor in the site planning for the Wellcome Trust Sanger Institute's campus in Hinxton, Cambridgeshire, UK. The pioneering genetics research institute sought to accommodate an expanded role in research that included laboratories, a supercomputing data center, and future laboratory support spaces as well as education in a variety of formats on its 30 ha (74 ac) site adjacent to its existing research building. It also saw advantages in finding sites for future commercial ventures based on research at the institute. The site plan established a central green for the research and academic campus and a parallel green for the innovation center. Each green spine has the potential to accommodate growth beyond the structures shown, as the institute develops.

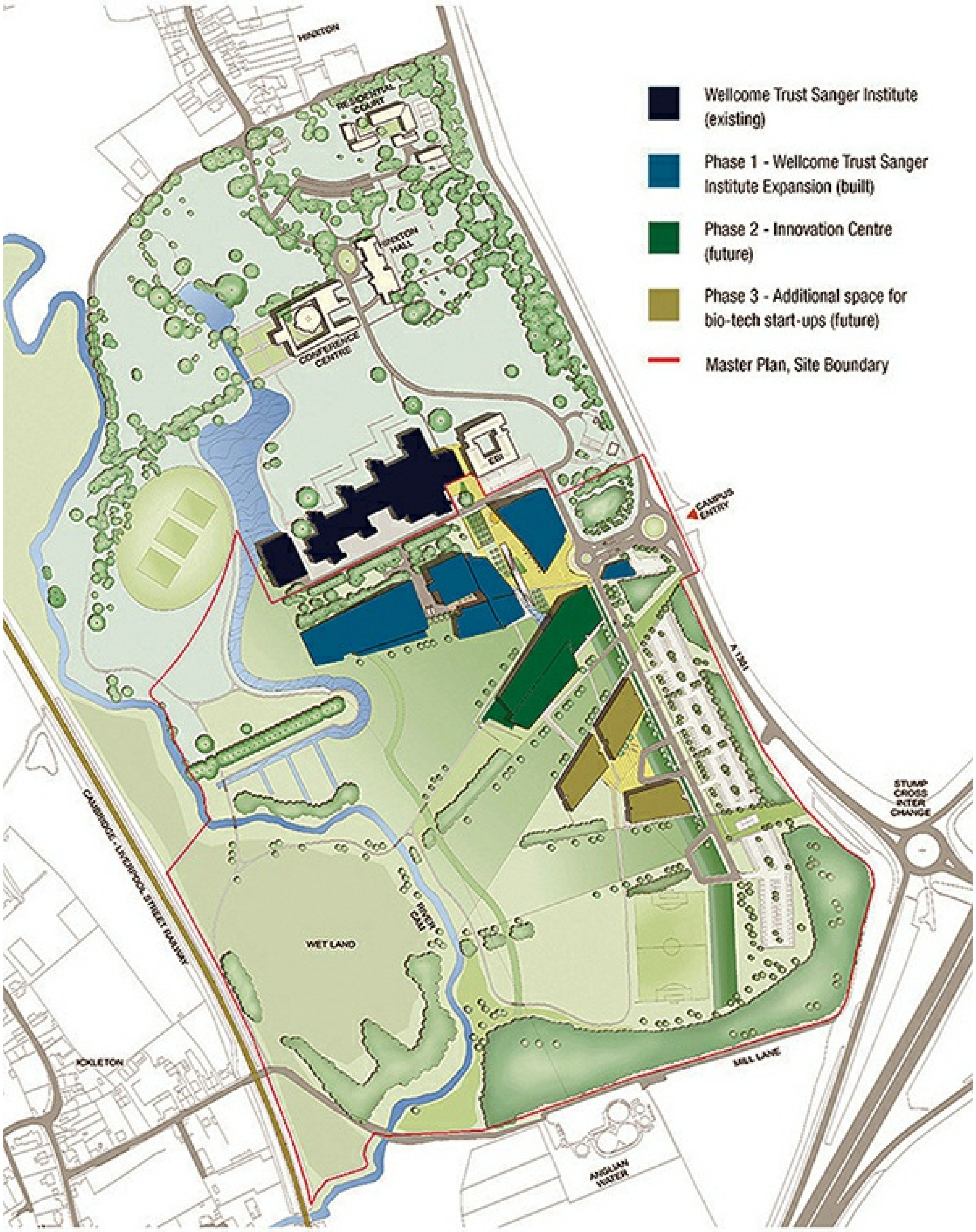


35.46 Plan, Salk Institute laboratories, La Jolla, California.
(Louis I. Kahn Collection, Courtesy of The Architectural Archives, University of Pennsylvania)

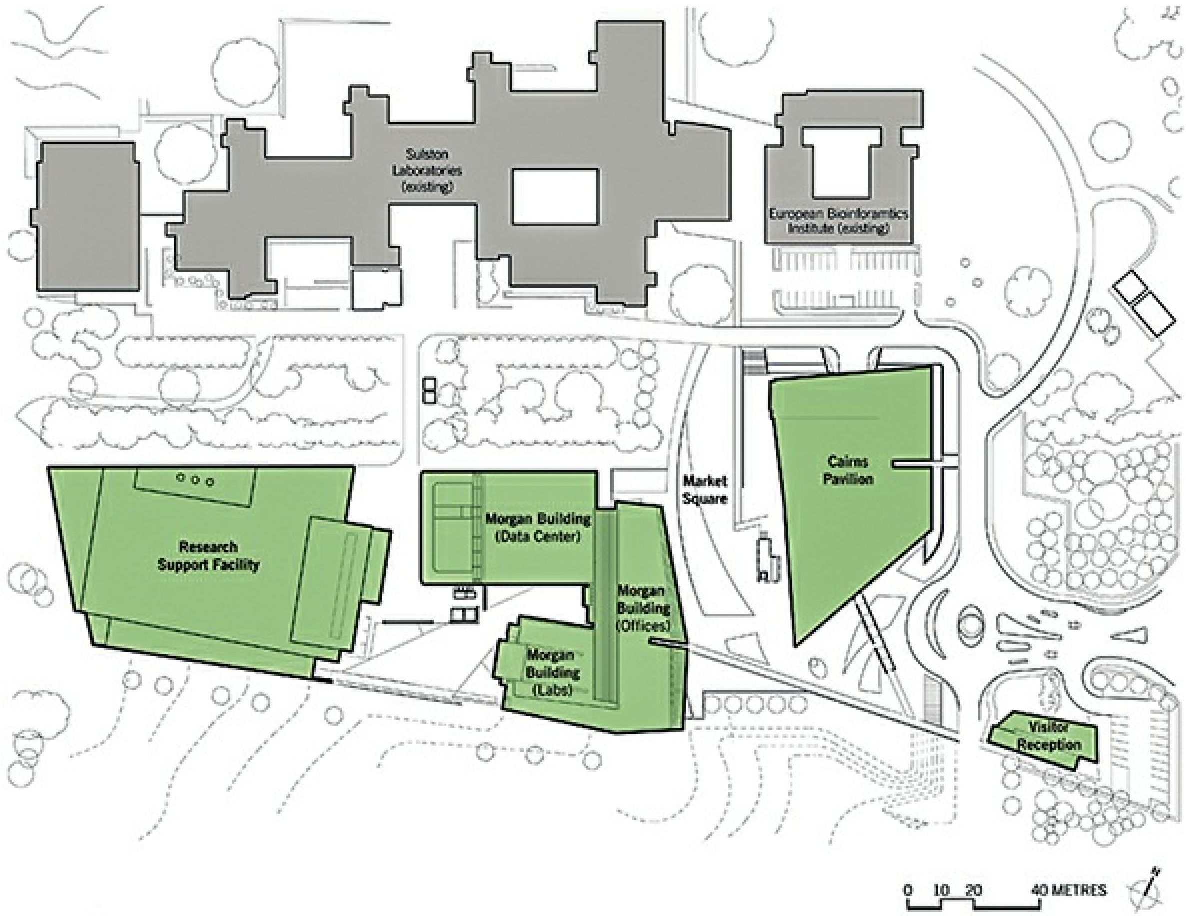
35.47 View of offices along central spine, Salk Institute for Biological Studies, La Jolla, California.
(Courtesy of The Architectural Archives, University of Pennsylvania, photo by John Nicolais)

35.48 Updated master plan, Salk Institute, La Jolla.
(Courtesy of NBBJ)

The fast-changing nature of laboratory-based re-search suggests planning a site with flexible blocks that can be developed or redeveloped without compromising the overall structure of a campus. This is the approach taken by the pharmaceutical company Novartis at its headquarters facility in Basel, Switzerland, which combines laboratories with administrative spaces. The Novartis campus is a work in progress, as it is intended to be. As science advances, the facilities required will change, but the structure of the site and its landscape should remain a constant.



35.49 Site plan, future development of the Wellcome Trust Sanger Institute campus, Hinxton, UK.
(Courtesy of NBBJ)



35.50 Site plan, research and education quadrant, Wellcome Trust Sanger Institute, Hinxton. (Courtesy of NBBJ)

35.51 Aerial view of campus development, Wellcome Trust Sanger Institute campus, Hinxton. (Genome Research Limited/Creative Commons)

35.52 Cairns Pavilion, the social hub of the Wellcome Trust Sanger Institute campus, with dining, exercise, meeting, lecture, events, and social facilities.
(Courtesy of NBBJ)

Sidebar 35.2

Novartis Campus, Basel, Switzerland

Novartis sought to consolidate its research, development, and management activities and create an urban environment for its 5,500 employees. The plan involved repurposing the St. Johann chemical factory, overlaying a block structure, adding parks and other amenities, and creating streetscape so that the area functions as a city district. While blocks vary in size, they average about 30 by 60 m (100 by 200 ft); some of the larger blocks may be divided into two if ultimately developed for smaller structures. Well-known international architects were engaged to design individual buildings, each competing to create the perfect lab or office structure. Where streets depart from the gridiron plan, there was an opportunity to create more freely formed structures, as in the iconic offices at Fabrikstrasse 15. The formal structure of the landscape and streetscape ties together all the varied elements into a coherent urban district.

Site planner: Vittorio Magnago Lampugnani

Landscape architect and planner: PWP Landscape Architecture

35.53 Aerial view, Novartis headquarters campus, Basel, Switzerland.
(Novartis)

35.54 Master plan for Novartis campus, Basel.
(Vittorio Magnago Lampugnani, Courtesy of PWP Landscape Architecture)

Sidebar 35.2 (continued)

Novartis Campus, Basel, Switzerland

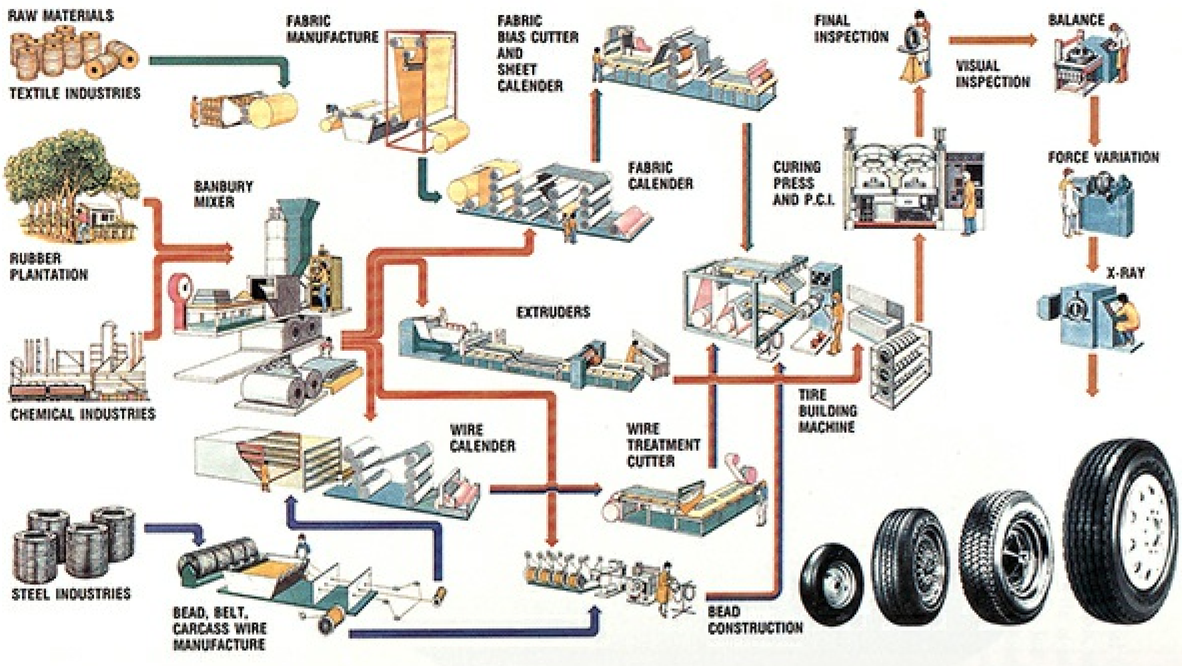
35.55 New laboratory buildings and Fabrikstrasse 15 office building, Novartis campus, Basel. (Novartis)

35.56 Walkway, Novartis campus, Basel.
(Courtesy of PWP Landscape Architecture)

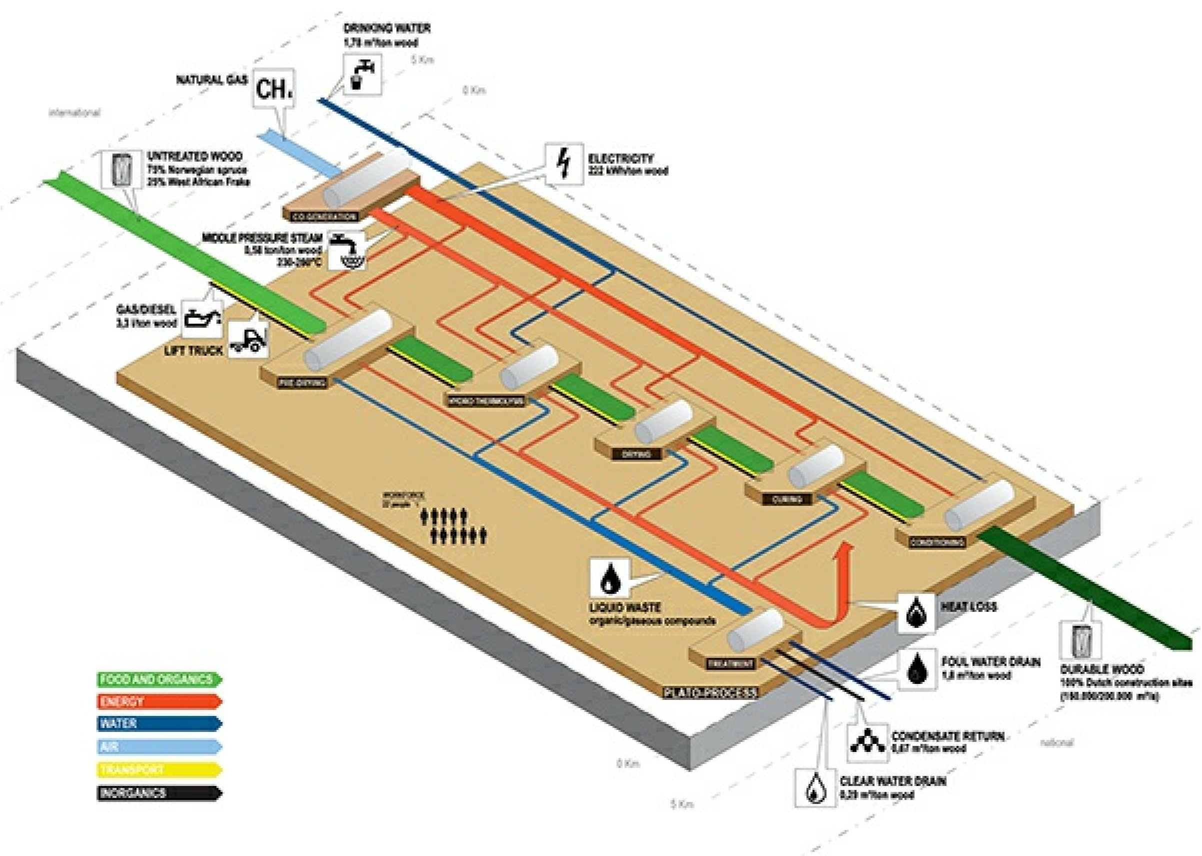
35.57 Park, Novartis campus, Basel.
(Novartis)

Manufacturing Spaces

Manufacturing and other production spaces span such a broad array of activities that it is difficult to generalize about site planning principles for them. They range from small specialized places assembling a single item to vast plants assembling aircraft that may be as large as 10 football fields. The site planner will need to immerse himself in the production technologies and processes, materials flows, safety standards, and a host of other factors before making proposals. In the US and other countries where land is available at moderate cost, single-story structures are generally favored. Materials arrive in trucks or at a railway siding, and finished products depart in the same manner, unless they are aircraft or heavy trucks. Most of the employees arrive by automobile or in minibuses. In Asia and other countries that make extensive use of human labor, facilities may be many stories in height and employees often arrive by transit, or are housed nearby in worker's dormitories.



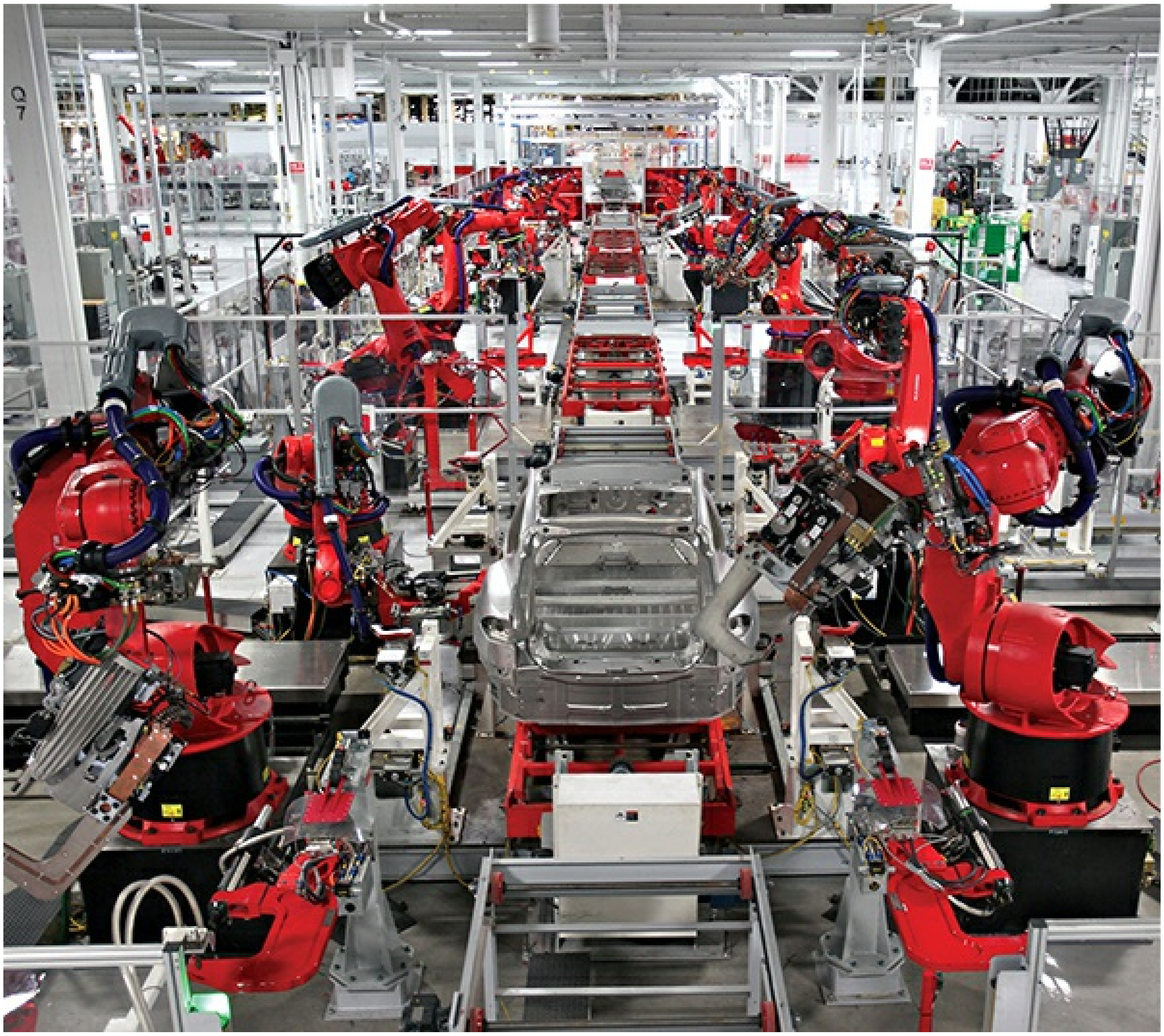
35.58 Process diagram, production of automobile tires.
(Firestone Tires)



35.59 Three-dimensional Sankey diagram of wood product process.
(Courtesy of Superuse Studios)

Despite the differences, there are a number of opportunities that can affect site planning and design. Materials flows are often the point of departure, using a process diagram to identify the raw materials that need to be imported and stored, the production process, and the final products. A number of computer programs that construct *Sankey diagrams* are helpful in charting the relative flows of materials (or energy or other inputs). Effective organization of flows is important, since each time material is transported, energy and labor are expended. Working with an accurate diagram, the site planner can begin to map the flows onto the site—where will the raw materials arrive? how much storage space is required? how much space will be required for the industrial processes? will the final products be inventoried or shipped immediately? And so on.

A second consideration is the rapidly automating nature of most production processes. Robots now assemble most automobiles, and in some industries handle materials from their arrival to completed product. The implication is that manufacturing facilities have evolved into large, tall multipurpose spaces with power and control grids, capable of being quickly reprogrammed and redeployed to new products. While humans control the processes and are involved in final finishes and quality control, they no longer attend to each detail. To justify the high cost of automation, production plants have grown in size and become more generic in their layouts. This results in large roof areas that offer the opportunity for solar installations, green roofs, and greenhouses. Even small structures offer the opportunity to use rooftops for urban agriculture.



35.60 Robotic construction of Tesla automobiles.
(Steve Jurvetson/flickr/Creative Commons)

35.61 Solar array, Boeing assembly plant, Charleston, South Carolina.
(Courtesy of Boeing)

Manufacturing facilities that make considerable use of water and generate contaminated wastes may also need to devote a portion of their site to remediation of effluents before discharging or recycling the water. We have outlined the prospects of using engineered natural systems for organic wastes (see chapter 27), but it is also possible to construct wetlands that remediate inorganic and complex contaminants such as BTEX, PAHs, metals, and CVOCs. Such wetlands require a large area, and their design is a highly specialized task.

35.62 Green roof over manufacturing facility.
(Courtesy of American Hydrotech)

35.63 Rooftop greenhouse for Lufa Farms in industrial area, Montreal, Canada.
(Lufa Farms/Wikimedia Commons)

35.64 Engineered wetlands for remediation of industrial wastes, filtration of ore fines and other suspended solids, and detaining of stormwater runoff, Texas.
(Courtesy of Roux Associates)

Industrial complexes and structures can become positive assets for their communities when they combine economic, environmental, and human considerations. One fine example is the Method plant on the South Side of Chicago, near Pullman (historic home of the railway car manufacturer). Its 150,000 sq ft (14,000 m2) LEED Platinum facility is consistent with the company's mission to create cleaning products that are environmentally responsible. The 22 ac (9 ha) site absorbs or retains all of its runoff and has been designed to allow the structure to be doubled in the future, while part of the site is dedicated to a park that is open to the public. Unlike most industrial plants, it has no fence on its perimeter. The plant is highly automated, producing 200 products and millions of bottles a year, making good use of its 30 ft (9 m) height for automated storage systems and mezzanines with administrative and laboratory functions. The roof of the facility is partially covered by a greenhouse (operated by New York-based Gotham Greens), and a wind turbine and solar panel installations supply energy for the plant. The planning and design possibilities of industrial uses are often overlooked, but the Method plant demonstrates that they go well beyond simply producing goods.

35.65 Articulating solar panels, wind turbine, water detention, and rooftop greenhouses make the Method plant one of the most sustainable manufacturing facilities, Chicago, Illinois.

(© Patsy McEnroe Photography/Courtesy of William McDonough + Partners)

35.66 Manufacturing area, Method plant, Chicago.
(Courtesy of Method Home)

35.67 Stacked storage space, Method plant, Chicago.
(Courtesy of Method Home)

36 | Recreation

Spaces dedicated to public recreation occupy up to 30% of the surface area of North American cities, and their planning and management are a significant challenge for planners. Areas for recreation in the rapidly growing cities of Asia and Africa lag behind their Western counterparts, without long traditions of their use. Dedicated recreation spaces can range from small pocket parks to playgrounds to vast open-space reserves. Often new recreation spaces are acquired in the course of developing sites for other uses, but they may also be planned as additions to a city's public facilities. Each location has its own opportunities, influenced by topography, climate, and traditions in the use of outdoor spaces that provide the basis for unique site designs.

The term *recreation*, which dates to c. 1400, is something of a misnomer, originally denoting places for the recovery from illness or refreshment after exertion. To be sure, that is part of the role that recreation spaces play, but they also serve many other important purposes: promoting childhood development, social skills, and physical dexterity; encouraging neighboring; maintaining health through fitness; reinforcing family and social ties; offering a diversion from the workaday world; connecting people to nature (beyond humans); and providing a setting for public events and spectacles, not to mention their aesthetic virtues. No single label captures all these functions equally. *Open space* is too narrow a term, since the best recreation areas are often filled with equipment; *parks* are only one variant of recreation spaces; *play areas* or *playgrounds* usually refer to areas dedicated to children's play, although adults also play sports and otherwise use recreation areas. So we will stick with *recreation places* as the generic term, and be more precise when describing the types of spaces to be planned.

Human Functions of Recreation Places

From the child's first steps, the environment is important in developing human capabilities and social and cognitive skills. While protected indoor environments may be the first places children play, by the time they are two years old they are ready to explore more open outdoor spaces under the protective eyes of their parents. Play is the way children develop their physical skills and their minds. The importance of providing places for play is enshrined in the UN Convention on the Rights of the Child, which recognizes that children have the right to "rest and leisure, to engage in play and recreational activities appropriate to the age of the child and to participate freely in cultural life and the arts" (Article 31).

Human development occurs in stages, which play spaces should support. The youngest children discover their ability to grasp objects, and develop the hand-eye coordination to be able to touch objects suspended above them. As toddlers they learn to walk to their parents' outstretched arms, and make their way on their own cautiously, holding on to a rail or bench. By the time they are three or four, they are attracted to climbing short runs of steps and enjoy the thrill of slides and crossing bridges. Collaborative play becomes the attraction when they are five or six, sharing objects and imagining possibilities with their peers. By seven or eight, they are on to pickup and organized sports, building things and participating in other forms of creative play. Children need constant challenges to push their development and are always on the lookout for new opportunities. But their environments must also be safe enough to deal with inevitable spills

and falls.

Play remains important to human development when people outgrow childhood. Teamwork and collaboration are developed through organized sports, and personal esteem can come from mastering track and field events or technical climbing. Teenagers wish to develop skills that they can show off, often spending endless hours at skateboard parks, demonstrating their ability to master the pipes, or on public plazas climbing benches (while chipping away their edges). Kinship is often formed by cross-country running or walking with friends. And as young people settle into more sedentary occupations, outdoor exercise becomes an essential antidote to weight gain and flab, and the outdoor environment takes on new meaning. Cardio exercise is a life-preserving strategy for the upper years, and walking or exercise groups can be the center of elderly social networks.

Outdoor environments are doubly important for those who have restricted skills or abilities. Being able to make one's way through a recreation space in a wheelchair, stopping to exercise limbs, meet others, or simply observe activities, is a critical part of life. Differences are narrowed as developmentally disabled children join others in shared play. Recreation spaces need to celebrate differences, not frustrate those who have special needs.

36.1 Mastering the spider web.
(North Carolina Office of Public Education and Public Affairs)

36.2 Outdoor play.
(National Fund for Family Allowances, France)

36.3 Celebrating teamwork.
(GameTimeCT)

36.4 Seniors cycling.
(Kzenon/Shutterstock)

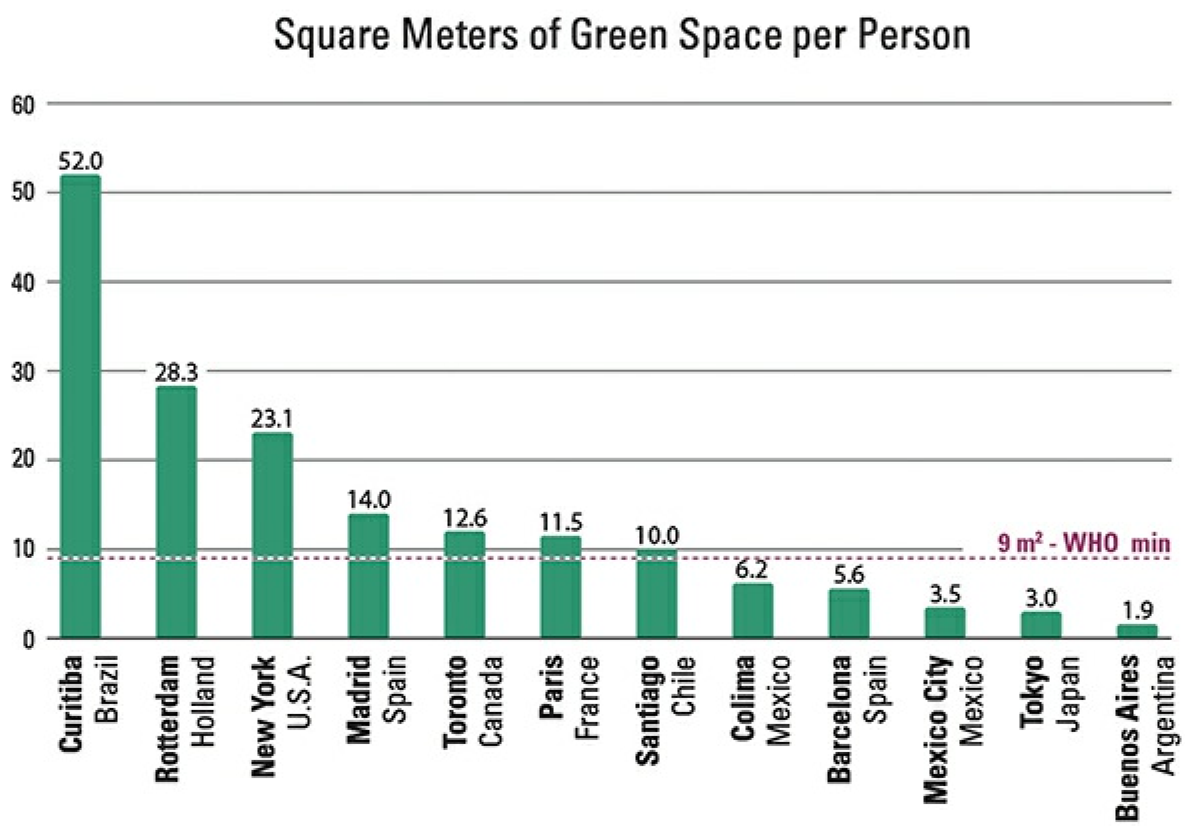
Thinking of the environment as a matrix for human development is at least as important as ensuring that it functions efficiently to move traffic, or provides the spaces needed for commercial and residential facilities. Recreation is not restricted to the formal parks and playgrounds provided in a community; play opportunities can be found in streets, plazas, and parking lots if they are designed for that purpose, and sometimes in spite of their designs. The most creative recreation places are sometimes found where they are least expected.

Recreation Standards

How much space do communities require for recreation? A much-cited standard for the US suggests that 10 ac (4 ha) per 1,000 residents, or 40 m2 per capita, is a desirable norm (Lancaster 1990), although the origin of the standard has been lost to time. More sophisticated measures of the adequacy of space focus on the level of service offered by available open spaces, recognizing that a mix of types of spaces is necessary, ranging from the smallest pocket parks and playgrounds to neighborhood parks, organized playfields, and large regional nature preserves. Cities across the globe vary considerably in the amount of green space they actually provide. Curitiba, Brazil provides 52 m2 for each of its residents (equivalent to 13 acres per 1,000 residents), while New York provides 23.1 m2, Toronto 12.6 m2, Paris 11.5 m2, and Tokyo only 3.0 m2. In general, Asian cities provide considerably less than cities in North America, with European cities in between. Cultural differences in the use of recreation spaces are an obvious source of difference, although it is hard to decide whether these are the result of not having adequate outdoor recreation space or a response to traditions of using public environments. The World Health Organization suggests a minimum of 9 m2 per capita, roughly one quarter the amount of the (outdated) US standard (Morar et al. 2014).

The more important issue is the types of spaces required in cities. Again, these are culturally determined. Some places combine children’s play facilities with schoolyards; in other cases the two are separate. Some cities, particularly in China, prefer multipurpose public spaces that can be used for dance and movement exercises in the evening and children’s games in the day, while other places strictly segregate children’s play facilities from places dedicated to leisure. North American cities often have norms for creating recreation spaces in newly developing areas, and expect developers to either create spaces or provide the funding for them beyond their sites. Vancouver, Canada, as an example, requires developers to

contribute 2.75 acres (1.1 ha) of publicly accessible recreation space per 1,000 residents, or provide the funds to the city to create such spaces. The most important issue is how recreation space is distributed between local, neighborhood, and more regional facilities. One set of national standards for the US suggests that for each 1,000 residents, communities ought to have 0.25–0.5 ac (0.1–0.2 ha) of local close-to-home recreation space, 1–2 ac (0.4–0.8 ha) of neighborhood play spaces, 5–10 ac (2–4 ha) of large community recreation spaces with sports fields, and 5–10 ac (2–4 ha) of regional open spaces. These are broad ranges but represent overall aspirations for North American cities (Lancaster 1990; Moeller 1965).



36.5 Per capita green areas in cities.
(Adam Tecza/Sustainable Cities International Network)

Table 36.1 | Typical recreation facility standards

Facility	Number of units/population	Service radius	Minimum space requirements	Orientation
Archery range	1/50,000	30 min travel	0.65 ac (0.3 ha)	Target faces S
Badminton	1/5,000	0.5 mi (1 km)	1,600 sq ft (150 m2)	Long axis N-S
Baseball				
Official	1/5,000	0.5 mi (1 km)	3.5 ac (1.4 ha)	Home plate to pitcher faces ENE
Little League	1/5,000	0.5 mi (1 km)	1.2 ac (0.5 ha)	Home plate to pitcher faces ENE
Softball	1/5,000	0.5 mi (1 km)	2 ac (0.8 ha)	Home plate to pitcher faces ENE
Basketball	1/5,000	0.5 mi (1 km)	8,000 sq ft (750 m2)	Long axis N-S
Bocce (boules)	1/5,000	0.5 mi (1 km)	1,200 sq ft (120 m2)	
Cricket pitch	1/20,000	30 min travel	5 ac (2 ha)	Bowling NE-SW
Curling (2 sheet)	1/20,000	30 min travel	6,000 sq ft (600 m2)	
Field hockey	1/20,000	30 min travel	1.5 ac (0.6 ha)	Long axis NW-SE
Football				
US football	1/20,000	30 min travel	1.5 ac (0.6 ha)	Long axis NW-SE
Canadian football	1/20,000	30 min travel	1.6 ac (0.6 ha)	Long axis NW-SE
International football (soccer)	1/10,000	0.5 mi (1 km)	2 ac (0.8 ha)	Long axis NW-SE
Rugby	1/20,000	30 min	2 ac (0.8 ha)	Long axis NW-SE

		travel		
Australian rules football	1/50,000	30 min travel	5.7 ac (2.3 ha)	Long axis NW-SE
Golf				
Driving range	1/50,000	30 min travel	13 ac (5 ha)	Long axis SE-NW
Pitch and putt	1/20,000	30 min travel	15 ac (6 ha)	
Full course	1/20,000	30 min travel	120 ac (50 ha)	
Handball	1/100,000	15–30 min travel	1,000 sq ft (100 m2)	Front wall at N end
Horseshoes	1/2,000	0.25 mi (0.5 km)	500 sq ft (50 m2)	
Ice hockey	1/100,000	30–60 min travel	0.5 ac (0.2 ha)	Long axis N-S
Running track	1/20,000	0.5 mi (1 km)	4.3 ac (2 ha)	Finish line at N end
Swimming	1/20,000	0.5 mi (1 km)	1 ac (0.4 ha)	
Table tennis	1/2,000	0.5 mi (1 km)	1,000 sq ft (100 m2)	
Tennis	1/2,000	0.5 mi (1 km)	7,000 sq ft (700 m2)	Long axis N-S
Volleyball	1/5,000	0.5 mi (1 km)	4,000 sq ft (400 m2)	Long axis N-S

Adapted from Lancaster (1990) and other sources.

Another way of thinking about recreation standards is in terms of the desirable commuting range from homes to various types of spaces. Table 36.1 offers general guidance on the need for playfields of various kinds, and their optimal distances from residential areas. Casual and organized

sports obviously vary among countries, and local standards need to reflect these differences. There is also a need for places where those learning a sport can practice and where pickup games can occur (in spaces that may be quite minimal). A basketball hoop on a city street may serve these purposes, and a blank wall fronting a warehouse parking area may become a good location for honing handball or tennis skills.

36.6 Street hockey, Canada.
(Arctic Photo)

36.7 Street play, Brooklyn, New York.
(© Arthur Leipzig/Courtesy of Howard Greenberg Gallery, New York)

36.8 Street basketball, Seattle.
(Joe Mabel/Wikimedia Commons)

Streets and Public Spaces

As a youngster growing up in Canada, I spent countless winter hours on the street playing pickup games of hockey with my friends. We had no equipment other than our hockey sticks; blocks of snow marked the goals,

and a tennis ball proved easier (and less punishing) than a puck to stickhandle on the frozen street. We also had ice rinks nearby, but with half an hour to kill, it was never worth strapping on skates. In the real game of hockey, you could always tell the street hockey kids by their amazing stickhandling skills and lightning passes. In the summer the same street became our bicycle racecourse and baseball practice field, even at risk of occasional broken windows. There were few cars on the street to disrupt the flow of the games, and we felt that we owned the street.

Playing in the street has a long tradition in cities throughout the world. Stickball became New York's local version of baseball, taking account of the long narrow streets lined with stoops and the constant banter of spectators sitting on them. For younger children, hopscotch and other jump games are chalked on the pavement, and on hot summer days sprinklers magically become attached to fire hydrants to provide a cooling spray. In much of the world, skills of dribbling and ball handling a football (soccer ball) are acquired in the streets and neglected spaces, rather than in formal sports grounds. Suburban cul-de-sacs have proved to be ideal spots for neighborhood basketball hoops, and informal curfews determine when games must wrap up. Studies have found that streets, vacant lots, and other spaces near homes are used far more intensively than areas formally dedicated to recreation. So the place to begin thinking about recreation is with the underused spaces planned for utilitarian purposes—little-used roads, boulevards, parking lots, paved schoolyards, and other spaces.

36.9 Painting the street, Cincinnati, Ohio.
(Courtesy of Arts Wave)

36.10 Parking lot doubles as basketball area, Williamson, Michigan.
(Anon.)

36.11 Street trampoline, Copenhagen.
(crazikyle/imgur)

36.12 La Cienega outdoor gym, Beverly Hills, California.
(City of Beverly Hills)

36.13 Shared street, San Sebastián, Spain.
(Courtesy of Heather K. Way)

36.14 Downtown court street, Detroit, Michigan.
(Gary Hack)

36.15 Skating at Nathan Phillips Square, Toronto.
(Courtesy of Michelle Shen)

36.16 Rahel-Varnhagen-Straße play street, Freiburg, Germany.
(City of Freiburg)

36.17 Dancing the tango on Sunday, San Telmo Plaza and streets, Buenos Aires, Argentina. (Helge Høifødt/Wikimedia Commons)

The simplest strategies include painting streets and installing recreation equipment at the edges of parking lots to give them a second life in evenings and weekends. This will signal that they are more than vehicular spaces and will also slow traffic. But the functions of streets can be expanded to make them part of recreation routines. In Copenhagen, trampolines have been installed along city streets, attracting people of all ages. Many cities have created outdoor gyms along streets.

It is also possible to look carefully at existing street patterns and identify lightly used streets that can be converted to outdoor recreation areas. In European cities, this is done by dispensing with curbs and allowing streets to be closed for parts of the day or week. In a stroke of imagination, the city of Detroit has converted redundant downtown streets to outdoor

basketball courts and recreation zones, drawing office and service workers at lunchtime and after work. The beauty of this strategy is that uses can be tried on a temporary basis, and made permanent if they are successful. It is also possible to make seasonal changes, as by converting ponds and water elements to skating rinks in winter. Nathan Phillips Square at the Toronto City Hall becomes a beehive of activity in winter when its reflecting pool is transformed into a skating rink.

Where there is an opportunity to design new streets, it is important to get the conditions right so that children are safe while playing. Eliminating through traffic, minimizing parked vehicles (which can be damaged or can hide children darting out into the street), providing seating along the street for parents with young children, and adding play equipment to the street are ways to create successful play streets. It is also possible to design streets so that they can be closed to traffic on weekends to encourage recreation uses while maintaining movement on adjacent streets, or to close one half of a boulevard street.

Playgrounds

Playgrounds for children are often among the least creative examples of site planning. A small plot of ground is typically set aside for play; designers immediately reach for the catalog of manufactured playground equipment, and clients order the largest assemblage the budget will permit. The result is plenty of bright colors, a safe place to play, a place adults are comfortable with but where children are quickly bored. Part of the appeal

is that manufactured equipment has been designed to minimize risk and carefully tested, to minimize the threat of lawsuits over injuries. While there are plenty of manufactured play components that are enduring, they need to be assembled in creative ways that develop children's potential. And there are alternatives to predesigned playgrounds.

One place to begin the planning process is with the developmental stages the playground seeks to accommodate. Table 36.2 lists the key steps in children's physical, socio-emotional, and intellectual development, and suggests the kind of facilities and equipment that promote each. A play area for preschool children obviously requires quite different elements than one for rambunctious seven-year-olds, but it is entirely possible to accommodate a broad range of ages on a single well-planned site. Separation and sequence are the key: young children have to be separated from older, more active kids, and need to be under the watchful eye of their guardians, and the area needed for play tends to expand as ages increase. Agreeing on the program of users and mapping the developmental stages on the site are a prerequisite to its design.

Play equipment designed for each of the stages of development should be organized as a series of "cells," with pathways and seating areas as the connective tissue. Youngest children need the most benign environments, and a sand base is ideal both for play and harmless tumbles. Safety tiles are another essential, particularly for areas with slides and climbing equipment. As children progress to larger climbing structures with hanging bridges and collaborative play wheels, these need to be separated from the young children's areas, but within sight so that youngsters can be challenged by what older children are doing. Swings will need their own separate area to prevent accidents.

Children's playgrounds need to be fenced, both to keep children from straying off the reservation and to keep dogs out and prevent contact with unwanted passersby. Parents and caretakers are also part of the playground and need to be provided with comfortable places to sit (and converse with other adults), shade for the hot summer days, and ample room to park

strollers. Adding picnic tables to the playground will allow the adults to work while the children play, and accommodate hungry and thirsty playgrounders.

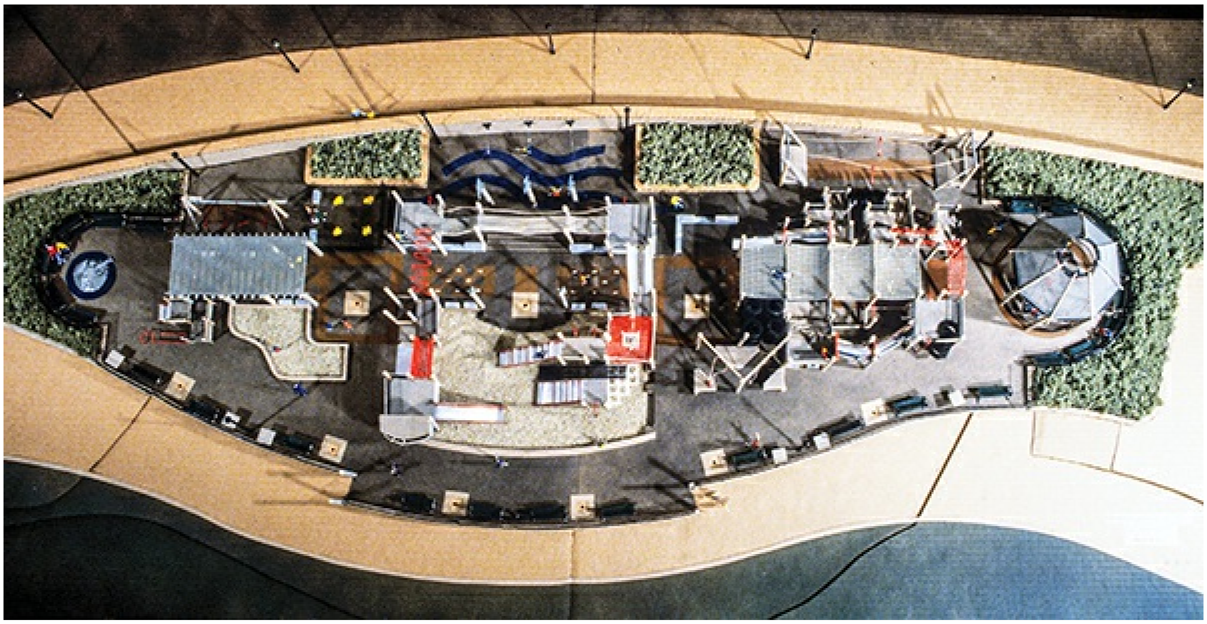
Water can add special magic to a playground. It cools on a hot day, adds mischief to the fun, and allows castles and other fantasies to be molded out of wet sand. Where there is room for programmable fountains, excitement is added in the anticipation of when the water stream will appear.

Table 36.2 | Play facilities for child development

Age	Physical development	Social-emotional development	Intellectual development	Facilities and equipment
0–2	Swipes at dangling objects; begins to creep, crawl, and walk; begins to grip and grasp objects	Egocentric; plays alone but with adult support	Explore and discover, begins to coordinate movements	Dangling objects to strike; objects to grip and grasp; soft objects to play with such as blocks; equipment that encourages exploration; soft surfaces, separated from toddlers
2–3	Walks and talks; jumps; climbs and creeps	Plays alone but near others	Understands short directions	Surfaces for walking; climbing structures (small): safe places to jump; short slides; equipment that encourages parallel play; self-explanatory equipment; sand and water
4–5	Large motor skills being developed; need vigorous activity but lack muscular endurance; developing equilibrium and balance	Egocentric and impatient; needs approval; enjoys repetition; learning to share; transition between individual and group play	Enjoys problem solving; eager to learn; general lack of feel; sorting out differences between real and make-believe	Equipment that promotes movement; items to promote agility and flexibility; ladders and climbing structures; problem solving equipment; places for dramatic play; shallow-water fountains and hoses
6–7	Steady gains in height and weight; legs short in relation to trunk; gross motor skills developing; boys	Plays in small groups or alone, needs praise, beginning differentiation in abilities	Still short attention span, improved reasoning and memory; imaginative play	Horizontal ladders, chinning bars, climbing equipment; balance beams; creative playgrounds; places of enclosure, collaborative play opportunities

and girls equal in skills	sought; seeks creative opportunities

Adapted from Thompson, Hudson, and Mack (n.d.).



36.18 Model of playground, Rockefeller Park, Battery Park City, New York City.
(Johansson and Walcavage/Carr, Lynch, Hack and Sandell)

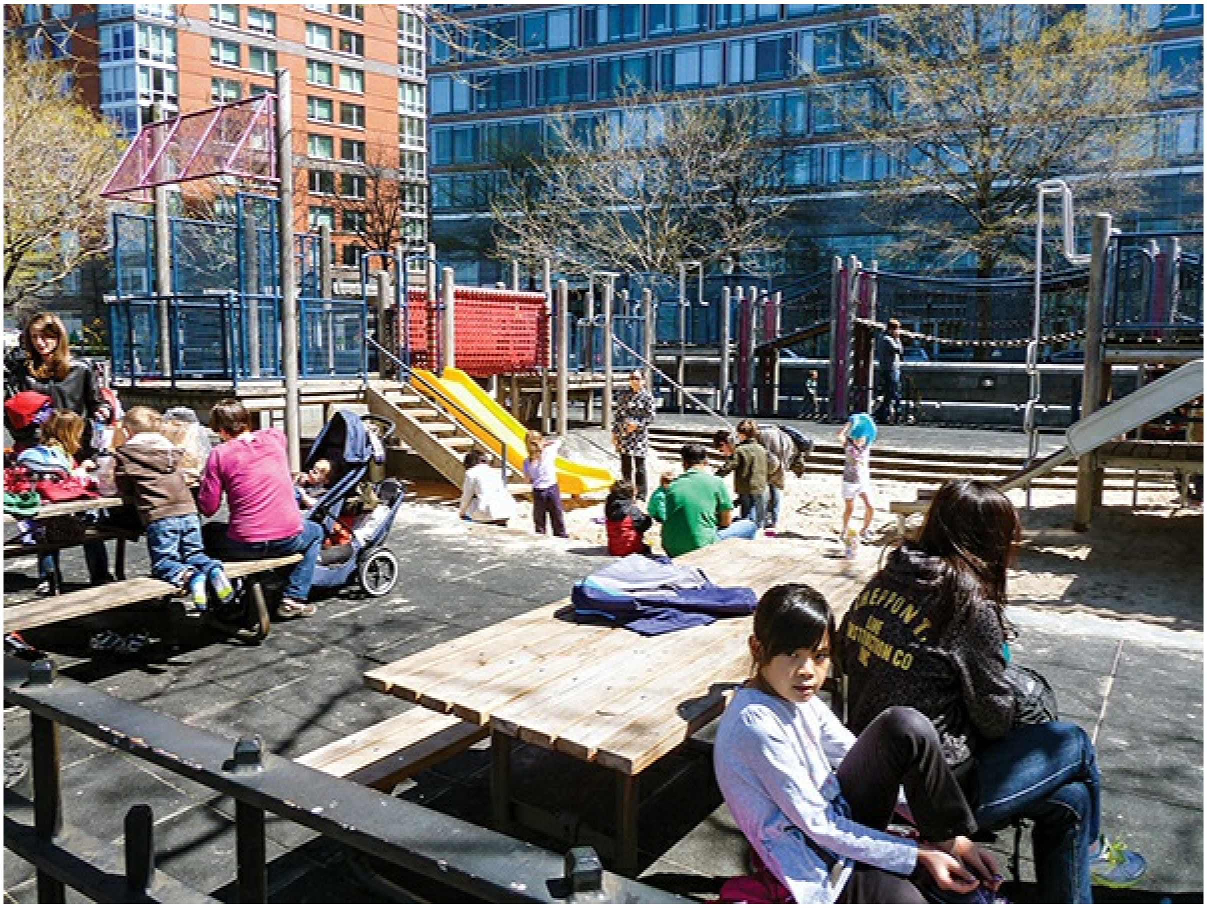
36.19 Sand play area, Rockefeller Park playground.
(Gary Hack)

36.20 Young children's play area, Rockefeller Park playground.
(Gary Hack)

36.21 Older children's play area, Rockefeller Park playground.
(Gary Hack)

36.22 Swings area, Rockefeller Park playground.
(Gary Hack)

36.23 Adult seating area, Rockefeller Park playground.
(Gary Hack)



36.24 Picnic tables, Rockefeller Park playground.
(Gary Hack)

36.25 Water wall, Rockefeller Park playground.

(Gary Hack)

36.26 Water park, Granville Island, Vancouver, Canada.
(Gary Hack)

36.27 Programmed fountain, Centennial Park, Atlanta, Georgia.

(Gary Hack)

36.28 Sculpture, Rockefeller Park playground.
(Tom Otterness/Gary Hack photo)

36.29 Bob Cassilly hippo playground, Riverside Park, New York City.
(Gary Hack)

36.30 Wall-holla climbing wall structure.
(Lappset Group.Ltd)

36.31 Adventure playground, St. Kilda, Victoria, Australia.
(City of Port Phillip)

36.32 Zip line, Berkeley Adventure Playground, Berkeley, California.
(Courtesy of Coby McDonald/California Magazine)

The addition of sculpture and objects that recall children's stories can be especially important for fantasy play. The very best of such works avoid transitory icons, and become works of art in their own right. Creative design of playground equipment can create objects that become a special form of sculpture.

Children can also design and construct their own play environments. The *adventure playground* movement, which emerged in the 1960s, advocated providing children with the materials and tools, and adult guidance, for them to construct huts, climbing structures, watercourses, rope lines, and other devices they dream up. Every type of material—demolition wood, tires, metal sheeting, cast-off chairs and furniture—is a legitimate resource for an adventure playground. Some such playgrounds emphasize individual or small-group collaboration—construction of huts, as an example, which then need to be maintained physically and socially. Some allow pets to be kept in the huts. Other adventure playgrounds are

devoted to collective structures, heroic assemblages of materials that continue to grow as new materials are found. Bright colored paint can be the great leveler, helping forgive awkward construction.

Adventure playgrounds are usually offensive to adult eyes, hence the first step is finding a site that is out of sight, or constructing a wall that allows the designs of children to occur beyond adult scrutiny. At least one adult needs to be present during opening hours, to sign out tools, dispense nails and other consumables, and keep an eye out for obviously dangerous activities. As children grow out of the playground, decisions need to be made about playground renewal, whether to clear abandoned structures and make room for the next group of builders. Adventure playgrounds are no different in this respect from urban settlements.

Schoolyards

Schoolyards are a great underused resource for community recreation. Many urban schoolyards are simply paved areas where kids let off steam for 15 minutes or so midmorning and afternoon. There may be basketball hoops, and if the space is large enough, soccer (football) goals that are sometimes used for practice after class. Turf issues and worries about liability for accidents often mean that schools discourage after-hours and adult use of their facilities. Properly planned and equipped, outdoor spaces at schools could serve many more needs.

Painted surfaces can transform even the smallest schoolyard into a place for children’s games, or ensure that a green space does not become the

captive of a single sport. The addition of outdoor play equipment will help ensure that a schoolyard becomes a destination on weekends and summer breaks as well as during school hours.

A more radical transformation of the schoolyard involves creating a space for environmental learning and the production of edible products. Gardening is a remarkable recreation activity that can be enjoyed at any age, and how better to learn fundamentals of biology than through field experiments? Many elementary and secondary schools have devoted all or parts of their open spaces to growing vegetables, flowers, and fruits. The area needs to be fenced to protect it against unwanted intruders. Creating the garden usually requires a volunteer effort among neighborhood residents working with students, which helps forge stronger ties to the school. In temperate climates, a school garden is aided by having a simple greenhouse where plants can be germinated indoors, which can become an extension of the biology lab. Use of rainwater to irrigate the gardens offers valuable lessons in water cycles, and natural fertilizers and pesticides teach about the chemistry of plant growth. Produce from the gardens can be used in the school cafeteria, and since plant growth usually doesn’t recognize the school year, students and volunteers continue to tend the garden during vacation periods.

36.33 Schoolyard pavement markings, Brooklyn,

New York.
(PS 124 Brooklyn)

36.34 Schoolyard markings for multiple sports, Dover College, Dover, UK.
(SSP)

36.35 Edible schoolyard, P.S. 216, New York.
(Raymond Adams/Courtesy of WORKac)

36.36 Schoolyard high tunnel, George Washington Elementary School, Putnam County, West Virginia.
(Kenny Kemp/WVGazette)

Gardening is a significant recreation activity for many people, and can be extended to other spaces in the city—to landscaped medians, allotment gardens, courtyards, and portions of public parks set aside for neighborhood care.

Playgrounds for Teenagers and Adults

The growing interest in vigorous sports by teenagers and their elders has led to the construction of play facilities for in-line skating, skateboarding, BMX riding, climbing, jumping, competitive cycling, and *parkour*, among other sports. Skateboarding parks originated as a way of moving the nuisance of boarders out of traditional parks and squares where they were ruining benches and walls and annoying others. The sport has become an art form and a way to show off skills to peers. Guidelines have been written for the design of skateboard parks, which sometimes double as BMX riding courses. A good skateboard park contains some combination of full pipes, half pipes, quarter pipes, clamshells, hubbas, pyramids, and benches, which have conventional dimensions (Poirier 2008). They are best located away from residential areas or parks where solitude is desired, and may attract boarders from a broad area. They are, of course, dangerous —which is part of their attraction—and legal issues need to be resolved before their opening, including adequate warnings and supervision.

A variety of extreme bicycle sports have also become popular and have found their way into international events. Motocross racing consists of a single track for 6–8 riders, who race over a clay and sand surface with vertical jumps, turns, and other hurdles designed to make a finish difficult. The course may also consist of a single-lane track where riders compete for the best time. BMX riders may ride not to win contests but to show off skills to their peers. Sometimes they use skateboard parks, but these are not ideal because of their hard surfaces and extreme curves. Purpose-designed BMX courses use clay-sand surfaces with occasional jumps of concrete, and they are more forgiving when riders take spills.

36.37 Pedlow Field skateboard park, San Fernando Valley, California.
(Cbl62/English Wikipedia)

36.38 BMX race, Sainte-Maxime, France.
(Fabrizio Tarizzo/Wikimedia Commons)

36.39 Cyclecross course, Gloucester, Massachusetts.
(Courtesy of Seven Cycles)

36.40 BMX bicycles at Valley Gardens Skate Park, Harrogate, UK.
(Harrogate Borough Council)

36.41 BMX course, Chula Vista, California.
(NBC 7 San Diego)

36.42 Climbing structure, CalPoly Recreation Center, San Luis Obispo, California.
(Courtesy of Cal Poly University)

36.43 Parkour, Gaza, Palestine.
(European Pressphoto Agency)

36.44 Parkour course, San Diego, California.
(Courtesy of Nerd Reactor)

Rock climbing, once the province of mountaineers, has also become a popular urban sport. Rock climbing walls are now common in exercise centers but also are making their appearance in outdoor parks. Vertical surfaces, generally 6–13 m (20–40 ft) in height, have handholds and belay bars attached to the surface, and rings at the top to attach safety ropes. They may be freestanding structures or attached to exterior walls. The key element is a padded safety surface at the base to break any falls, of foam or inflatable mats or a thick layer of loose materials such as wood chips.

One step up on the scale of danger is the sport of parkour, which is based on military training regimes and is becoming popular among youths. Its fundamental idea is to climb, hurdle, jump, or flip across obstacles, reaching a destination in as close to a straight line as possible. There are a variety of philosophies and conventions, and style is as important as the mastery of moves. The hazards of falling, destroying property, or injuring others are obvious and, as for skateboarding, there is a movement to create organized playgrounds to serve the sport. These are true adult playgrounds.

Playfields

Fields (or pitches) for more traditional organized sports are the centerpieces of neighborhood and citywide recreation areas. The types of sports and their social roles vary across societies, but in most places both amateurs and professionals practice them. Beginning in preteen years, learning team sports is a way to develop camaraderie, teamwork, leadership skills, and self-esteem. They are a way for adults to pass important lessons along to youngsters, while imparting the appropriate physical and mental habits. In midlife, team sports played after work in the evenings and on weekends become a way of maintaining friendships (and rivalries) while staying in shape. Australian men recreate with a passion on weekends, playing rugby, football, or Aussie rules football with their mates. Hockey, played on outdoor rinks, is the team sport of choice in cold Canadian cities, where most kids go directly to the rink after school. On Sundays, the same rinks attract skaters of all ages for pickup games. In most US cities, basketball and tennis courts, baseball and football fields, and hockey rinks are booked far in advance by the growing number of self-organized teams and leagues.

Some cities tend to adopt a sport and provide facilities for it throughout their recreation areas. Melbourne, Australia, as an example, has a long tradition of promoting tennis at all levels, and the center of the city has a dense concentration of courts, which also can be found within a few minutes' walk of almost every home. Of course, it is also the home of Aussie rules football, and has many pitches for amateurs and professional

teams. Other cities have chosen to specialize in particular elite sports: Oklahoma City aspires to become the center for rowing for its region and has developed a fine rowing basin and boathouse district. Cities frequently use the occasion of hosting an international sporting event as an impetus to develop their elite sports facilities. Many of these facilities are only lightly used after the event, although participation may grow once the city has adequate facilities (speed skating, cycle racing, ski jumping, and bobsledding are examples). It is critical that sports facilities be planned for the long future, not just the immediate event.

The success of large dedicated sports spaces depends on future growth in demand that is not entirely predictable. It also depends on the land available for sports fields, and tradeoffs usually must be made among competing desires for facilities. The first step, then, in planning a recreation site is understanding the type and number of facilities that can be accommodated on the land available. Figures 36.47 and 36.48 provide templates for the areas required by various sporting activities. The capacity of a site is easily explored by shifting paper templates around on a base plan of the site, or by moving outlines around on a digital base map. As the fields or courts are shifted to achieve an optimal orientation and provide for access and spectator areas, soon the tradeoffs become clear. Should the site contain two football fields, or only one with six tennis courts and a basketball court? It is important to consider the number of people who may be served by each—a tennis court with two or four players requires much more area per person than a basketball court.

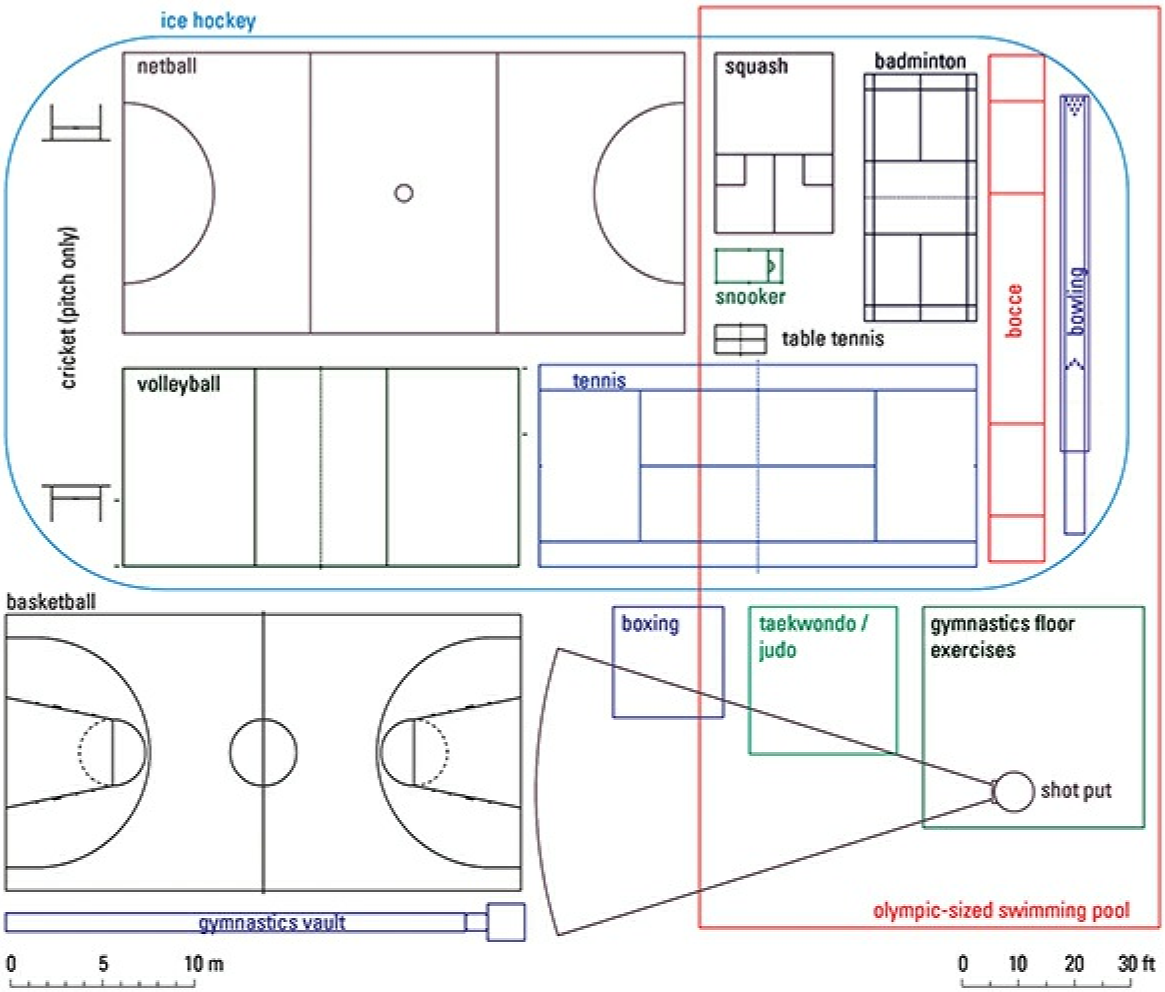
The decision about the mix and layout of athletic fields depends on many factors, not just whether they fit on the site. Cost of maintenance will be an issue, and the presence of organized clubs that can take responsibility for the fields is another. Sidebar 36.1 illustrates some of the alternatives considered in the planning of Jefferson Park in Seattle, where many pressures weighed on the choice of how to use two reservoir areas that were becoming available for recreation use. Large recreation areas are also constructed and improved over time, and the site plan needs to be flexible

to respond to changing trends in recreation.

36.45 Central Melbourne sports facilities.
(Google Earth)

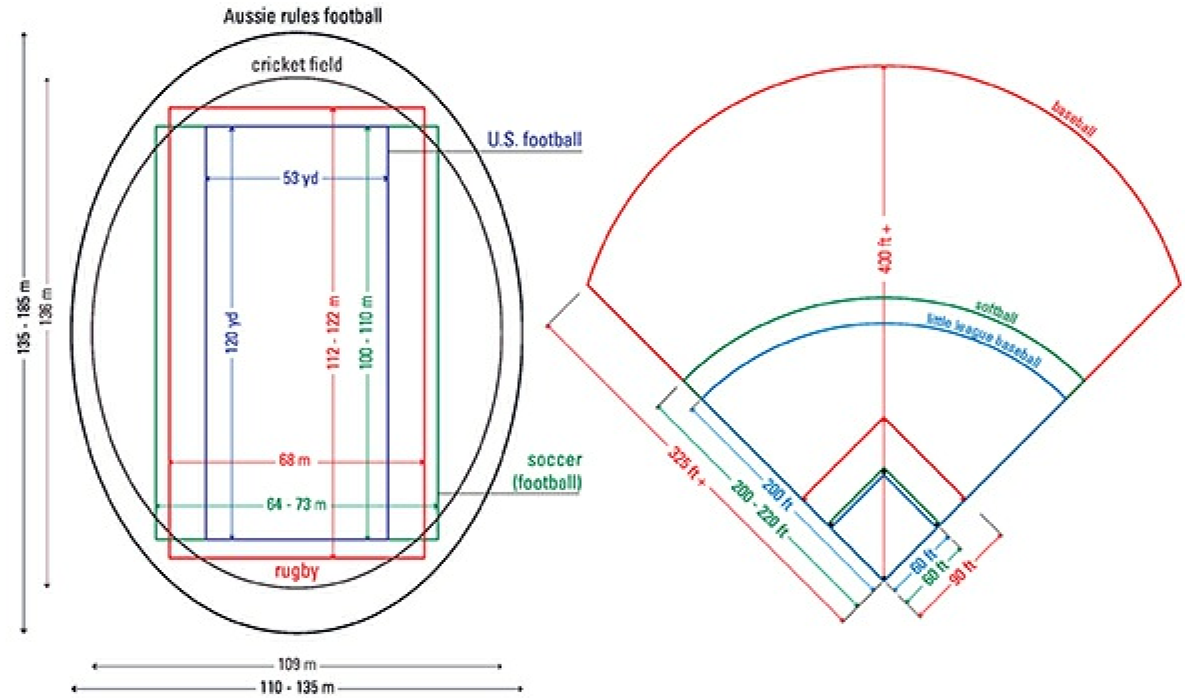
36.46 Oklahoma City boathouse district.
(Courtesy of Georgia Read/Read Studio Inc./Oklahoma City Boathouse District)

Participants in team sports will need dressing rooms, places to store their street clothes, and toilets, and may need roofed areas to wait out a sudden thunderstorm. If spectators are attracted to the games, they will expect seating along the sidelines or baselines, use of toilets, and concessions for food and drinks. This set of services can become the centerpiece of the site, with walkways radiating out to the individual fields. Of course, professional teams or even aspiring amateurs will seek more than a hut, and clubs cultivating a tradition of fellowship will want lounges, bars, restaurants, and permanent storage areas for members. Whole communities are being built with sports as their theme, including LakePoint Sporting Community near Atlanta, where youngsters, parents, spectators, and professional athletes rub shoulders around the clubhouses and retail areas surrounding the playing fields.



36.47 Sizes of playing courts, rinks, pools.

(Adam Tecza/Gary Hack)



36.48 Sizes of playing fields and pitches.

(Adam Tecza/Gary Hack)

Multipurpose Recreation Areas

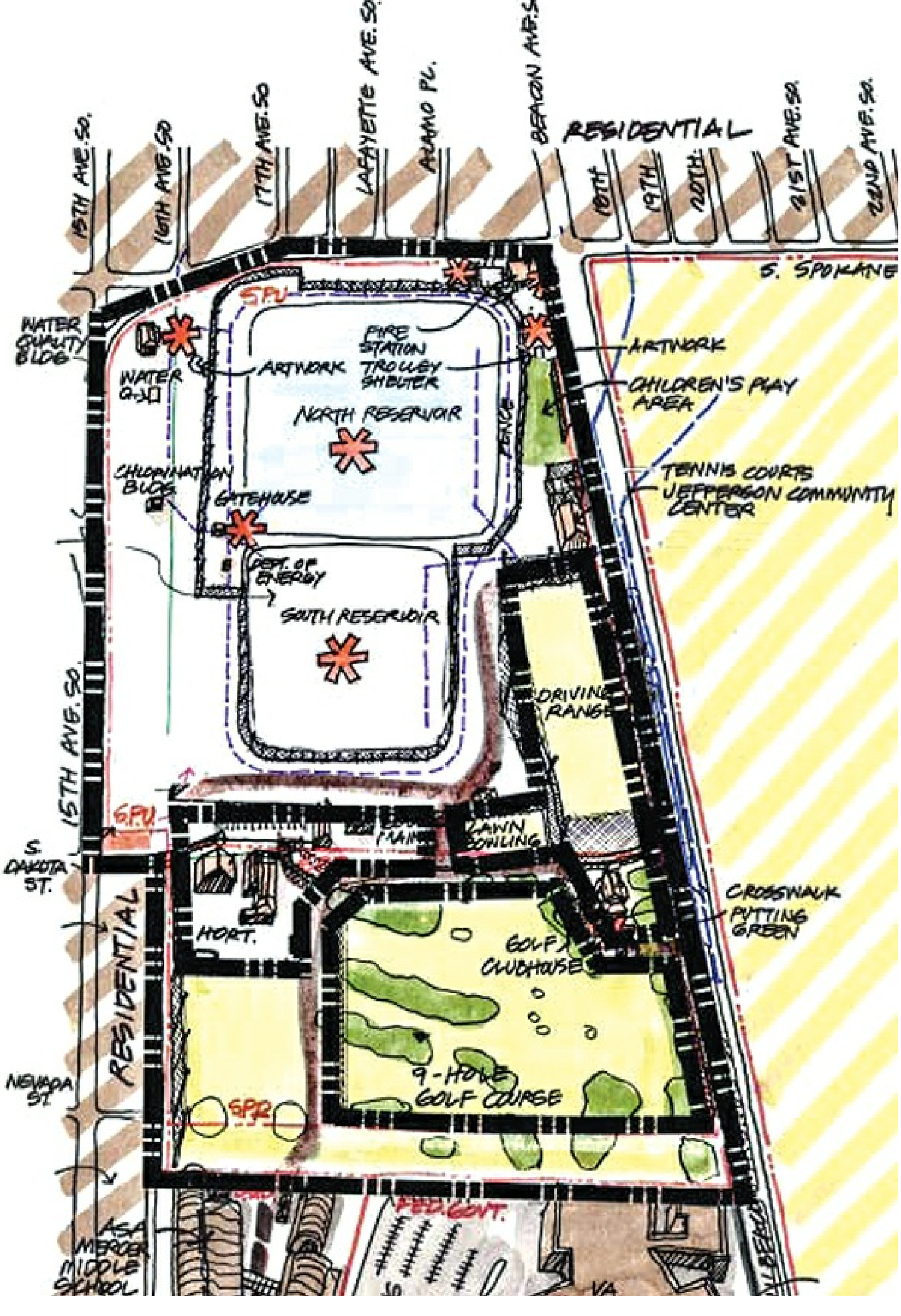
Team sports and other recreation activities can bring together a broad cross section of a community, breaking down barriers of income, race, age, and abilities. Where the town square once was a community's mixing bowl, today it is more likely to be found in parks and playgrounds or along walking and biking trails. Social contact is encouraged when places offer as many types of recreation facilities as possible. As Jefferson Park

illustrates, expanding the range of activities by having spaces for all ages makes for a more meaningful neighborhood center.

Sidebar 36.1

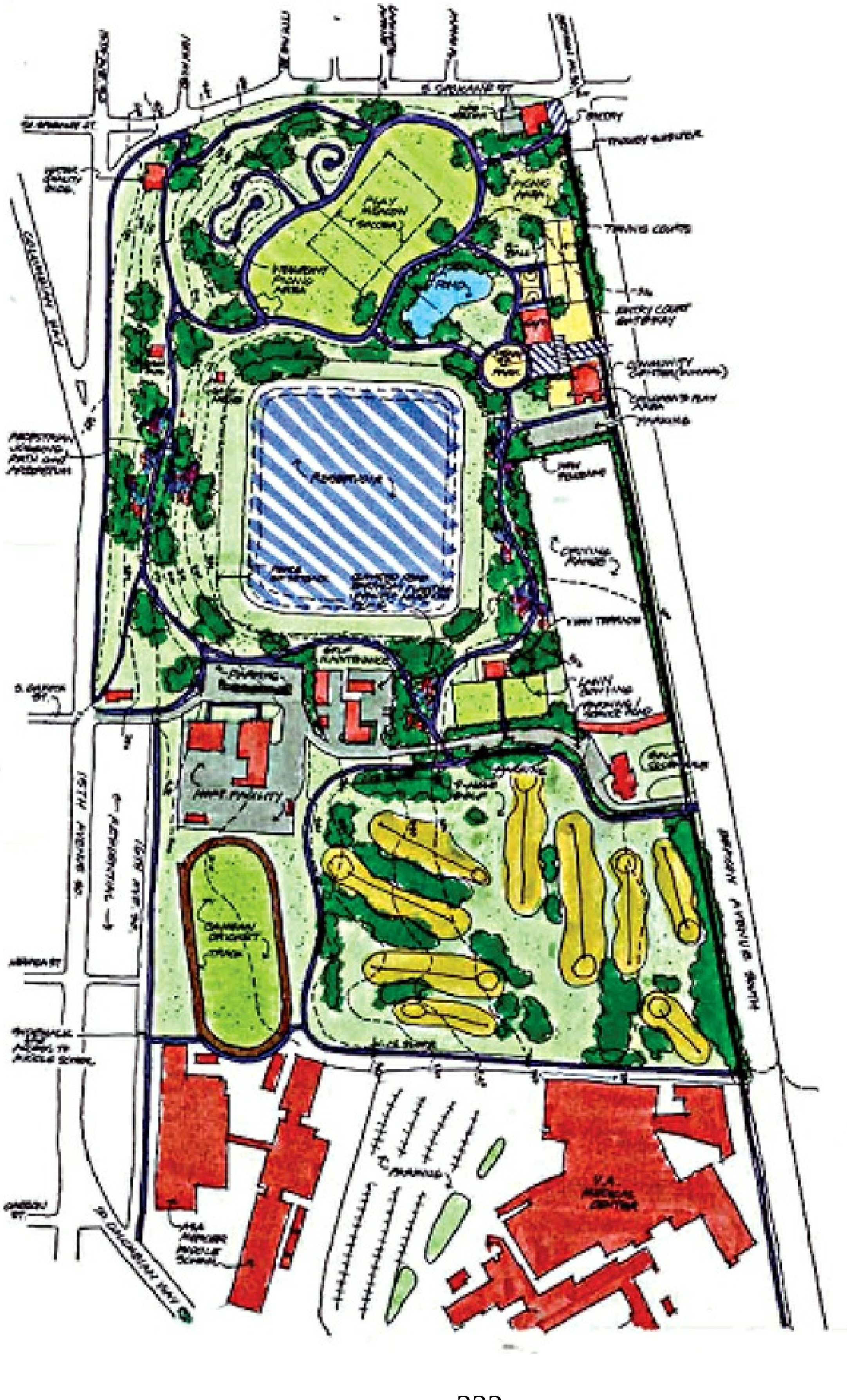
Alternatives for Jefferson Park, Seattle

Jefferson Park is a 100-year-old recreation and reservoir area in the Beacon Hill neighborhood of Seattle. Over the years, a variety of recreation uses were created on the site, including a nine-hole golf course, a golf driving range, a lawn bowling club, children's play area, and a large multipurpose field used by an adjacent elementary school. With the prospect that a 50 ac portion of the 137 ac site might become available as the two large reservoirs were abandoned (the northerly one immediately and the southern one in the indefinite future), a new plan was prepared for the site.



15TH AVE.SO.
16TH AVE.SO.
17TH AVE.SO
LAFAYETTE AVE.SO.
ALAMO PL.
BEACON AVE.SO.
RESIDENTIAL
18TH
19TH
20TH
21ST AVE.SO.
22ND AVE.SO.
S. SPOKANE
S.P.U.
WATER QUALITY BLDG
WATER Q.
ARTWORK
FIRE STATION
TROLLEY SHELTER
ARTWORK
CHILDREN'S PLAY AREA
NORTH RESERVOIR
FENCE
CHLORINATION BLDG.
GATEHOUSE
TENNIS COURTS
JEFFERSON COMMUNITY CENTER
DEPT. OF ENERGY
SOUTH RESERVOIR
DRIVING RANGE
15TH AVE.SO.
S.P.U.
LAWN BOWLING
S. DAKOTA ST.
RESIDENTIAL
HORT.
CROSSWALK
PUTTING GREEN
GOLF CLUBHOUSE
9-HOLE GOLF COURSE
NEVADA ST.
SPR
FED.GOVT.
ASA MERCER MIDDLE SCHOOL
VA

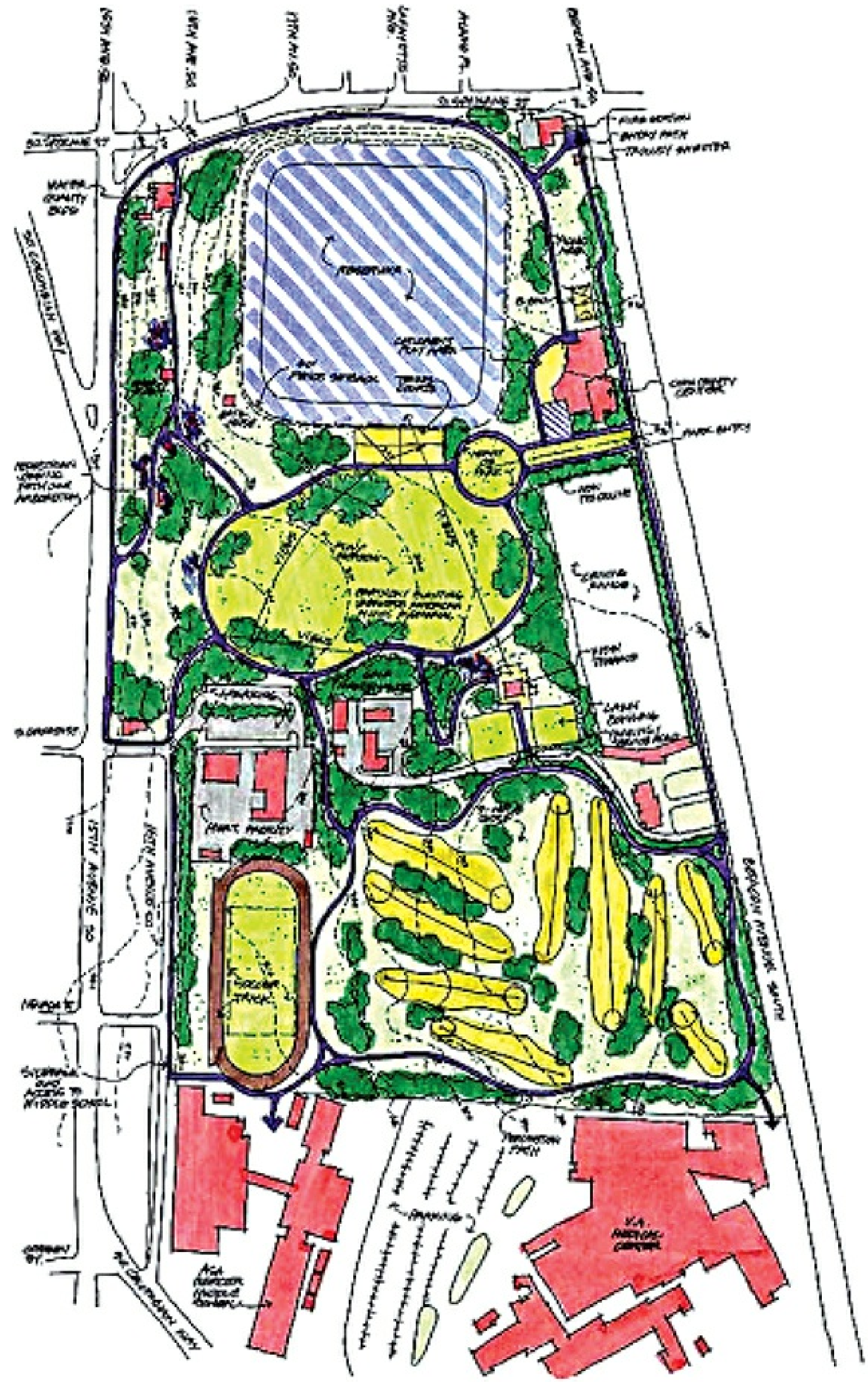
36.49 Plan of the site before development, Jefferson Park, Seattle, Washington.
(Seattle Department of Parks and Recreation)



ENTRY
TENNIS COURTS
PLAY MEADOW (SOCCER)
PICNIC AREA
ENTRY COURT GATEWAY
COMMUNITY CENTER
PARKING
RESERVOIR
VIEW TERRACE
GOLF MAINTENANCE
CRICKET TRACK
V.A. MEDICAL CENTER

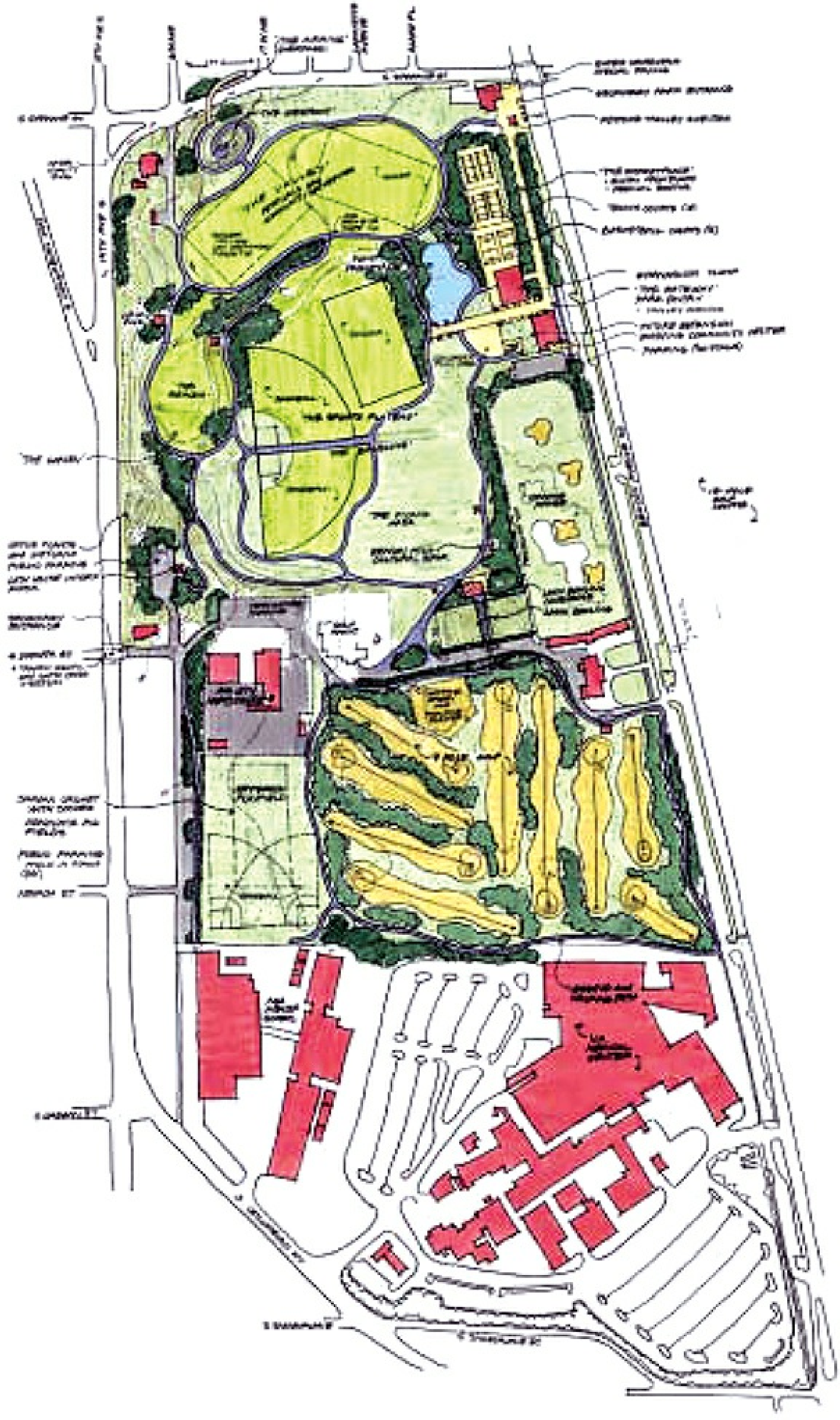
36.50 Site plan Alternative 1.
(SDPR)

36.51 Site plan Alternative 2.
(SDPR)



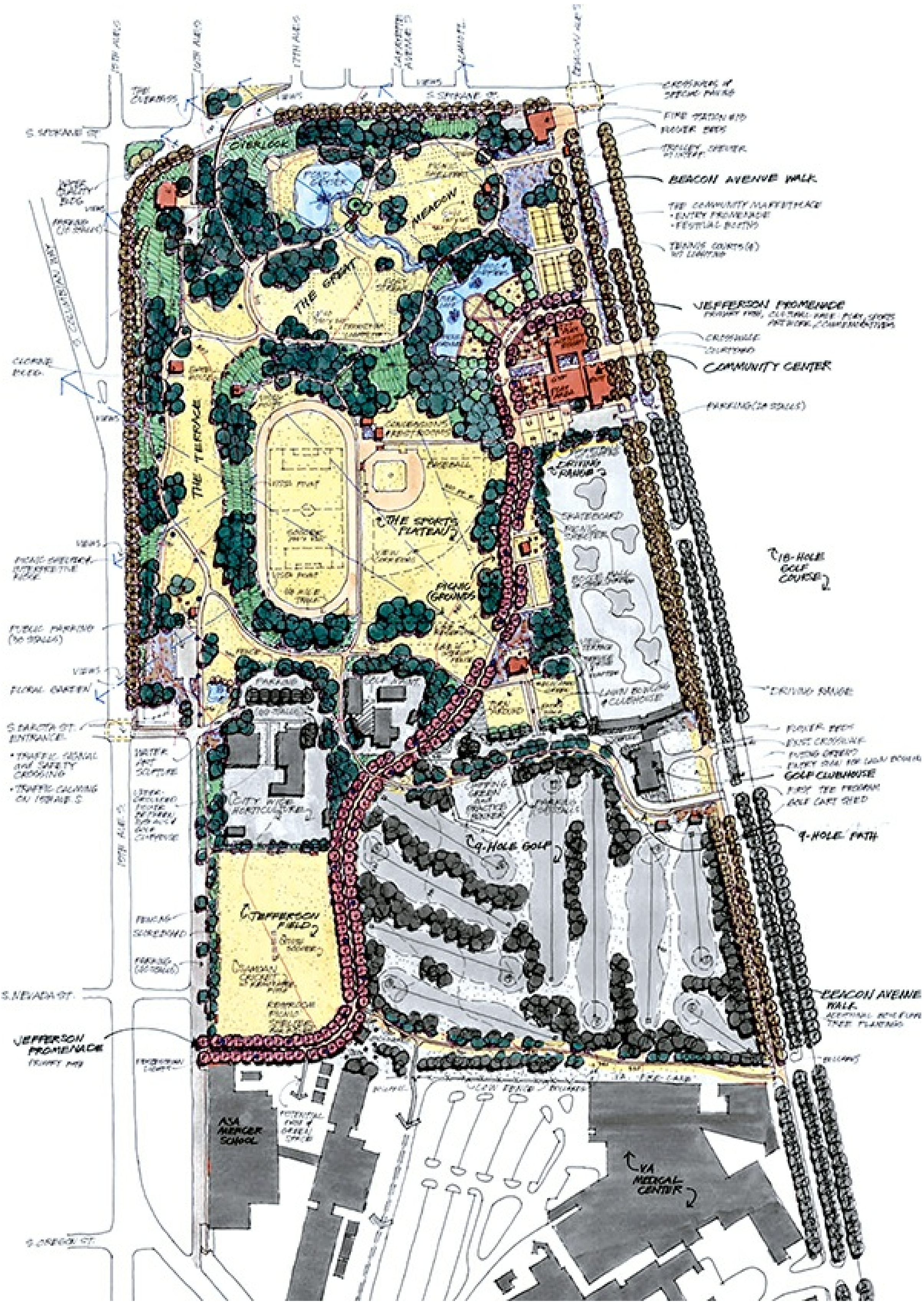
36.52

Site plan Alternative 3.
(SDPR)



36.53

Preferred alternative.
(SDPR)


S. SPOKANE ST.
OVERLOOK
THE GREAT MEADOW
FIRE STATION #13
FLOWER BEDS
BEACON AVENUE WALK
TENNIS COURTS (4)
JEFFERSON PROMENADE
COMMUNITY CENTER
PARKING (24 STALLS)
THE TERRACE
BASEBALL
THE SPORTS PLATEAU
PICNIC GROUNDS
DRIVING RANGE
18-HOLE GOLF COURSE
PUBLIC PARKING (50 STALLS)
FLORAL GARDEN
S. DAKOTA ST. ENTRANCE
GOLF CLUBHOUSE
9-HOLE GOLF
9-HOLE PATH
JEFFERSON FIELD
S. NEVADA ST.
BEACON AVENUE WALK
JEFFERSON PROMENADE
ASA MERCER SCHOOL
VA MEDICAL CENTER
S. OREGON ST.

36.54

Long-range plan.
(SDPR)

Many alternatives were considered, both programmatic and logistical: utilizing the north reservoir site for active sports; creating a largely passive recreation area surrounded by active uses; shifting the reservoir to the north area; and a more ideal plan, which involved capping the reservoir so that both sites could be used, with a heavy emphasis on playing fields. After much debate, cost analyses, public input, and logistical planning, a long-range plan was decided upon that balances active and passive recreation, with an understanding that it would need to be phased to account for the future of the south reservoir.

Over the past ten years, much of the plan has been implemented, including the construction of a skateboard park, a large lawn on the north reservoir site, a water play area, and improvements to the lawn bowling area and south playing fields.

Sidebar 36.1 (continued)

Alternatives for Jefferson Park, Seattle

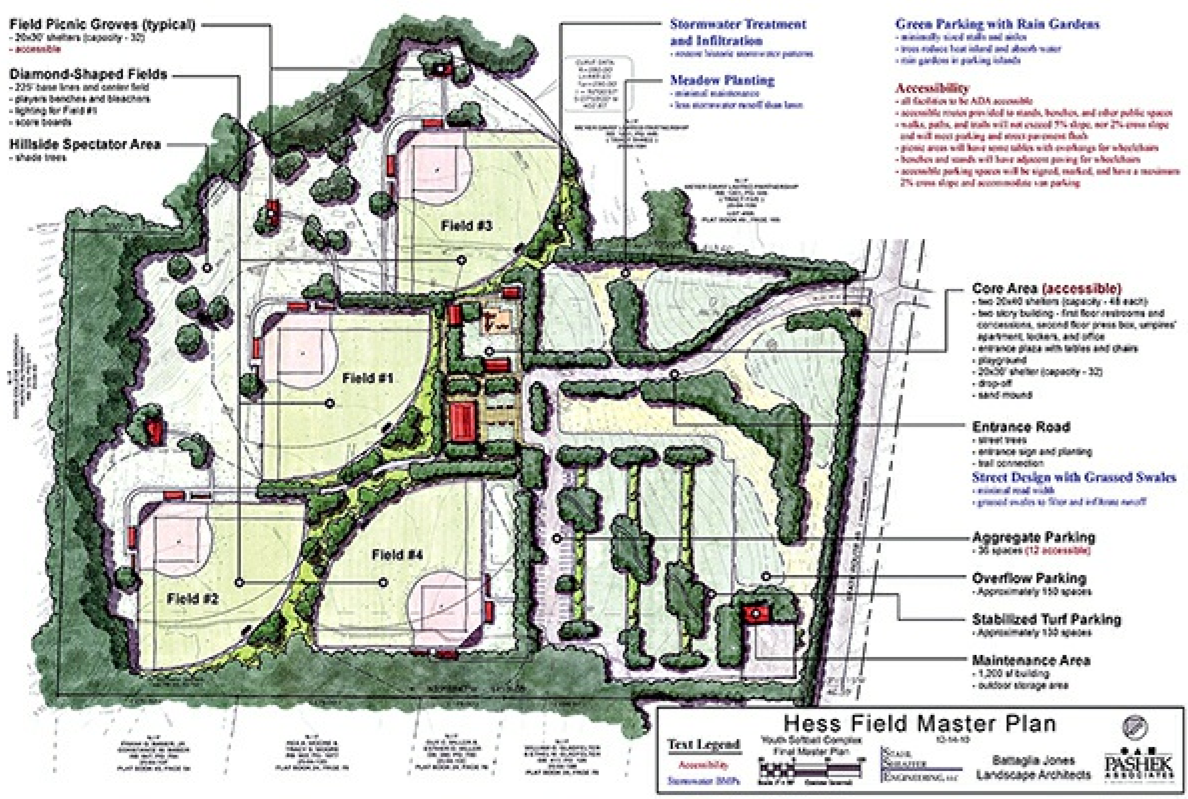
36.55 Skateboard park, Jefferson Park.
(Gary Hack)

36.56 North lawn, Jefferson Park.
(Gary Hack)

36.57 Beacon Mountain water park, Jefferson Park.
(Wendi Dunlap/flickr)

36.58 Jefferson Park Lawn Bowling Club.
(Gary Hack)

36.59 Jefferson Park lighted playing field.
(SDPR)



36.60 Softball fields, Hess Field master plan, Harris Township, Pennsylvania.

(Center Region Parks and Recreation)

36.61 LakePoint Sporting Community, Emerson, Georgia.
(Courtesy of LakePoint Sports)

In urban areas, there is never enough land to cater to all recreation needs. Hence there is a premium on the flexibility of spaces—creating an open field that can be used for sports but also for a neighborhood festival or musical performance, as an example. Spaces that sit idle for part of the day or week or year may be an aesthetic plus, but they are a lost opportunity for recreation. The best new parks find ways to allow uses to overlap, which requires creative management and scheduling. At Battery Park City in New York, Rockefeller Park was designed to concentrate as many activities as possible in close range of each other, a response to the mixed clientele of the park: singles; parents with children; elementary,

middle, and high school students; elderly; office workers; tourists and visitors; city residents looking for a place for an outing. Its users vary over the day and year, and it holds a special place in their hearts as a place to go in all seasons.

Sidebar 36.2

Rockefeller Park, Battery Park City, New York

Rockefeller Park is a 2 ha (7 ac) park constructed as part of the North Neighborhood of Battery Park City. The central idea was to accommodate as broad a spectrum of recreation opportunities as possible. Many sessions and workshops were held with Battery Park City and Tribeca residents to decide on the program and plan the park. There were many competing demands—create a passive green park while providing as much hard surface space as possible for active recreation; allow for organized sports while maintaining flexibility of uses; accommodate people of all ages while providing special environments for children; connect the park to the residential neighborhood but ensure that it feels open to the many office employees working nearby.

The park plan accomplishes these through its linear organization, with four parallel bands of activity—a riverside promenade, a continuous green space, a curving walkway that connects all activities, and a series of terraces nearest the neighborhood that provide contained environments for active and passive recreation. The green space is large enough to accommodate sports events (soccer, baseball, field hockey) but relies on removable backstops, bases, line markers, and goals so that it does not become the turf of any one group. The four terraces are devoted to social groups, active sports (basketball and handball), children’s play, and quiet relaxation. The park includes two pavilions, a performance gazebo, and a park house for management, equipment storage and lending, and public washrooms.

A landscape of salt-tolerant trees and perennial species provides definition to each of the areas and ever-changing color through the seasons. The park has been voted one of the city’s favorite open spaces for many years, and attracts users from a wide area.

Design team

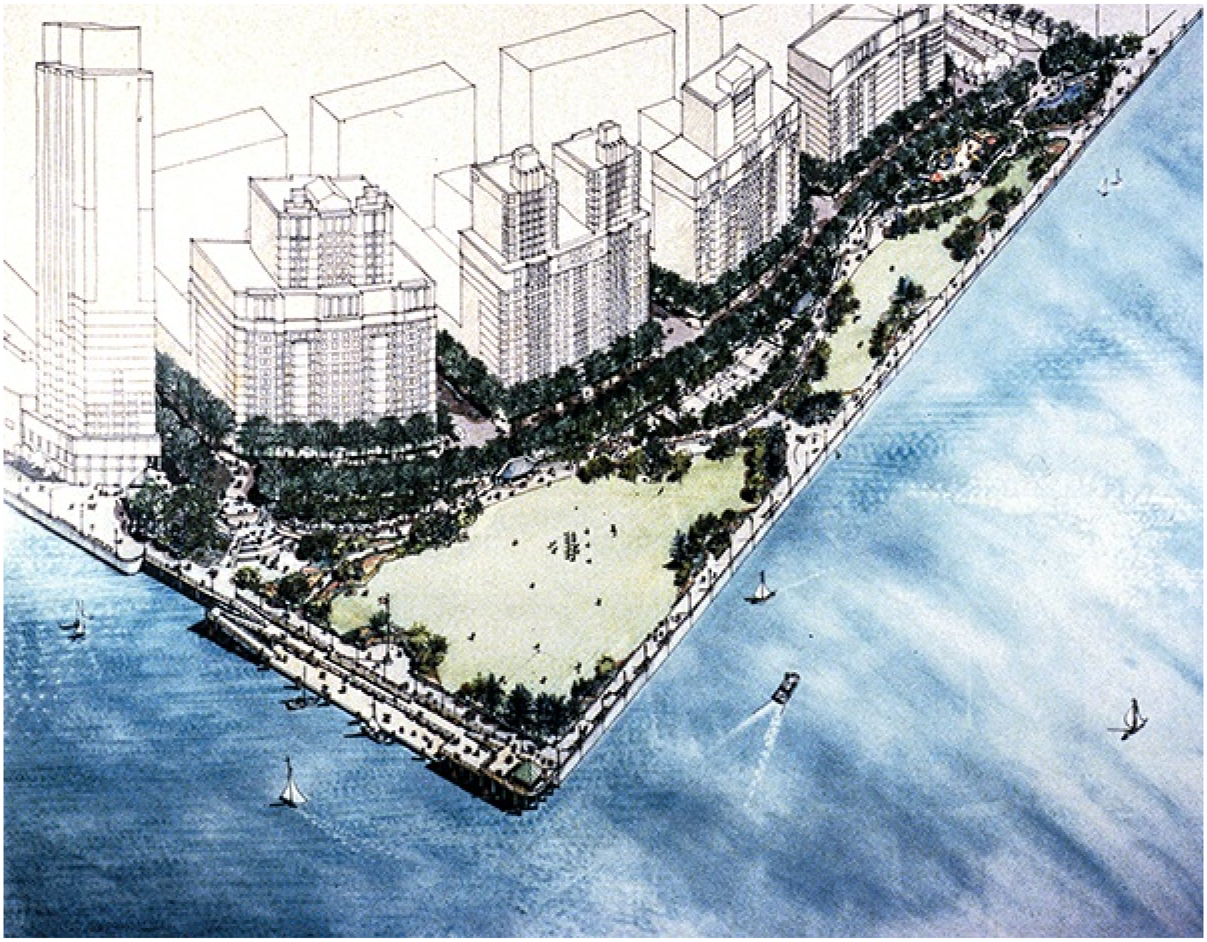
Architects and planners: Carr, Lynch, Hack and Sandell

Landscape design: Ohme, Van Sweden Associates

Playground design: Johansson & Walcavage

Pavilion design: Demetri Porphyrios

36.62 Aerial view, Rockefeller Park, New York City.
(Battery Park City Authority)



36.63 Plan, Rockefeller Park.
(Carr, Lynch, Hack and Sandell)

All illustrations by Gary Hack

36.64 Riverfront promenade.

36.65 Green lawn.

36.66 Walkway spine.

36.67 Social terrace.

36.68 Noontime chess, social terrace.

36.69 Half-court basketball, active terrace.

36.70 Playground terrace.

36.71 Lily pond.

36.72 Performance pavilion.

36.73 Park house with recreation activities.

37 | Colleges and Universities

Institutions of higher education and research are increasingly the economic anchors of communities, and they need to be planned as productive and educative environments. They can also stimulate other development nearby, including shops, services, and restaurants serving the staff and students, buildings for research and startup enterprises stimulated by the institutions, and housing for those associated with them. For this reason, it is seldom possible to plan an institution without also considering its surroundings.

Universities have a long history, growing out of the monastic traditions of Europe, the Middle East, and Asia, where knowledge was cultivated and maintained within the secure walls of religious orders. In China, Taixue, the imperial academy, was created during the Han Dynasty in 3 AD. Islamic institutions were founded to transmit knowledge beginning the year after the prophet’s death in 632 AD. The University of Al-Karaouine flourished in Fez in the ninth century; it and Al-Azhar University in Cairo became the centers of Arabic literature, science, and religious thought before 1000. The oldest European university is generally said to be the University of Bologna, established in 1088, followed shortly by Oxford and Paris.

37.1 University of Bologna, the oldest European university.
(Gaspa/flickr)

37.2 Purdue University, West Lafayette, Indiana, a prototype of the large public multi-university.
(Purdue University)

Most of the earliest European institutions were located in cities and usually consisted of a few buildings along city streets. If there were outdoor spaces attached to the teaching spaces, they were typically cloistered and restricted to students and teachers. As universities grew, more buildings were added nearby until districts of the city came to be seen as the academic quarter.

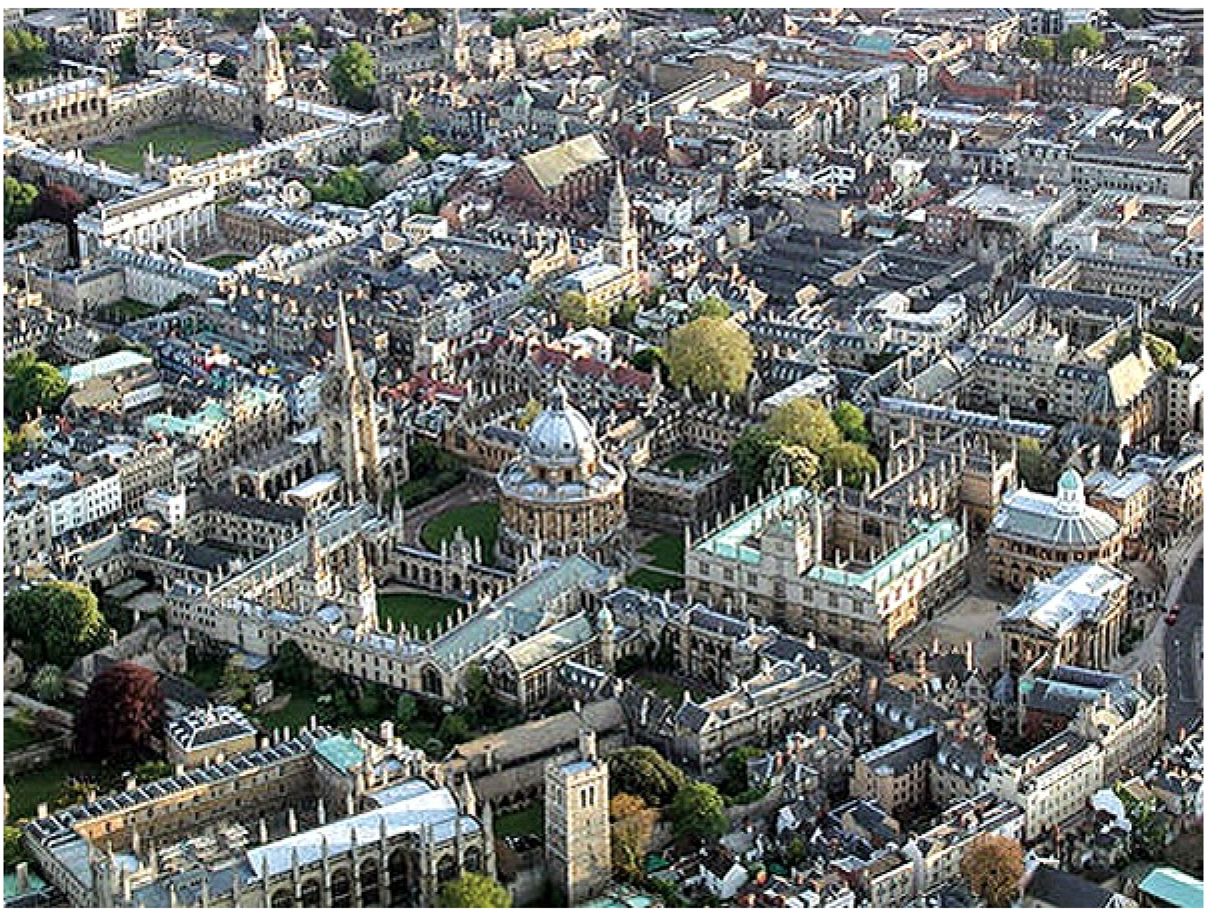
The idea of creating a campus for education is largely an American invention, as is the idea that higher education ought to be removed from gritty cities and established in small towns in the green countryside (Turner 1984). Institutions that began as a cluster of a few academic buildings in American college towns have evolved into large multidisciplinary research universities. The form of these mass education campuses has had a large influence on the hundreds of new universities created in rapidly developing parts of the world.

Types of Institutions

While we use the term university here in a generic sense, today’s institutions of higher education are remarkably varied, as are their spatial needs. Their differences are signaled by the many names they go by: colleges, universities, institutes, polytechnics, grandes écoles, tertiary schools, community colleges, technical colleges, seminaries, conservatories, and more. Many of these began as small colleges and have morphed into multipurpose institutions with diverse educational agendas. But there are prototypes that epitomize the educational missions that are at the core of the institution.

Colleges are generally focused on the education of undergraduate students, usually in the years just after secondary school. The most prestigious colleges combine living and learning, providing housing for a substantial fraction of their students within easy walk of their classrooms. Some incorporate educational spaces within a residential environment, following the model of the colleges that collectively form the larger academic institutions of Cambridge and Oxford. Yale University most faithfully replicates this model in the US. *Residential colleges* are incorporated in several Australian and Canadian universities as well. In recent years, many American universities have created *college houses*, sometimes thematic in character, which include spaces for dining, seminars, and activities that promote intellectual dialogue among the residents.

Thomas Jefferson’s plan for the “academical village” at the newly founded University of Virginia (1818) offered a new model for how a college should be organized. Jefferson’s idea was to construct individual pavilions for each academic discipline, connected by colonnades that lined two sides of a large lawn. The pavilions were the home for the faculty associated with the discipline, and the *range* behind the pavilions contained vegetable gardens, student housing, and hotels (dining halls). At the head of the lawn, the rotunda, modeled on Rome’s Pantheon, provided a place of assembly for the entire academic community and later housed the shared library. The college consisted of ten disciplines, each with a single professor, and about 100 students, all of whom lived along the lawn or ranges. Education then, as now in most colleges, involved students working under the tutelage of knowledgeable professors who provided instruction in the evolving intellectual traditions in their field.



37.3 The colleges at Oxford.
(SirMetal/English Wikipedia)

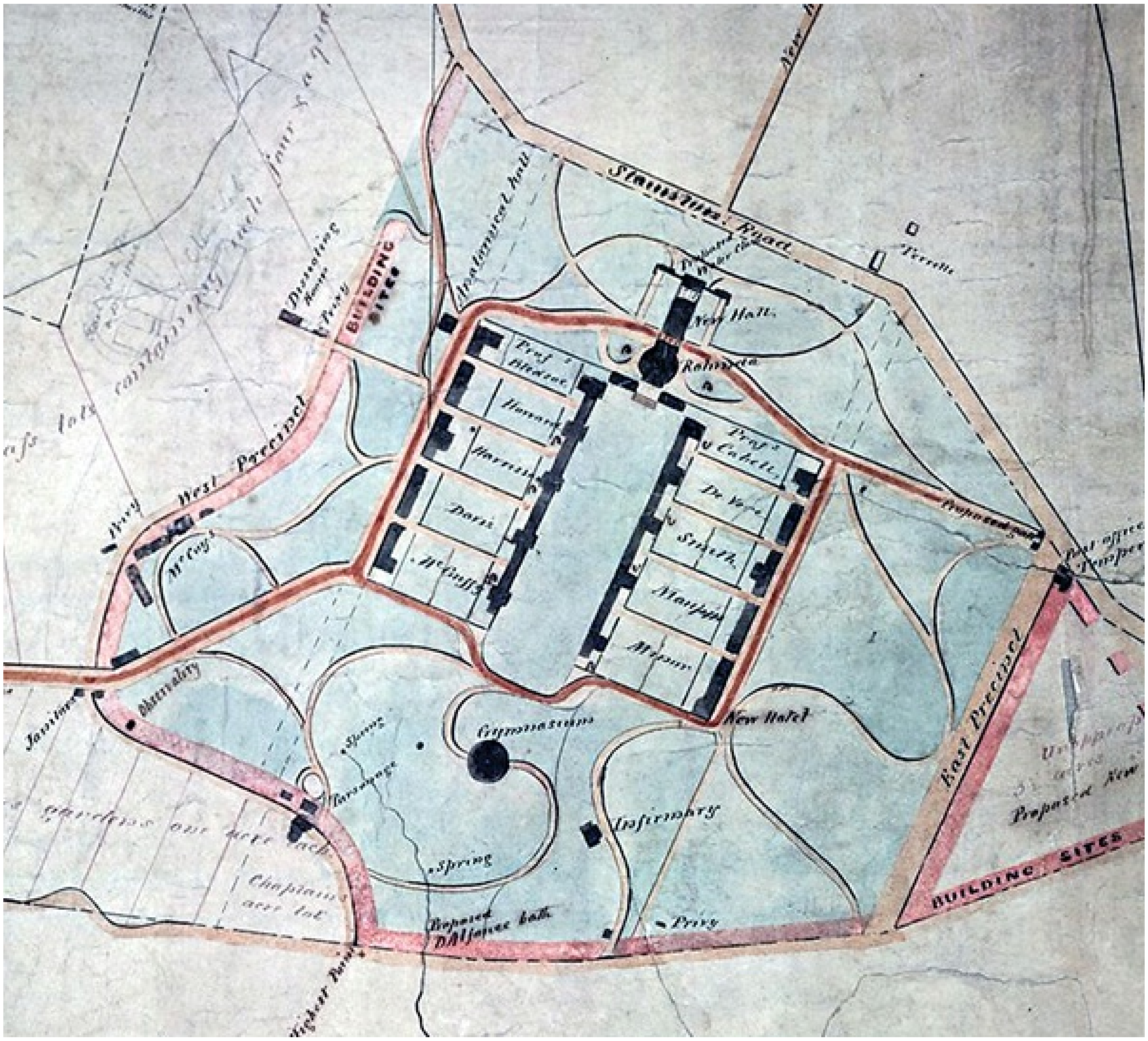
The academical village became the iconic prototype for the campus of dozens of American colleges, even as the plan was enlarged to accommodate thousands of students and hundreds of professors. The lawn became the mall or oval or green at the center of a campus, the pavilions were replaced by large academic buildings for academic disciplines (the English building or chemistry building), the rotunda became the university auditorium or library or administration building, and student and faculty housing were pushed further afield into dormitory complexes. Over the years new buildings were added on the lawn for student or cultural activities, and as athletics became an integral part of university life, playing fields and stadiums found their place on the periphery. In recent years many large American universities have revisited this strict segregation of uses, creating more integrated living-learning spaces, with faculty residents.

Universities differ from colleges by combining professional education and research with the education of undergraduate students in the basic intellectual disciplines. Benjamin Franklin created the first true university in North America by combining a liberal arts college and a school of medicine to become the University of Pennsylvania. The academic mission of universities is largely focused on the creation of knowledge through scholarship and research. Teaching may represent only a third of a university’s budget and occupy less than half of the space required. Universities traditionally have been among the slowest institutions to evolve; throughout much of the twentieth century methods of scholarship and pedagogy remained relatively constant. While buildings were added, most campuses maintained their basic form, catering to face-to-face interaction, viewing the library as the central resource, and emphasizing classrooms, seminar spaces, and laboratories organized by disciplines. But change has accelerated, and the spatial challenge today is to keep abreast of the rapidly evolving nature of research, which emphasizes

interdisciplinarity, and more recently the evolution of digital infrastructure for transmitting and storing knowledge and connecting members of the community. Flexibility is paramount in the creation of space and organization of university campuses today.

Polytechnics also combine research with education, particularly in the sciences and engineering, but the focus shifts from libraries and classrooms to research laboratories. Many specialized institutions, often called *institutes* or *academies*, share this orientation; examples include the National Institutes of Health in the US and the Academy of Sciences in China. The French tradition of *grandes écoles* grew up around the idea of creating specialized institutions devoted to particular fields (École des Beaux-Arts, École Normale Supérieure, École Nationale d'Administration, etc.). Institutions such as the University of Paris Marie Curie (Paris VI) consist of collections of specialized institutes occupying space that can be reallocated as the importance of particular fields ebbs and flows. The Russian model of creating specialized institutions for research and teaching based on areas of application (forestry, railways, chemistry, petroleum, building, etc.), also exported to China and Eastern Europe, has produced campuses where experimental spaces (workshops, growing plots, laboratories) play a central role. Frequently they resemble industrial or business complexes more than the bucolic campuses sought for college education.

37.4 Jefferson’s academical village, University of Virginia, Charlottesville.
(J. Sertz/University of Virginia Collections)



37.5 Plan of Jefferson's academical village.
(William Abbott Pratt/University of Virginia collections)

37.6 Ohio State University Oval.
(Ohio State University)

At the opposite end of the spectrum are institutions that provide technical and skill-based education, often to students who are already employed in business. They go by a variety of names, including *technical colleges*, *vocational schools* (UK), *trade schools*, *career schools* or *colleges*, *community colleges*, *business academies*, *Berufsfachschulen* (Germany), *technicums* (Europe), and *senmon gakko* (Japan). Each of these institutions has its own traditions, and curricula along with space needs vary widely. But to cater to working young (and middle-aged) adults, they are most often sited near jobs in urban areas or suburbs, near public transit, or in other accessible locations.

The new arrivals on the scene of higher education are the growing number of virtual institutions and universities with distributed campuses or

no campus at all, including *open universities*, *Internet universities*, and universities organized to deliver a blend of sited and online education. For such institutions, a base campus may be visited only occasionally by students, or not at all. The planning issue may be how to create a virtual campus on the Internet, since learning involves more than simply acquiring knowledge or information. But there are many functions that still require face-to-face interaction, such as career guidance, teaching skills that require coaching, and high-touch subjects such as design and creative arts. The facility needs of these institutions are not yet clear.

People who inhabit campus-based universities often develop great attachment to the buildings and spaces of their institution. Young people spend their formative years there, and for faculty inhabiting a campus becomes a way of life. Sports and cultural activities, special events, and patterns of behavior become institutionalized as traditions passed along to successive generations. Alums invariably return to their campuses to be photographed in front of the dormitory where they worked long into the night, before a favorite gate or sculpture, or in a space with special memories. Helping stimulate attachment is as important as functionality in designing settings for higher education.

37.7 University of Paris Marie Curie, Paris VI.
(Edouard Albert et Urbain Cassan/Wikimedia Commons.)

37.8 Normandale Community College, catering to suburban workers, Bloomington, Minnesota. (© Dave Warwick)

While knowledge is constantly evolving and technologies for learning have recently been exploding, university campuses usually change much more slowly, with new buildings taking their place beside old. Look closely at them and you see the history of ideas about university education.

Sites for Education

The formal educational process involves communication between learners and the more learned, one on one in faculty offices or studios or laboratories, in groups during scheduled classes, around the seminar table, or in large events in assembly rooms. It may involve performances by students, faculty, and visitors, displays of their work, and opportunities to view films or videos or vicarious events electronically. Learners will be challenged to work individually, on computers or trolling for information in libraries and archives, and collectively in small groups. Participating in casual recreation or athletic events will develop physical skills and teach cooperation. On residential campuses, the link between living and learning opportunities will be critical, along with the opportunities for recreation and unstructured activities. Some of the education will occur off campus in coffeehouses, bars, theaters, and places for recreation and leisure. Planning a university site cannot stop at the boundaries of the property.

Universities with postgraduate and professional programs may include settings for practice—medical and dental clinics, hospitals, institutes (as in China) for the practice of architecture, research institutes often with highly specialized equipment performing contract research, and the like. Research and creation of knowledge is the central purpose of many universities, and more than half of the space will be devoted to these functions.

The site planner has an opportunity to influence the quality of education, research, and university life in three areas:

The *layout of buildings*—through the formal structure of a campus, determining what goes next to what in three dimensions, the density of development, the scale of individual structures, the openness and transparency of structures, the consistency and coherence of building materials and forms, the flexibility provided for future growth and change;

The *spaces on the site*—places of arrival (and parking), spaces for assembly, crosswalks that encourage casual encounters, places for leisure and relaxation, the surfaces, landscape, and furnishings of public

spaces, and service yards that assure the smooth functioning ofthe university;

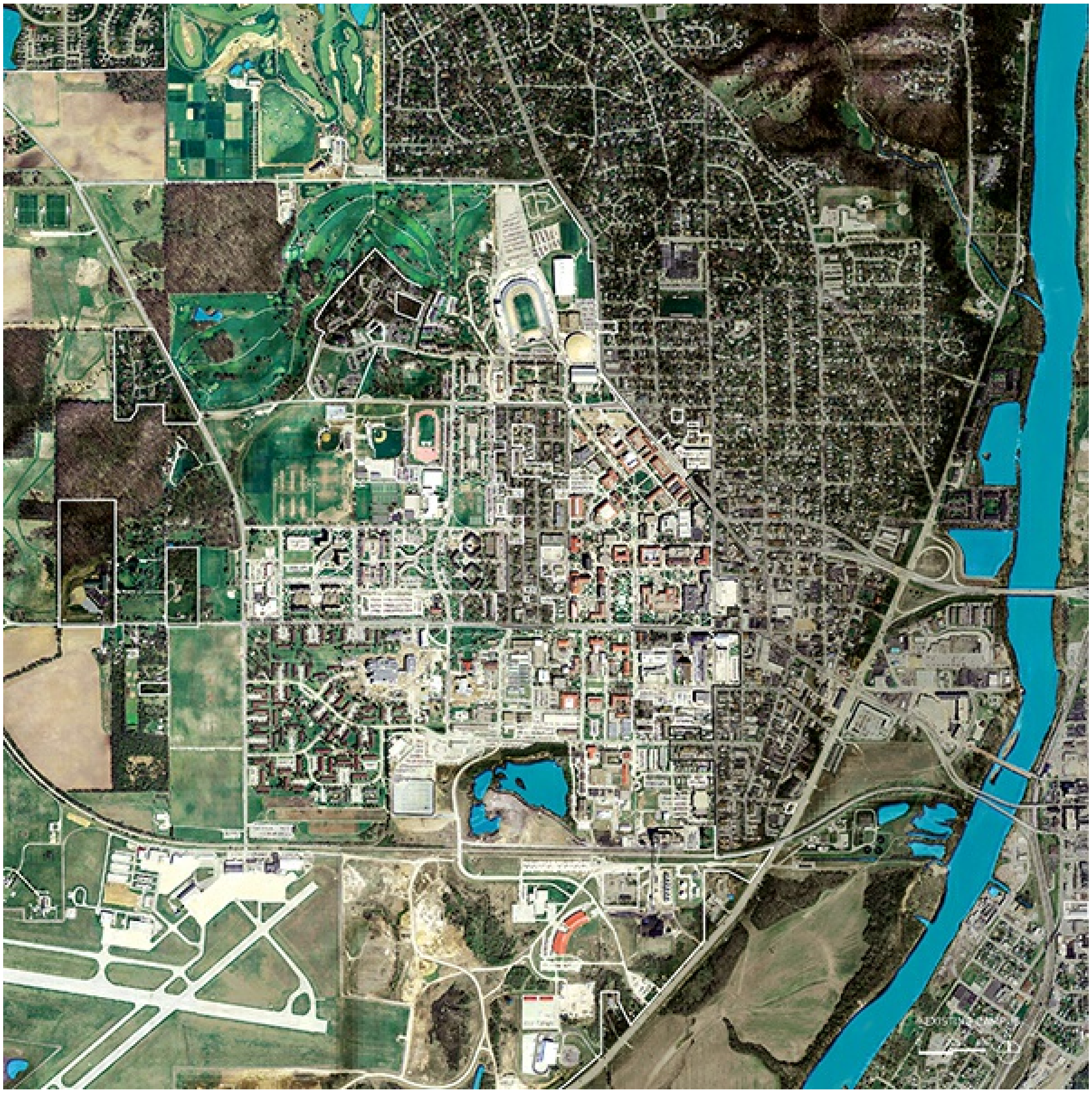
The *infrastructure of the site*—access and circulation routes for persons and vehicles, parking locations, security systems, communications systems, information infrastructure, service systems, and maintenance systems, all of which consume a large portion of any university's expenses.

Sidebar 37.1

Purdue University West Lafayette Master Plan (Sasaki, 2009)

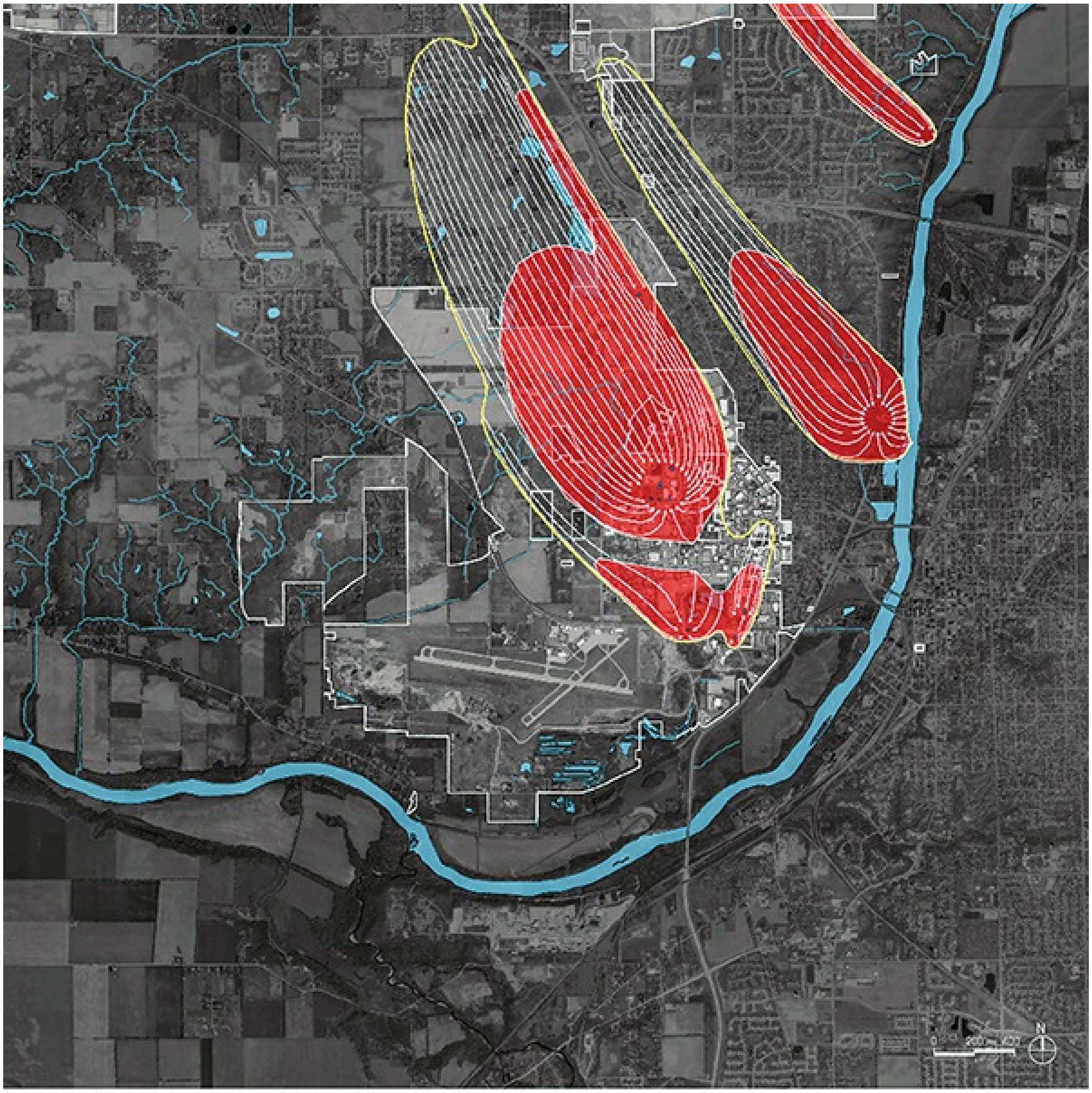
The master plan for Purdue's West Lafayette campus was created in dialogue with a broadly representative campus planning committee over two years. It is built on a careful analysis of existing buildings and sites available for development, a study of important environmental issues, and projections of future space needs. Five overarching planning principles were adopted to guide the plan: promote compact development, establish State Street as a collaborative center, create program synergies through strong mixed-use districts, encourage an integrated transportation system within a perimeter parkway, and preserve the western lands (figure 37.12). The master plan divided the campus into a series of districts, each with a dominant use, and indicated how green corridors could link the increasingly dispersed educational, research, and residential community. Infrastructure systems provide the backbone for future development, along with the system of roads and parking facilities.

All illustrations courtesy of Sasaki Associates.



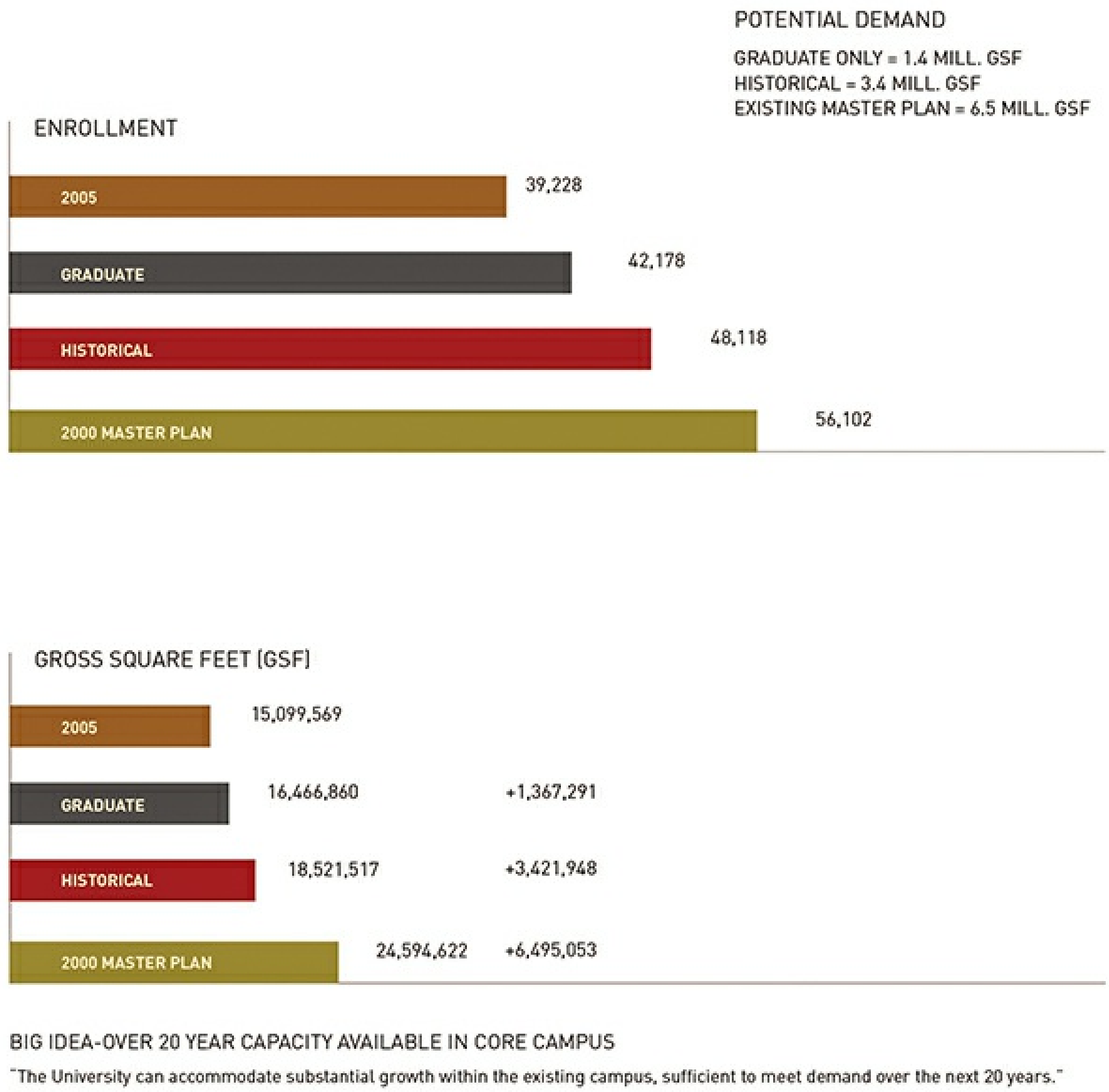
37.9

Existing campus, Purdue University, West Lafayette, Indiana.



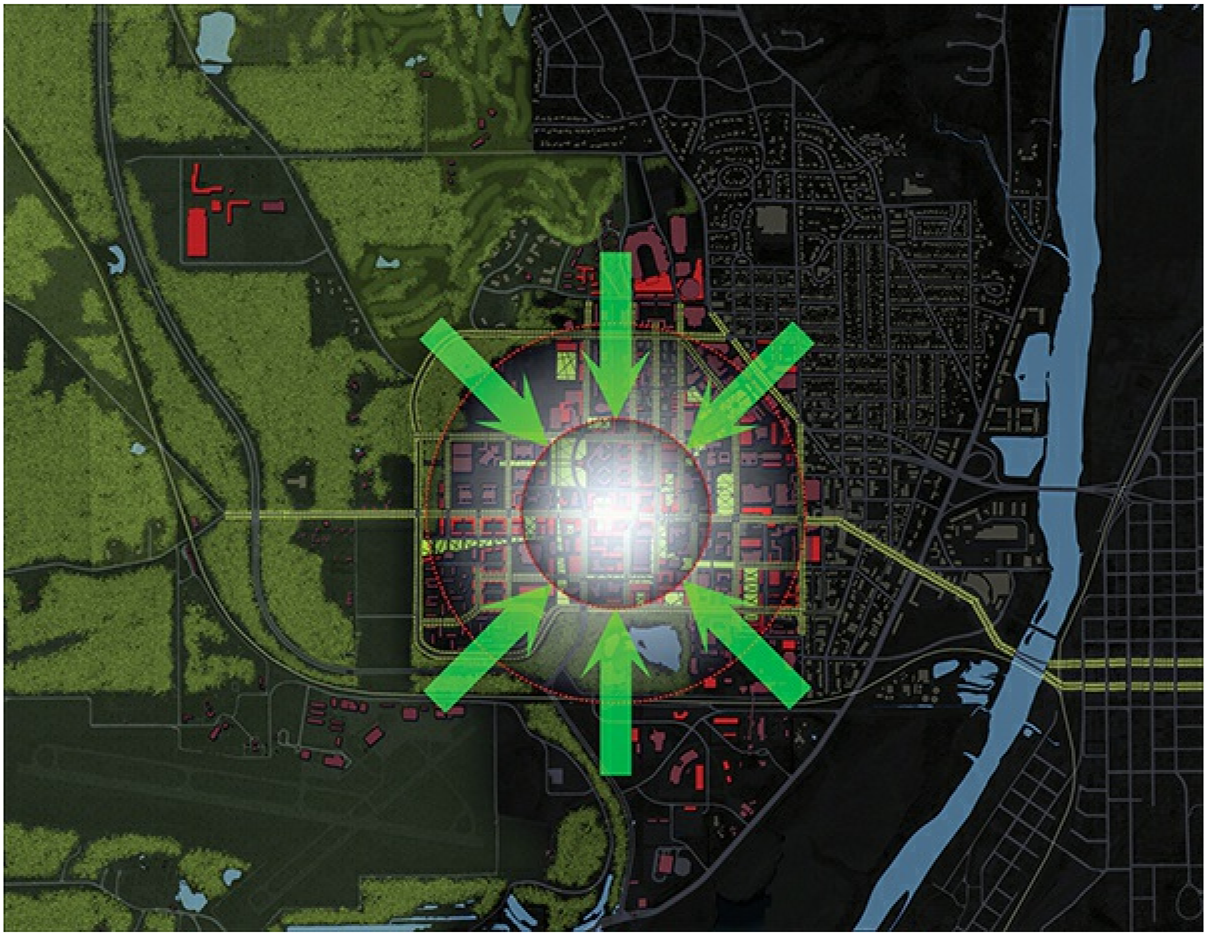
EXISTING WELLHEAD PROTECTION ZONES - TIME OF TRAVEL

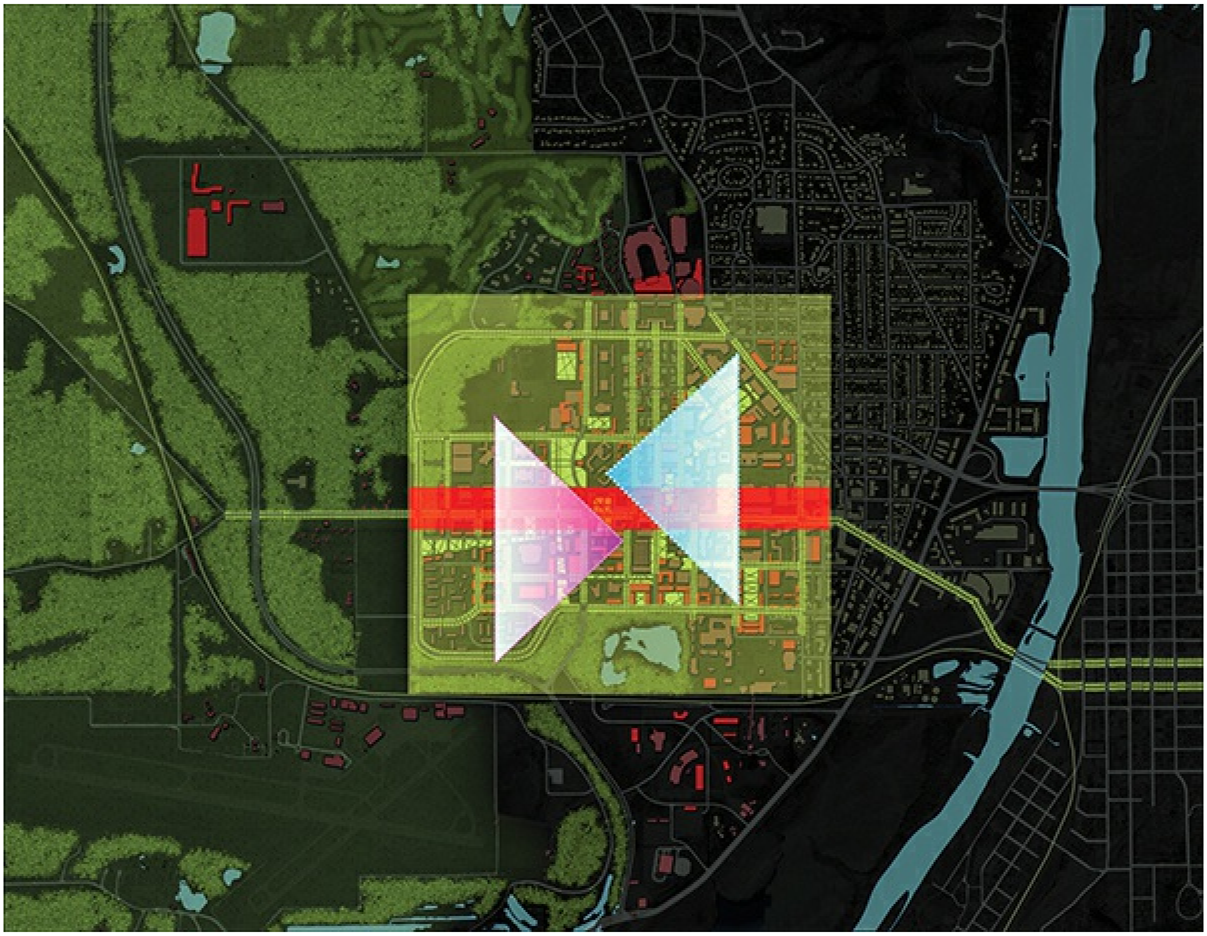
37.10 Wellhead protection zones on and near campus.

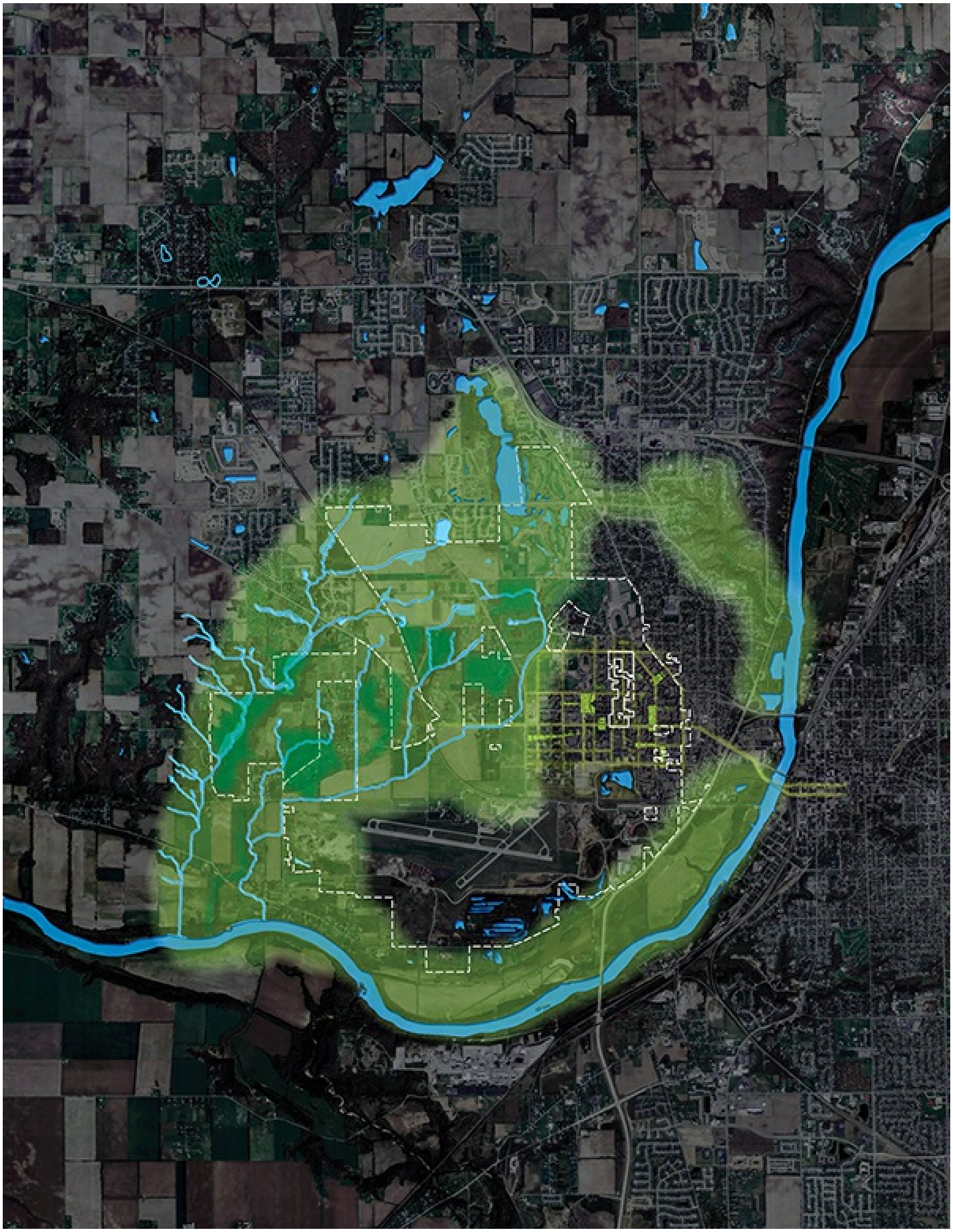


37.11

Projected space needs over 20 years.





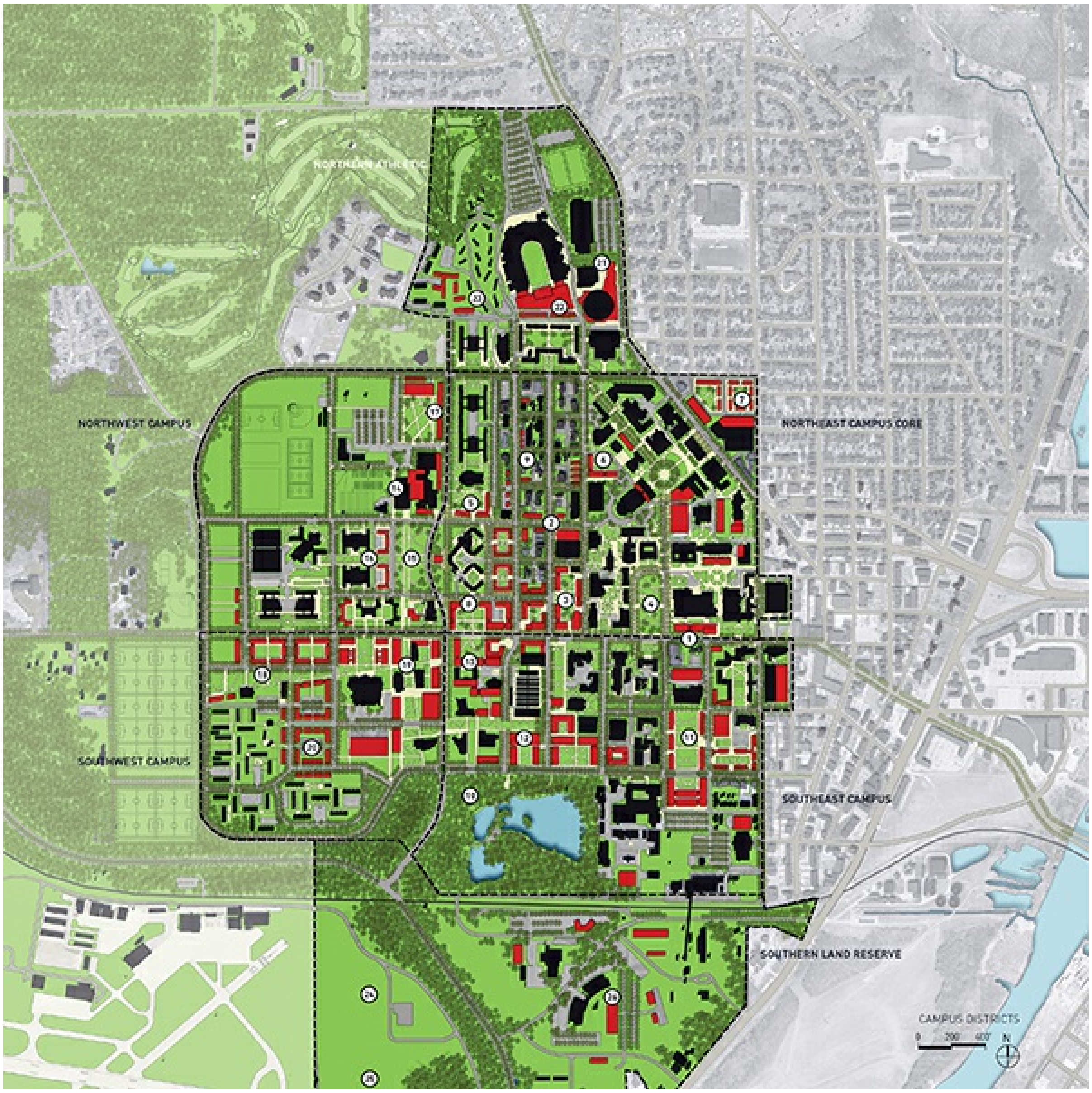


37.12

Planning principles for the campus.

Sidebar 37.1 (continued)

Purdue University West Lafayette Master Plan (Sasaki, 2009)

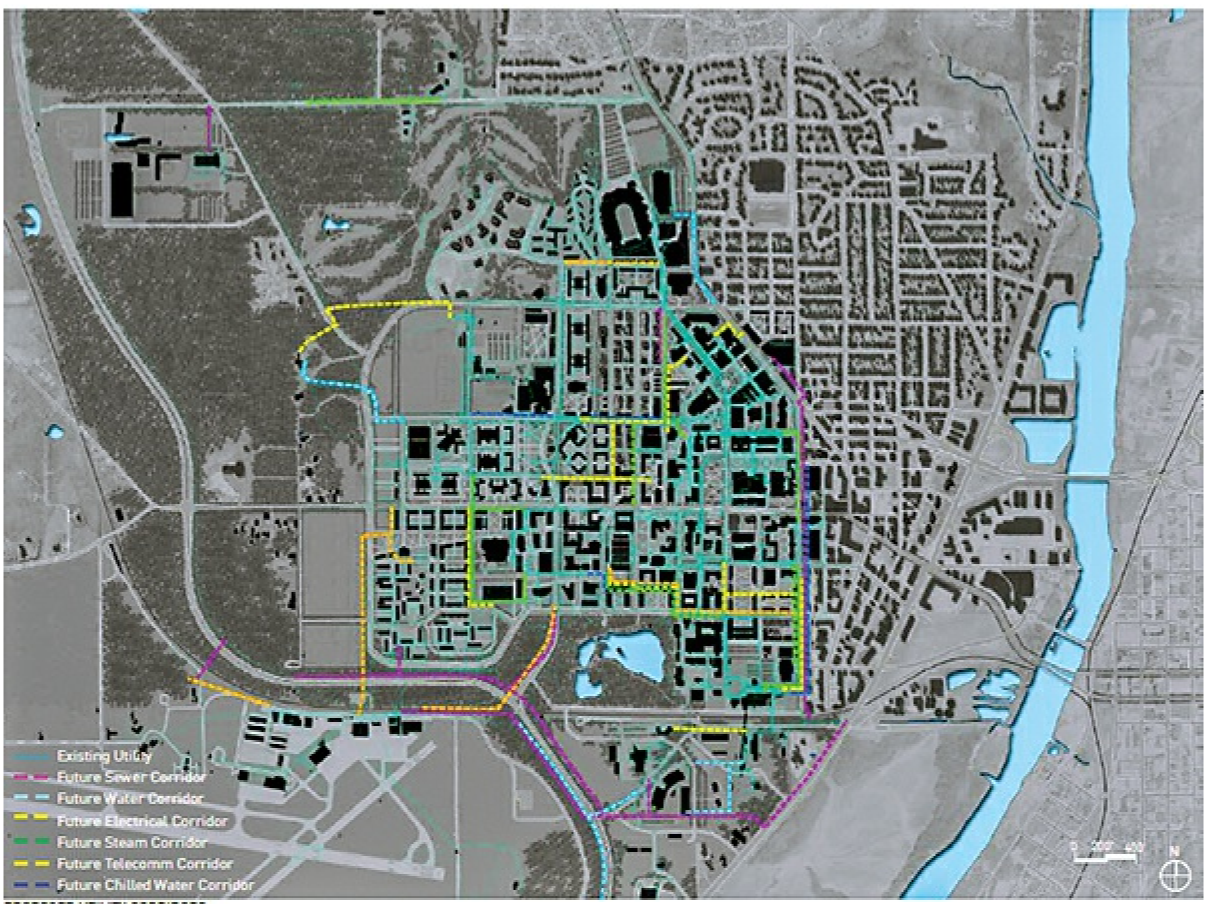


37.13

Campus master plan.

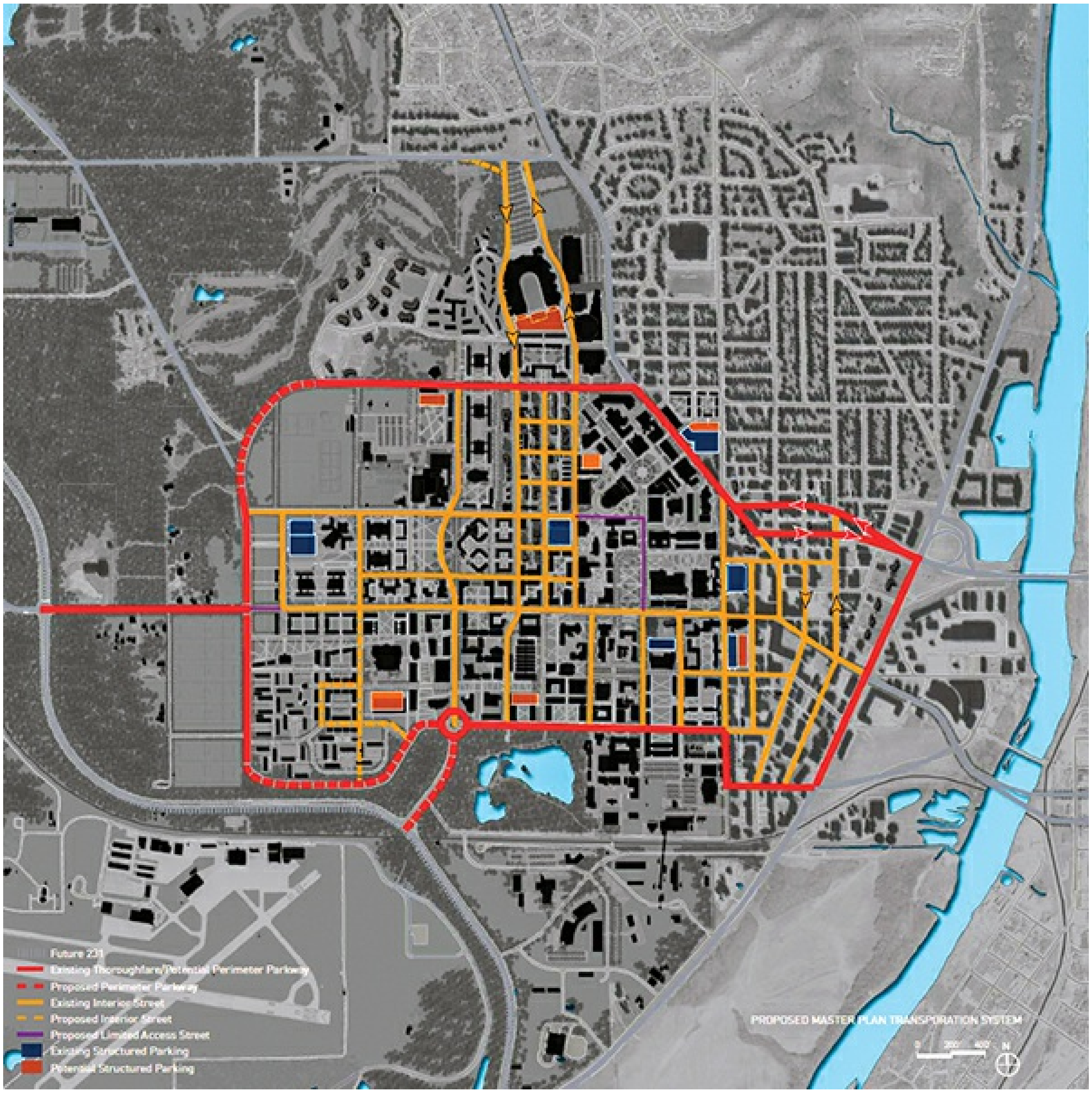
37.14

Vision of campus development.



37.15

Campus utility corridors.



37.16

Campus transportation system.

Usually these elements are combined in a *master plan* for development of the campus, with a 5- to 20-year horizon. It will set down the location of current and proposed buildings, the main connections (pedestrian, vehicular, service) on the site, the infrastructure network, and design

guidelines that will shape the form of buildings and landscapes. In a fast-growing or -changing place, the plan may need to be updated every five years, incorporating new opportunities, additional lands, and responses to changing educational techniques.

Space Needs of Universities

There is a world of variation in the types of universities and the campuses they occupy. Each campus has a unique history that reflects its evolving ideas about education and research and its success in attracting resources to realize its aspirations. Some of the key differences include: specialized institutions (such as art colleges or medical universities) versus general-purpose universities; urban campuses with constrained land resources versus expansive campuses in college towns and suburbs; residential versus commuter campuses; and undergraduate liberal arts colleges versus research-driven universities with a combination of academic and professional programs. Many US state universities are *land grant colleges*, with a mission to promote progress in agricultural and engineering practices, and their campuses include extensive fields, farm structures, and laboratories. Large urban universities often include medical schools with hospitals attached to them, used for teaching as well as medical practice. Most universities acquired their sites through government or private gifts or grants, and the site may be larger or smaller than needed for academic purposes. All of this makes it difficult to compare and generalize about site and space requirements for universities.

Table 37.1 includes data drawn from 142 university campuses mainly in the US. They are grouped into six types which capture many of the distinctions in educational mission. As the figures reveal, public universities are the largest on average, both in urban areas and college towns, with over 28,000 and 23,000 students respectively. US private universities are smaller, averaging less than half that size, with student enrollments at technology universities even smaller. At the opposite end of the spectrum, US colleges average just over 2,200 students. The small sample of international universities more closely approximates US public universities.

While the educational agendas vary considerably, on average US public universities in urban areas provide 313 sq ft (29 m2) of built space (gross) per student. Since faculty and staff occupy much of the space, a better measure of space may be the amount provided for each person on campus, which is 232 sq ft (22 m2). As table 37.1 indicates, US private universities provide about twice as much space per student (50% more per person on campus), and US technology universities even more. US colleges, often located in more remote locations, have the highest per capita amounts of space. These figures include housing for students, which can amount to as much as 30% of the built space on campus.

Space standards for universities in other countries tend to prescribe less space per student or member of the university population. Australasian surveys indicate that about 33% of all institutions provide less than 12 m2 (129 sq ft) gross space (excluding housing) per equivalent full-time student (EFTSL), while 46% provide between 12 m2 and 17 m2 per EFTSL, and 21% provide more than 17 m2 (Tertiary Education Facilities Management Association 2009). Much of the difference is attributed to the weighting of disciplines that require special facilities, such as science laboratories or a medical school.

The mix of disciplines in an institution also shapes the kind of spaces that are needed. A survey of US universities indicates that the largest quantities of space are devoted to offices and laboratory/studio space—48

sq ft and 35 sq ft (4.5 m2 and 3.3 m2), respectively, of assignable spaces per student. Libraries typically require 12 sq ft (1.1 m2) per student, and classrooms 10 sq ft (0.9 m2) (Society for College and University Planning 2003). Studies of Australasian universities reveal similar patterns (Tertiary Education Facilities Management Association 2009).

Converting the built space requirements into an estimate of site needs for universities requires assumptions to be made about the density of development that is desired, the amount of outdoor recreation and parking space to be provided, and the area that needs to be reserved for future growth and development. Using current US universities as a guide, campus FARs range from 0.1 (10%) for colleges to 0.6 (60%) for technological universities, with large urban universities typically falling between at an average of 0.4 (40%). Thus, a new US college for 2,000 students might aspire to have a site of 290 acres, a technology university of 10,000 students might seek a site that is at least 265 acres, and a new large public urban university with 30,000 students probably should have a site that is at least 540 acres. Circumstances will, of course, dictate whether this is possible.

Table 37.1 | University comparisons

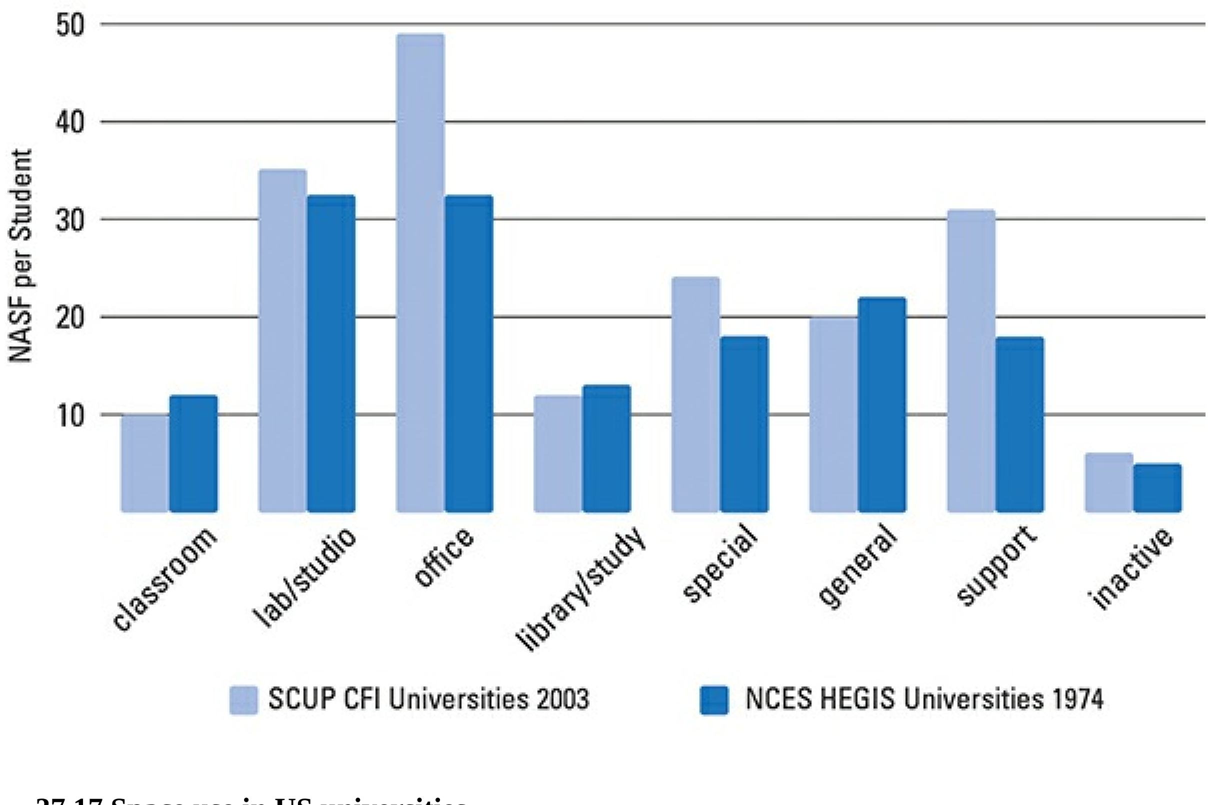
	Large US public universities (urban)	Large US public universities (small town)	US private universities	US technology universities	US colleges	International universities1
Sample size	21	42	32	6	31	10
Average enrollment	28,795	23,208	10,409	7,830	2,258	26,713
Average faculty	2,765	1,661	1,351	605	203	1,761
Student: faculty ratio	14.7	16.1	10.1	13.5	11.5	17.4
Average staff	7,310	4,525	4,737	3,039	445	2,629
Average campus	38,893	29,864	16,494	11,474	2,833	31,188

population						
Average building area (sq ft)	9,005,618	8,527,765	6,304,673	5,453,215	1,436,222	3,284,968
Average building area (m2)	836,622	792,229	585,704	506,604	133,425	305,174
Average building area/student (sq ft)	313	367	606	696	636	123
Average building area/student (m2)	29	34	56	65	59	11
Average building area/campus population (sq ft)	232	286	382	475	507	105
Average building area/campus population (m2)	22	27	36	44	47	10
Average site area (ac)	573	1,561	651	208	324	256
Average site area (ha)	232	632	264	84	131	104
Average site area/student (sq ft)	867	2,930	2,724	1,157	6,250	417
Average site area/student (m2)	81	272	253	107	581	39
Average site area/campus	642	2,277	1,719	790	4,982	358

population (sq ft)						
Average site area/campus population (m2)	60	212	160	73	463	33
Parking ratio (number of spaces/campus population)	0.29	0.42	0.38	0.33	0.52	0.13
Campus FAR	0.36	0.13	0.22	0.60	0.10	0.29

Source: Based on data from Ayers Saint Gross Architects, "Comparing Campuses," www.asg-architects.com/2007/07/research/case-studies-research/comparing-campuses/.

1 Includes universities in Canada, Australia, Hong Kong, and Ireland.



37.17 Space use in US universities.
(Adam Tecza/Society of College and University Planners)

Table 37.2 | Distribution of space on Australasian campuses

Type of space	Average % of total space	Average usable floor area/EFTSL (m2)
Academic (teaching, research, academic offices, academic general support, dedicated classrooms and laboratories)	46.8	5.2
Central administrative (support spaces)	12.0	1.1
Centrally scheduled space (lecture theaters, seminar and tutorial rooms)	9.4	0.9
Library space (including study center, computerized student work spaces, information commons, etc.)	8.5	0.9
Student and staff services (including counseling, sport and recreation facilities, etc.)	5.9	0.6
Commercial space (bookshop, cafeterias, etc.)	4.8	0.5
Other (including transition and vacant)	5.2	0.7

Source: Tertiary Education Facilities Management Association (2009).

Principles for Planning University Sites

The central tenet of any university is human contact—it is what justifies bringing people together for education, scholarship, and research.

Through human interaction, planned and un-planned, ideas are created and shared, relationships are formed, minds are changed, and worldviews are expanded. Creating opportunities for contact needs to be the key organizing idea for the campus. It will help determine which activities are

central and which can be consigned to the periphery. It requires the clustering of buildings at a density high enough to promote spontaneous contact, and designing indoor and outdoor places and pathways that encourage face to face interaction. And there must be places for crowds to gather for special events.

Identity is a second important planning principle. The identity of a university is formed through the symbolic buildings and spaces on its campus—what are the focal points and what do they say about the university? What makes the campus special? Are there particular materials and styles of building that characterize the campus? Campuses such as Stanford University, Rice University, and the University of Colorado, Boulder have long maintained a consistent palate of materials to unify the image of the campus.

Individual disciplines and programs also need to have a special identity. Where does mathematics occur on the campus? Or business education? Or environmental engineering? Historically, a commonly accepted pattern was to locate the basic disciplines (English, chemistry, physics, biology, mathematics, language studies, etc.) in a central location, often surrounding a campus green, with applied fields such as civil engineering, architecture, or business in more peripheral locations. Alternatively, separate clusters might be created for the arts, engineering, and life sciences or medicine, each with their own central open spaces. Today many of the interesting intellectual breakthroughs occur at the intersections of fields. Centers for cross-disciplinary study, such as environmental studies, nanotechnology, or life sciences, have become key elements in the pattern of organization of space on campuses, forcing a reversal of thinking about the center and periphery.

Universities may change slowly but they are constantly evolving, and a third important organizing principle of a campus is its adaptability. New uses, new programs, and entities not yet invented will need to find a place on campus in the future. Campuses need to have generic space that can be adapted to many purposes over time, and swing space that new entities can

move into while new space is being created. Sites need to be reserved for future buildings; the best campus plans build in flexibility. Universities allocate increasing amounts of money to adapting their campuses, and realize that renovation is as critical as new construction in enabling them to grow and adapt to the changing intellectual environment.

37.18 Old Campus, Yale University, providing a shared outdoor space for interaction, New Haven, Connecticut.
(Yale University)

37.19 Consistent materials and respectful buildings unify the Stanford University campus, Palo Alto, California.
(Courtesy of Tom Fox/SWA)

A fourth principle achieving a balance among the many competing forces shaping the university. The campus wants to be a world apart, but not completely cut off from the city. It wants to minimize the distractions of everyday life so that students can focus on their studies, but also wants to provide an introduction to the wider world of work and living and culture. In practical terms, this usually means creating a car-free environment at the center of a campus, linking housing and educational opportunities and gathering places. For universities scattered across many city blocks, the burden falls on creating compelling interior spaces that serve as the mixing bowl of campus activity. It also means that universities that are strongly oriented to interior spaces (malls, greens, walks) need to pay equal attention to their margins, where the campus meets the community. The blend of university and commercial activities is an

important part of the support system for students, faculty, and staff.

37.20 The university bookstore and shops at the edge of University of Pennsylvania campus, Philadelphia, are important meeting places.
(Gary Hack)

37.21 Rice plots have been created at the center of Shenyang Architectural University, Shenyang, China.
(Courtesy of Turenscape)

University campuses, like all site uses, need to be sustainable—energy-efficient, conserving water, harnessing the sun, incorporating landscape that minimizes the draw on resources, and in other ways minimizing the carbon footprint of the campus. Rather than create landscapes that are purely ornamental, some campuses are experimenting with productive landscapes. Such campuses can serve as an example for other areas while inculcating a sense of the value of sustainability in the minds of impressionable students (who are often the most enthusiastic advocates of campus sustainability). Universities have been among the leaders in inventorying and managing GHG emissions, and carbon impacts need to

be considered for each new project on a campus.

While the planning of every campus will (and should) address objectives that are unique to its institution, attention to the five main principles—human contact, identity, adaptability, stasis, and sustainability—will assure that the site is used to its fullest potential.

Campus Prototypes

The Collegiate Form

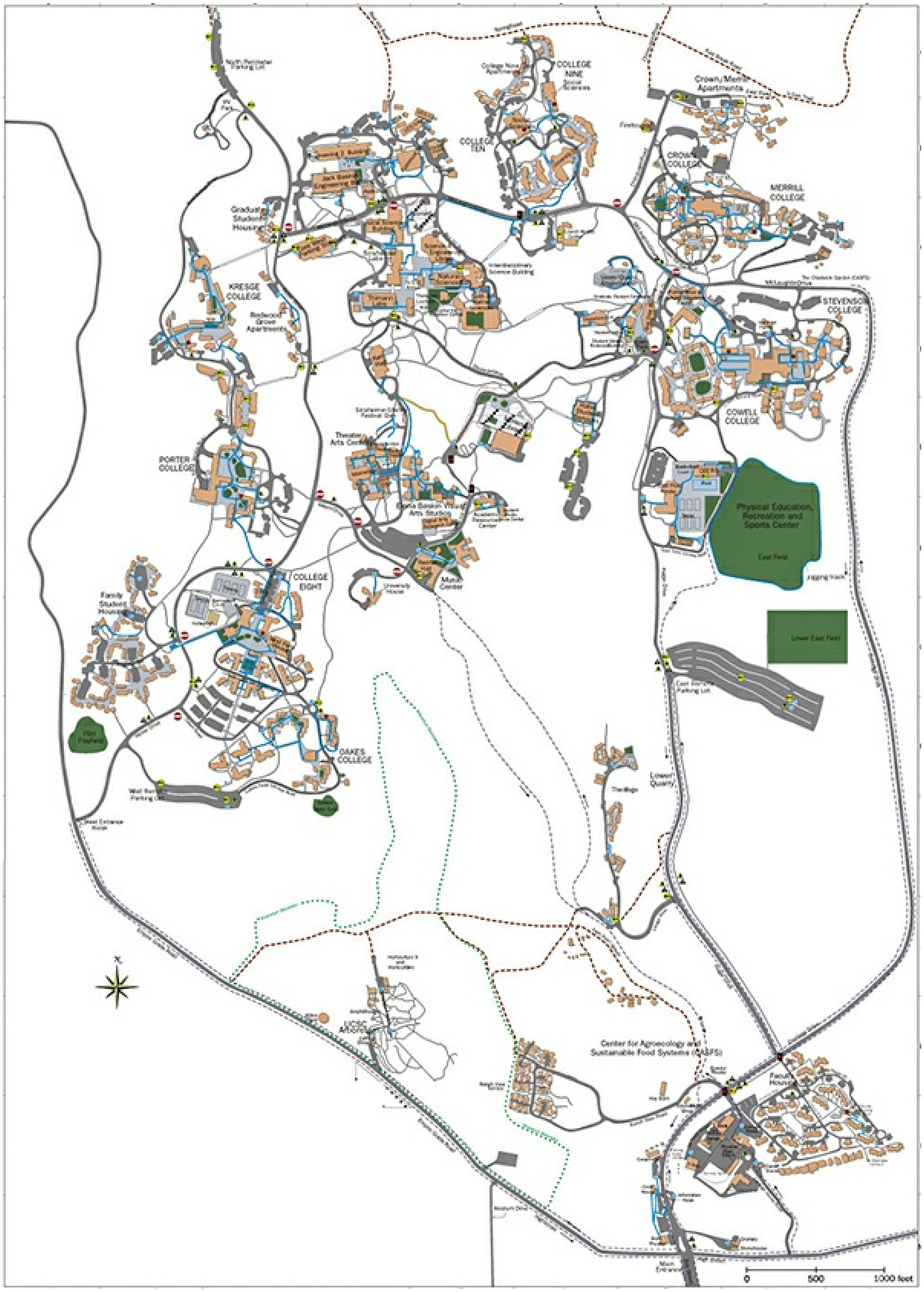
Many of the oldest colleges sought to emulate the monastic tradition, creating cloistered worlds separated from the congested and commercial streets around. The first such colleges, including the University of Salamanca and Merton College at Oxford (1264), were planned as enclosed quadrangles housing scholars and masters in charge of their education. Undergraduate students initially lodged with families in the surrounding cities, but with the creation of New College at Oxford in 1379, they were integrated into the cloistered environment (Turner 1984). These traditions continue at Oxford and Cambridge and have been exported to the new world, where examples may be found at the University of Sydney, Trent University in Canada, Yale University, and the University of California, Santa Cruz.

37.22 Cloister, University of Salamanca, Spain.
(Diego Delso, delso photo/Wikimedia Commons)

37.23 Plan of Cambridge colleges, many between the commercial high street and the river, Cambridge.
(Cadell & Davies 1808)

37.24 King’s College, Cambridge, fronting on King’s Parade, the high street.
(Geoffrey Robinson/Alamy Stock Photo)

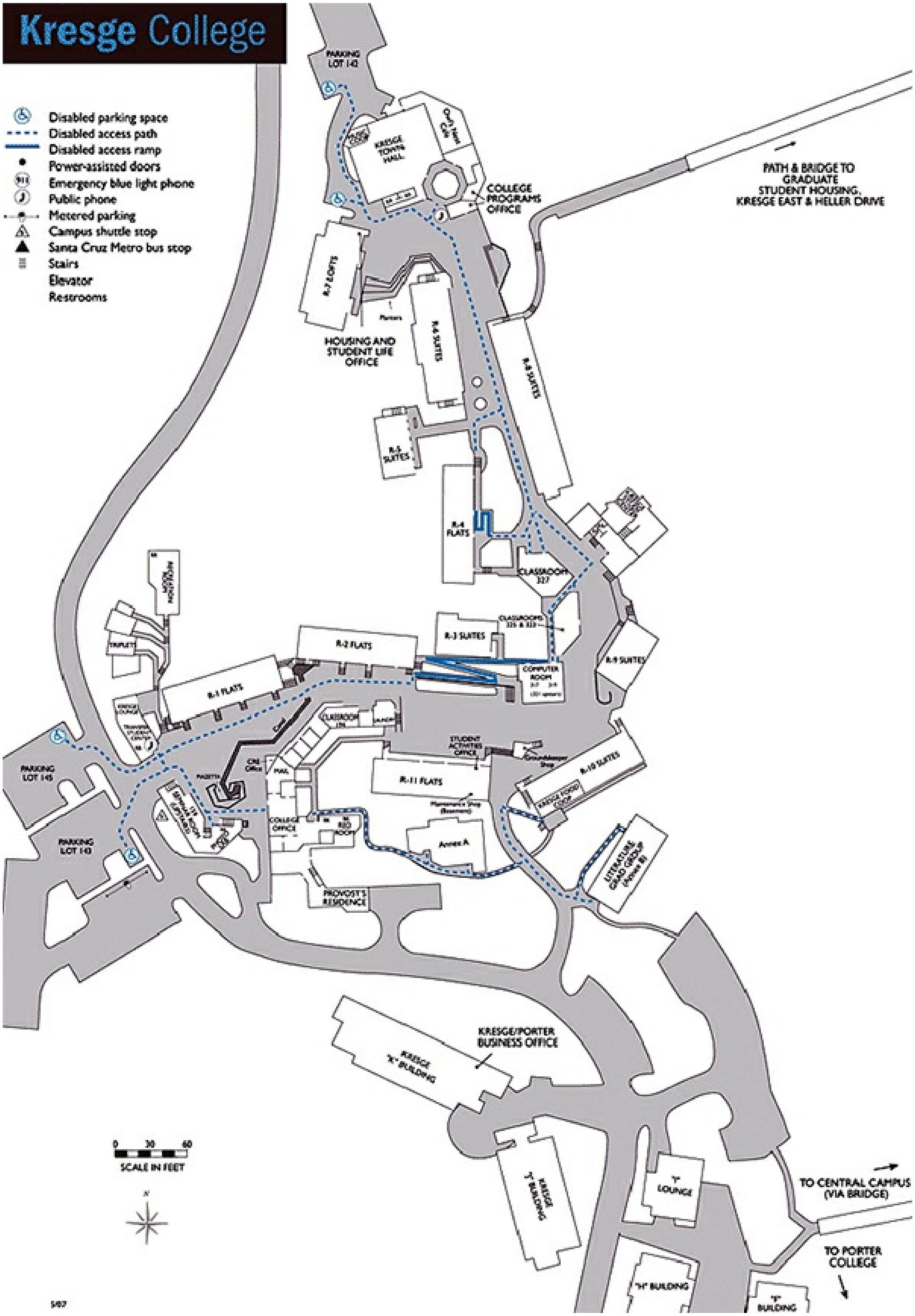
37.25 The Backs at King's College, Cambridge.
(RXUYDC/Wikimedia Commons)


COLLEGE NINE
COLLEGE TEN
Crown/Merrill Apartments
CROWN COLLEGE
MERRILL COLLEGE
Graduate Student Housing
KRESGE COLLEGE
Redwood Grove Apartments
STEVENSON COLLEGE
COWELL COLLEGE
PORTER COLLEGE
Theater Arts Center
Physical Education, Recreation and Sports Center
East Field
Lower East Field
Music Center
COLLEGE EIGHT
Family Student Housing
OAKES COLLEGE
East Remote Parking Lot
Lower Quarry
West Remote Parking Lot
UCSC Arboretum
Center for Agroecology and Sustainable Food Systems (CASFS)
Faculty Housing
Main Entrance
0
500
1000 feet

37.26 Campus plan, University of California, Santa Cruz.
(UCSC)

37.27 Baskin Engineering Complex, University of California, Santa Cruz.

(Dynaflow/Wikimedia Commons)


Kresge College
Disabled parking space
Disabled access path
Disabled access ramp
Power-assisted doors
Emergency blue light phone
Public phone
Metered parking
Campus shuttle stop
Santa Cruz Metro bus stop
Stairs
Elevator
Restrooms
PARKING LOT 142
KRESGE TOWN HALL
COLLEGE PROGRAMS OFFICE
PATH & BRIDGE TO GRADUATE STUDENT HOUSING, KRESGE EAST & HELLER DRIVE
R-7 LOFTS
HOUSING AND STUDENT LIFE OFFICE
R-6 SUITES
R-8 SUITES
R-5 SUITES
R-4 FLATS
CLASSROOM 327
CLASSROOMS 325 & 323
R-3 SUITES
R-2 FLATS
R-1 FLATS
TRIPLETS
COMPUTER ROOM
R-9 SUITES
STUDENT ACTIVITIES OFFICE
R-10 SUITES
R-11 FLATS
PIAZZA
COLLEGE OFFICE
RED ROOM
Annex A
PROVOST'S RESIDENCE
LITERATURE GRAD GROUP
PARKING LOT 145
PARKING LOT 143
KRESGE/PORTER BUSINESS OFFICE
KRESGE "K" BUILDING
KRESGE "I" BUILDING
"L" LOUNGE
"H" BUILDING
"F" BUILDING
TO CENTRAL CAMPUS (VIA BRIDGE)
TO PORTER COLLEGE
0 30 60
SCALE IN FEET
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37.28 Plan of Kresge College, University of California, Santa Cruz.
(UCSC)

37.29 View of Kresge College, University of California, Santa Cruz.
(BradCuppy/Wikimedia Commons)

The colleges at Cambridge provide a particularly compelling example. While each college has a unique history and form, they generally have three characteristics: their front doors face a commercial street, sometimes with a green forecourt or chapel serving as the interface; their living and educational spaces are integrated around a cloistered inner courtyard; and behind the colleges is generally green space offering a respite from both the street and scholarship. Thus they span three distinct environments dominated by town, gown, and leisure. Over the years as the university has

grown in stature, many more institutes, laboratories, and other facilities have been sited beyond the initial historic university area, but the heart and soul of the institution lies in its iconic form.

The University of California, Santa Cruz is a relatively new campus (opened in 1965) that builds on the Cambridge model of colleges, but is set on heavily forested hillsides above the town. The colleges and university facilities are sited so that they are as separate as possible from each other, but accessible via a short walk through the woods. Vehicular roads are mostly on the periphery of the site. Each college has been shaped by its educational theme, site opportunities, and location. They generally include housing, educational spaces, faculty residents' accommodations, a dining hall, small library, and other facilities to support student life. The colleges created in the second wave of construction also engaged students in the process of determining how they should be designed. Kresge College is a unique product of this participation. Its spine is a pedestrian street that widens to provide places for gathering, and narrows to promote the flow through the college. It has been greatly loved by several generations of students.

The Campus on the Green

Jefferson's academical village at the University of Virginia epitomizes the campus centered on a green, but it has much earlier antecedents dating from the first colleges created on American soil. Harvard's Yard, crisscrossed by pathways between dormitories and classrooms, took its form in the late seventeenth century (Turner 1984), a pattern that was followed at William and Mary and other early eastern colleges. Their plans evolved building by building, and today there are dozens of New England colleges with quiet greens at their center. Among the finest examples is Middlebury College in Vermont with its dual quadrangles, Colby College

in Maine centered on a green, and the original college on a hill, now Brown University.

37.30 The Lawn today, University of Virginia.
(Courtesy of Sanjay Suchak/UVA Today)

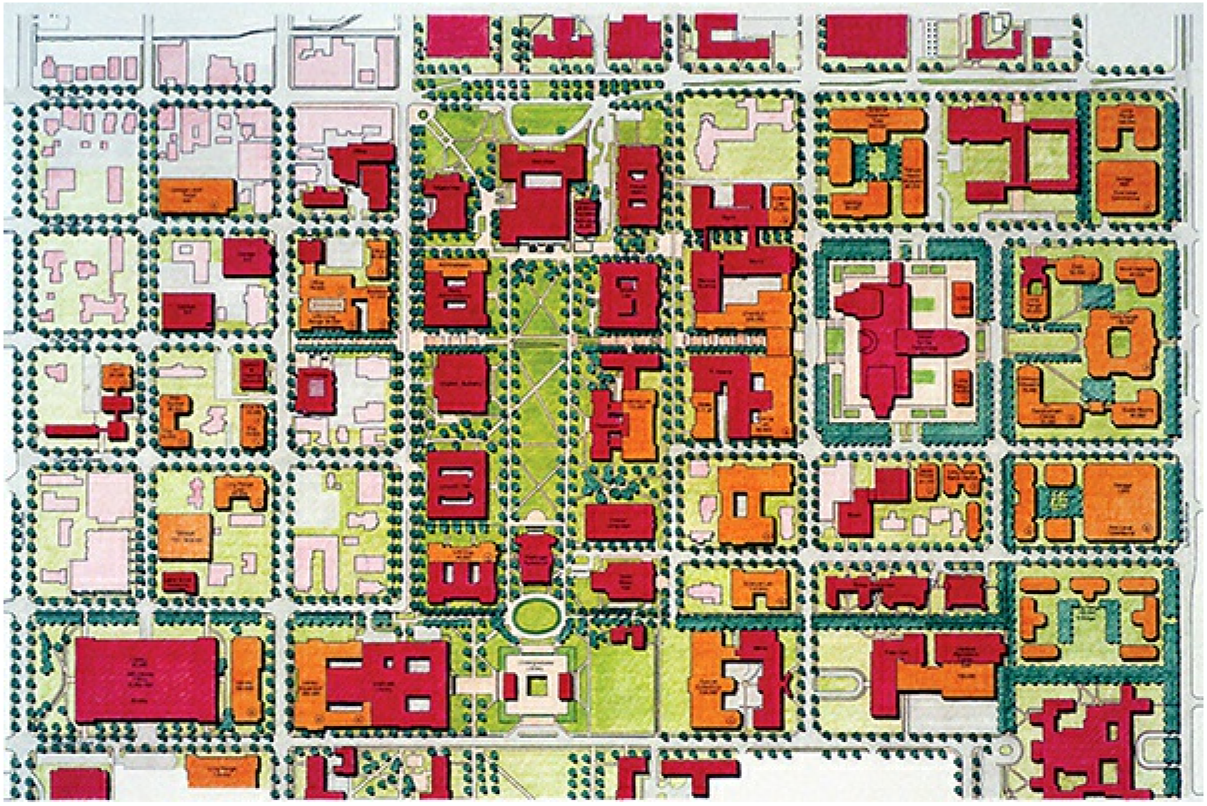
37.31 Aerial view of the green at Colby College, Waterville, Maine.
(Dave Cleaveland/Maine Imaging)

The great explosion of university building in the US occurred through the creation of land grant colleges in every state in the late nineteenth century. The Morrill Acts granted federal lands to the states to create and endow new universities, and charged them with promoting agriculture and mechanical skills. Subsequently, the mission of many of the colleges was expanded with the addition of agricultural experiment stations and extension programs. Over 70 new universities were created, and Jefferson's vision provided the template for many of their campus plans.

The University of Illinois campus in Urbana-Champaign is a literal interpretation of the Jefferson plan, scaled to a much larger university. The auditorium sits at the head of the 400 by 1,000 ft (122 by 304 m) quadrangle, facing the student center, which was added at the opposite end in the twentieth century. Classroom buildings, the main library, and the administration building line the two sides. The next layer of structures surrounding the quadrangle buildings includes laboratories, arts facilities,

and other uses that require much larger spaces. As the engineering field grew rapidly, a separate cluster was created a short walk from the main quad. As professional schools were added to the campus and agricultural laboratories needed to expand, a second quad was created on the opposite side of the auditorium. In the midst of all this growth and change, a 1 ac (0.4 ha) plot, the Morrill Fields, was left undisturbed and is said to be the oldest continuously planted cornfield in the world.

37.32 Quadrangle, University of Illinois, Urbana-Champaign.
(Courtesy of Sasaki Associates)



37.33 Campus plan, University of Illinois, Urbana-Champaign.
(Courtesy of Sasaki Associates)

37.34 Green heart, University of California, Berkeley.
(Courtesy of philip.greenspun.com)

37.35 Mall, University of Texas at Austin.
(University of Texas)

Sidebar 37.2

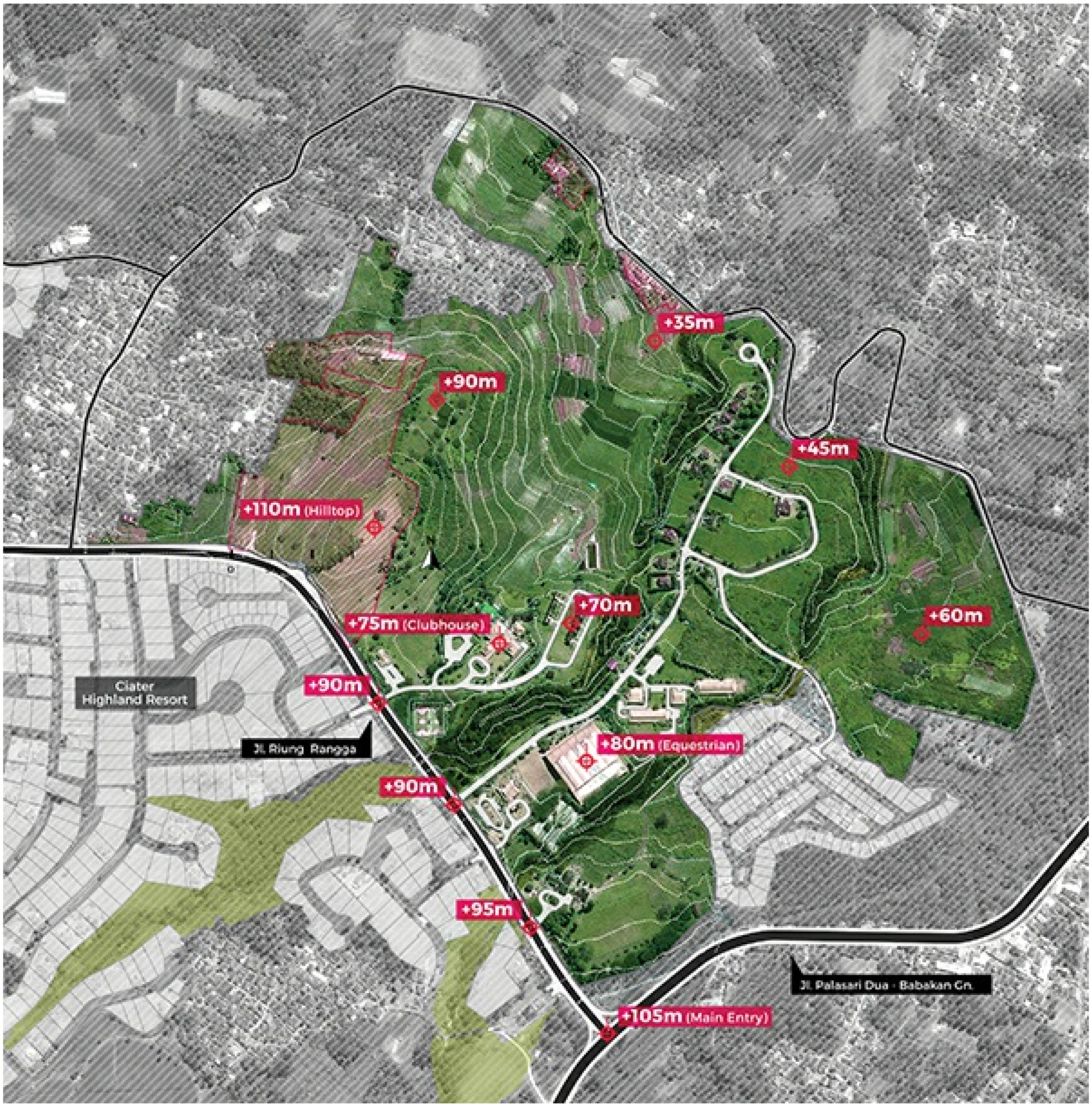
West Java New University, Subang, Indonesia (Sasaki 2016)

Located 25 km from Bandung, the New University is planned as a residential campus for 10,300 full time students and 230 faculty. It will focus on the sciences (60%) and humanities (40%), and is intended to provide an international quality education in a living-learning-recreational environment.

The site in rolling agricultural land was previously used as an equestrian facility, with large open sheds capable of being redeployed. The campus program calls for 166,000 m2 (1.8 million sq ft) of built space, approximately half of which is student housing.

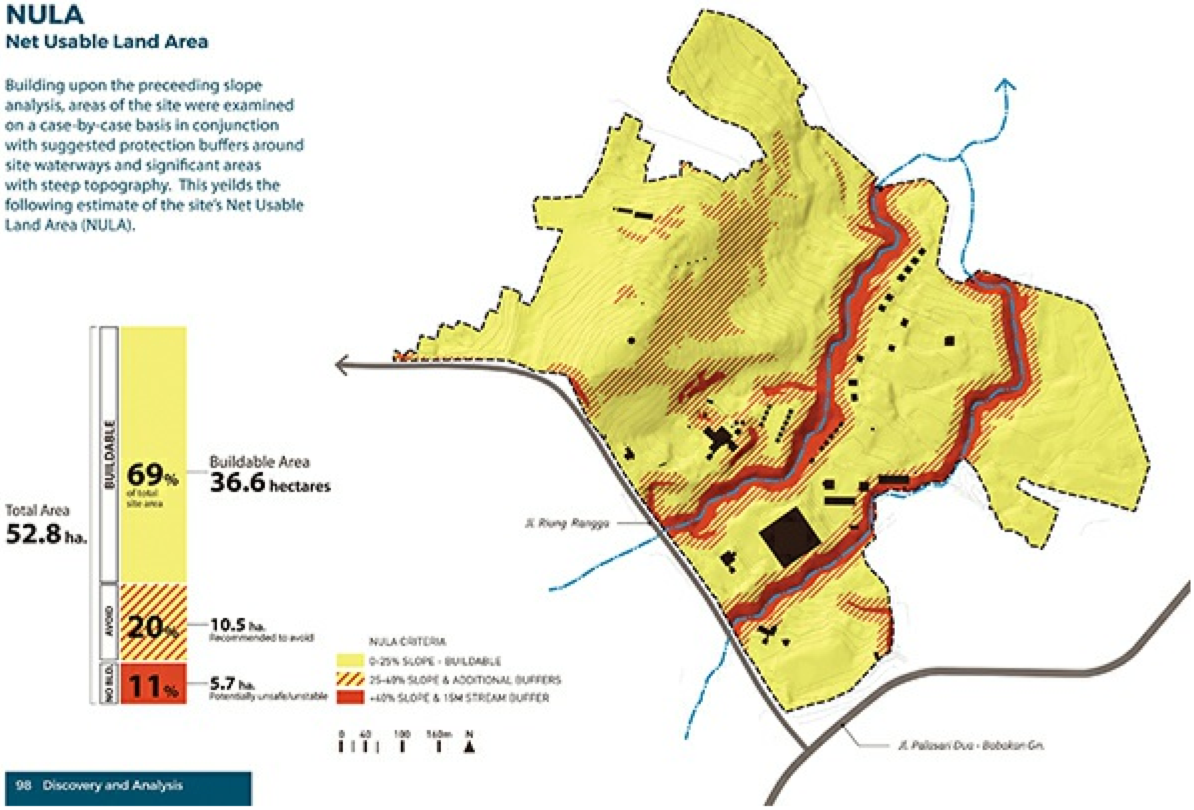
The leading idea is creating a *learning valley* centered on the lushly landscaped stream that bisects the site. Nature and campus life are closely intertwined. Along the valley are the academic spaces, the student hub, recreation facilities and large public open spaces. Portions of the valley will also remain as farmland, providing food supply for the campus. Rising up from the valley are housing and a mixed use area that provides the interface between the campus and the surrounding community.

All illustrations courtesy of Sasaki Associates.



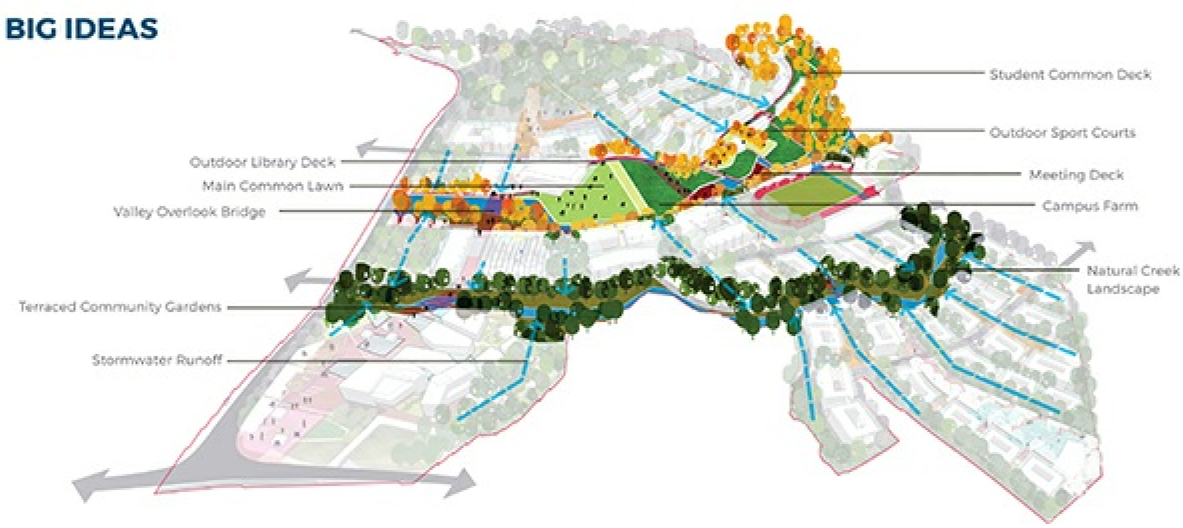
37.36

Site for the university, West Java New University, Subang, Indonesia.



37.37

Site area available for facilities.

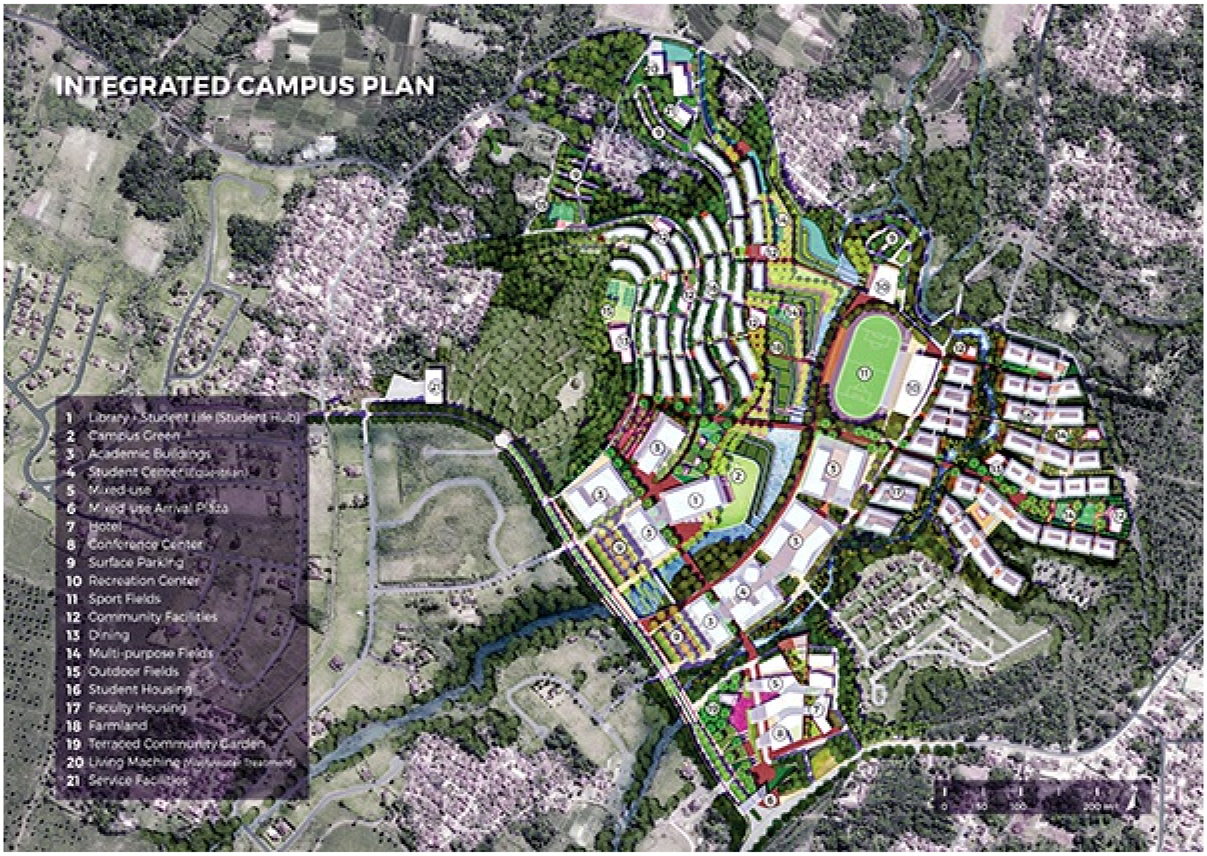


37.38

Site concept plan.

37.39 Concept for the site:

the learning valley.



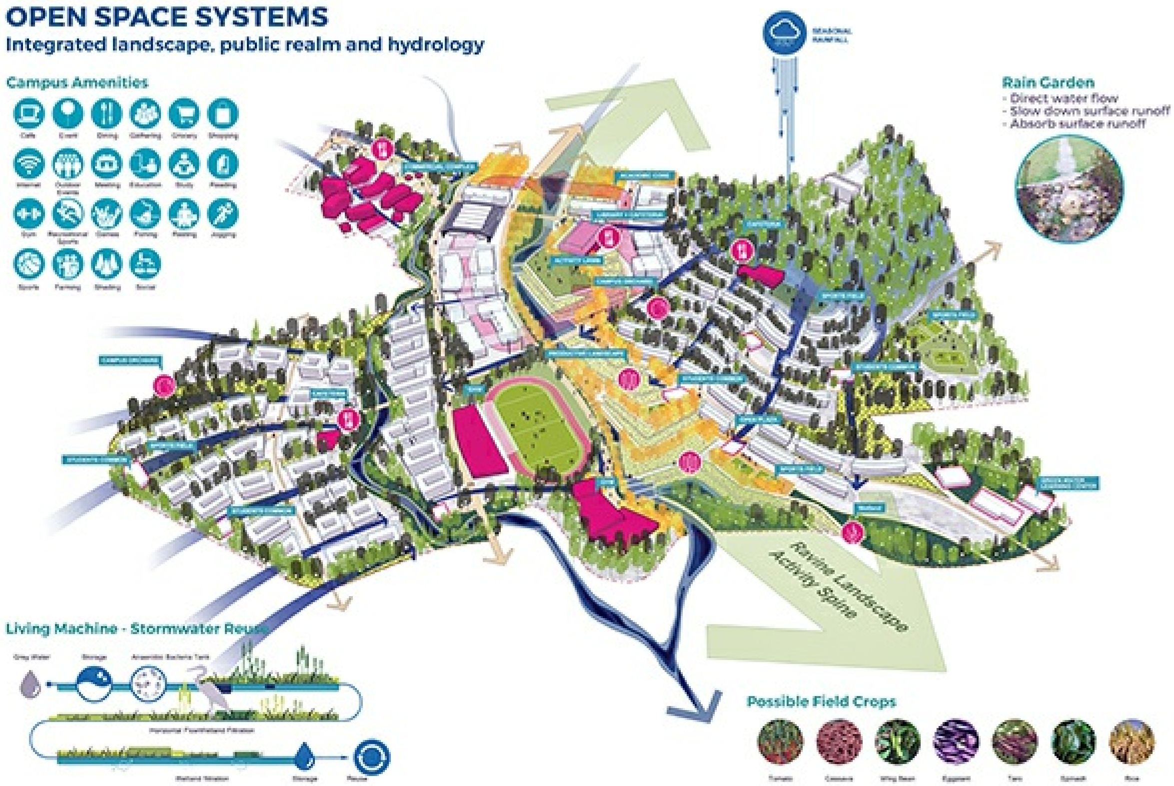
37.40 Illustrative plan of campus.

Sidebar 37.2 (continued)

West Java New University, Subang, Indonesia (Sasaki 2016)

37.41

Aerial perspective of proposed campus.



37.42

Diagram of academic area of campus.

37.43

Student activity hub.

37.44 Diagrams and section of hillside housing.

Table 37.3 | Space program for West Java New University campus (in m2)

Space type	Recommended GFA	West Java New University GFA	CEFPI1 GFA	Difference
Instructional	46,026	44,026	54,115	−10,089
Office space	5,700	4,875	6,372	−1,497
Study space	10,000	1,154	10,944	−9,791
Sports	14,000	14,132	17,587	−3,455
Student life	13,700	9,185	13,721	−4,536
Support	13,000	—	13,070	−13,070
Health care	642	46	642	−596
Student housing	147,269	83,354	147,269	−63,915
Employee housing	9,320	9,320	9,320	—

Total	259,657	166,091	273,039	−106,948

1 The Association for Learning Environments.

Each of the green quadrangles created at the heart of the new land grant universities has a distinctly different character. The Oval at Ohio State University (see figure 37.6) is one of the largest and handsomest formal spaces, surrounded by academic, administrative, and cultural facilities. The sequence of green spaces at the center of the University of California, Berkeley retains many of the features of the hillside landscape before there was a university, including Strawberry Creek. The University of Texas mall in Austin is dominated by the towering administration building at the center of campus, on axis with the state capitol a mile away. In all these cases, everyday motorized traffic is not allowed, pedestrian paths crosscut the spaces, and there is ample space for students and faculty to use the lawns and shaded areas for leisure and recreation.

The campus around the green requires a superblock to be created, with automobiles limited in their penetration into the academic core. In most cases, large parking structures are located on the peripheral streets, sometimes integrated with athletic facilities. There is also logic in locating large visitor facilities—stadiums, athletic venues, museums, and institutions attracting large numbers of short-term visitors—along the perimeter access roads. Large laboratories and other facilities that are likely to change regularly are also candidates for perimeter locations. Because of the intensity of use in the core of the campus, student housing is generally located in clusters beyond the perimeter road.

Most campus planning occurs within a framework of existing roads, settlement, and infrastructure. However, in rapidly developing countries many new universities and campuses are being created de novo in the countryside, which opens up possibilities for a close integration of natural features of a site with the built environment. An excellent example is the planning of the West Java New University in Subang, Indonesia. It aspires to maintain a productive landscape while stimulating contact between

students and faculty. The climate allows much of the education to occur out of doors, and the structured spaces at the center of the campus are an inventive new form for the traditional campus green.

The Polytechnic

When the Massachusetts Institute of Technology sought a model for the planning of its new campus in Cambridge on lands it had purchased in 1911, it looked to Europe for ideas. The first university that taught technology is said to have been the predecessor of today's Budapest's University of Technology and Economics, established in 1782, and by the beginning of the twentieth century there were many thriving technical universities in Europe. So it was logical that a MIT delegation visited the polytechnics of Berlin, Vienna, Darmstadt, Dresden, and others that had constructed new buildings, and returned concluding that the new MIT should consist of a single continuous building, with a building module and structural system that allowed flexible use for laboratories, classrooms, and faculty offices (Jarzombek 2004). It made no sense to construct buildings for individual disciplines, since these were rapidly evolving and would regularly change as new knowledge shaped praxis. This distinctive approach to creating a campus was a sharp departure from earlier US colleges.

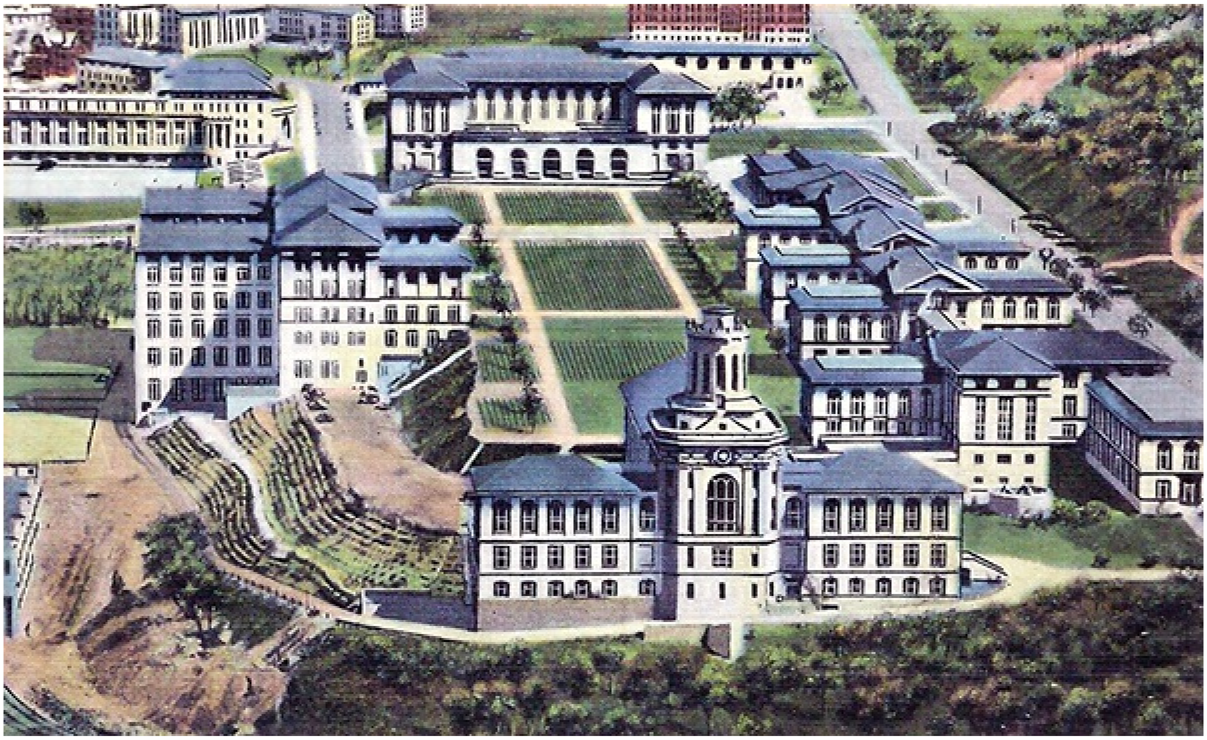
William Welles Bosworth's plan for the MIT main complex that opened in 1916 went one step beyond what was ordered. The interior layout followed the original dictum, adopting a 30 by 50 ft (9.1 by 15.2 m) building module and simple concrete frame structure throughout the complex. But not content to settle for the utilitarian, Bosworth shaped the structure around a great court, clothed the sides and ends of the complex with neoclassical facades (the rear was unadorned, with the presumption that new additions would cover it), and punctuated the ensemble with a

great dome devoted to the university library. Over the last century MIT has added dozens of buildings on its main campus, almost all interconnected below or above grade and modular in dimensions. Its main indoor passageway has been dubbed “the infinite corridor,” and every space along it has been adapted for new uses multiple times. Housing, athletic facilities, research institutes, and spaces for its business school have been constructed a short walk from the main linked complex, but there is a constant search for ways to fill the gaps to enlarge the continuous environment.

37.45 Royal Joseph Technical University, Budapest (now Budapest University of Technology and Economics).
(Misibacsi/Wikimedia Commons)

37.46 The MIT main complex shortly after its completion in 1916, Cambridge, Massachusetts. (MIT Archives)

37.47 MIT campus in 2012, Cambridge.
(DrKenneth/Wikimedia Commons)



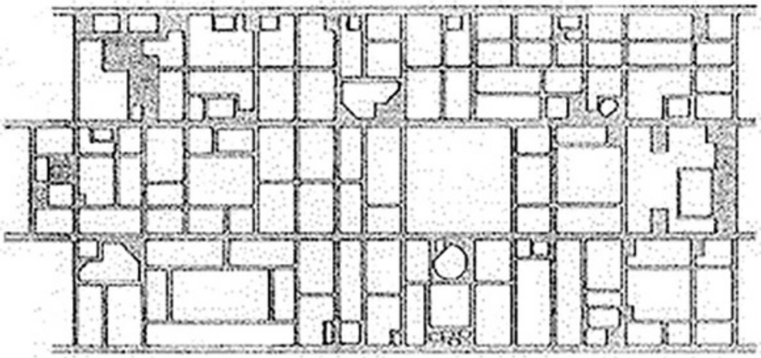
37.48 Hornbostel plan for Carnegie Technical University, now Carnegie Mellon University, Pittsburgh.

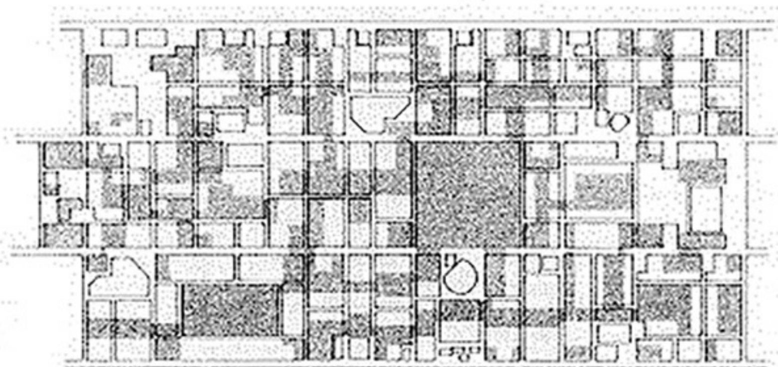
(CMU Archives)

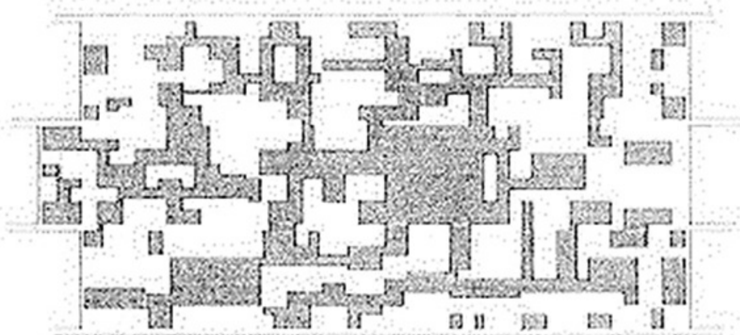
The polytechnic plan has other stellar examples in Europe and the US, and has been adopted for both technical universities and general-purpose campuses. In the US, the campus plan for the Carnegie Technical Schools (now Carnegie Mellon University) in Pittsburgh, designed by Henry Hornbostel in 1900—predating MIT's campus—was an innovative arrangement of adaptable laboratory buildings connected by a horseshoe-shaped corridor around a green courtyard. The plan provided flexibility for each laboratory in size and module. Many of the original laboratories remain in educational use today.

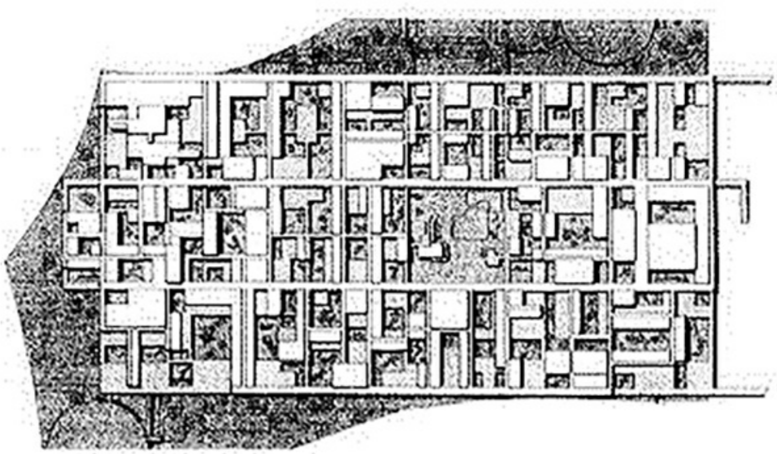
More recent plans following this model have carried the opportunity for flexible development even further. The 1963 competition-winning entry for the new campus of the Free University of Berlin, by Candilis, Josic and Woods (with Manfred Schiedhelm), proposed an orthogonal grid of walkways and indoor corridors, with cell size roughly 65.6 by 65.6 m (215

by 215 ft); into this grid classrooms, laboratories, and other educational and research spaces of varying dimensions could be inserted over time (Domingo Calabuig, Castellanos Gómez, and Ábalos Ramos 2013). While only a portion of the campus was developed on this module—other portions became fully integrated buildings—it offers a glimpse of the potential of such an open planning system.









37.49 Mat building scheme, Free University of Berlin, Candilis, Josic and Woods, 1963.
(Domingo Calabuig, Castellanos Gómez, and Ábalos Ramos 2012)

37.50 Aerial view, Free University of Berlin.
(Courtesy of Freie Universität Berlin/Bavaria Luftbild)

The McMaster University health sciences center in Canada, planned by Eberhard Zeidler, is the ultimate evolution of this building strategy: a three-dimensional grid of corridors and vertical circulation systems, with interstitial floors for mechanical and electrical systems. Within this armature, floors may be stacked as needed, with subsequent additions and changes in one area not disrupting the basic functionality of the institution. Over its 30-year life, it has undergone considerable change, adapting to the changing nature of health care and research.

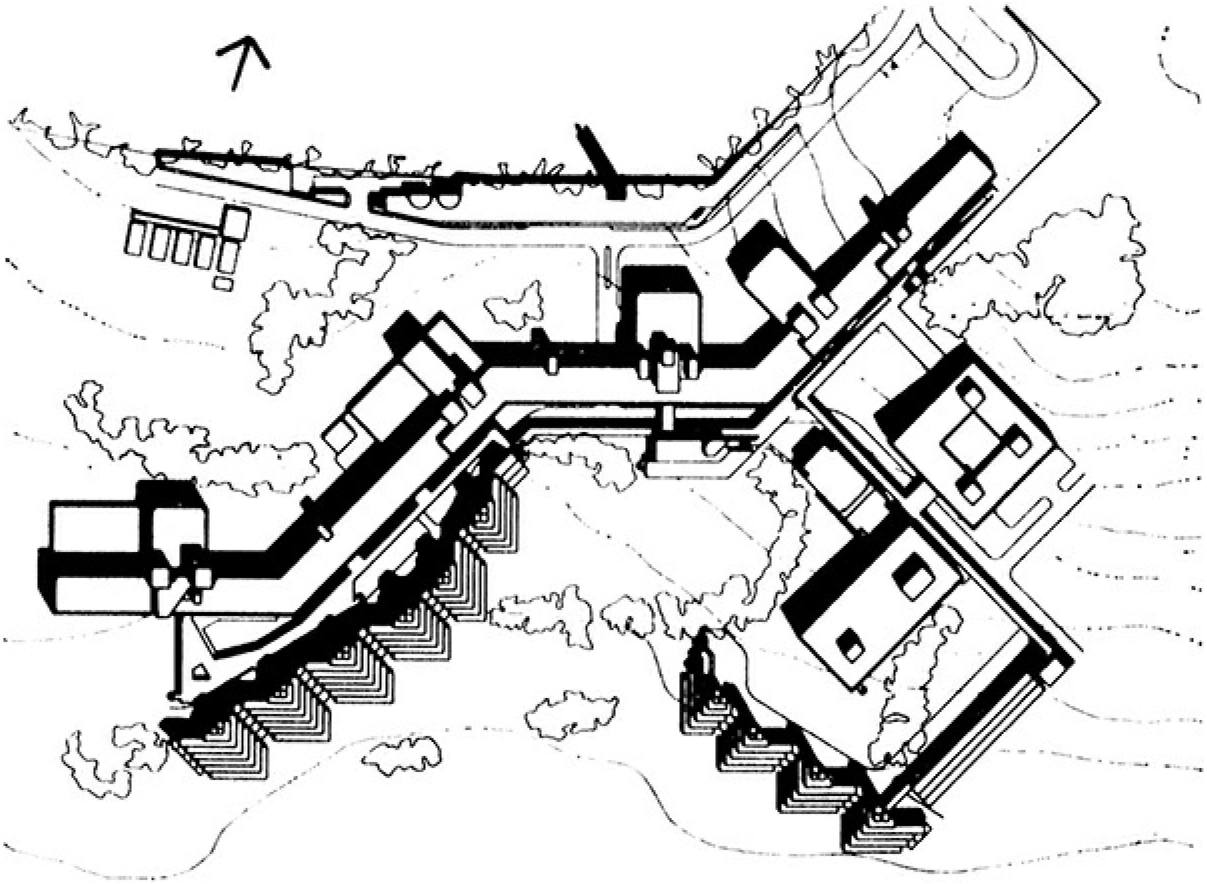
Two- and three-dimensional circulation grids such as these are complicated, and may overestimate the need for circulation. A more

common strategy is to create a central spine off which spaces for various purposes are constructed. The University of East Anglia, designed by Denys Lasdun in 1962, is among the leading examples. Following the contours of the high ground of its site, the central spine of the university connects all of its functions. The masterstroke of the plan is the cascade of student housing down the slope to the playing fields below. Every student living at the university has just a short walk under cover to all its educational spaces. The system is capable of being added to and changed over time, with new structures connected to the spine.

The Technical University of Munich has applied this strategy to several waves of new buildings at its Garching campus, constructing new clusters of research and educational spaces along spines radiating outward from the linear center of the campus, the point of arrival from the U-Bahn. The spines, no longer the infinite corridors of MIT, are designed as gathering spaces for the research communities. Those who arrive by automobile enter the spaces from the opposite end on the perimeter of the campus.

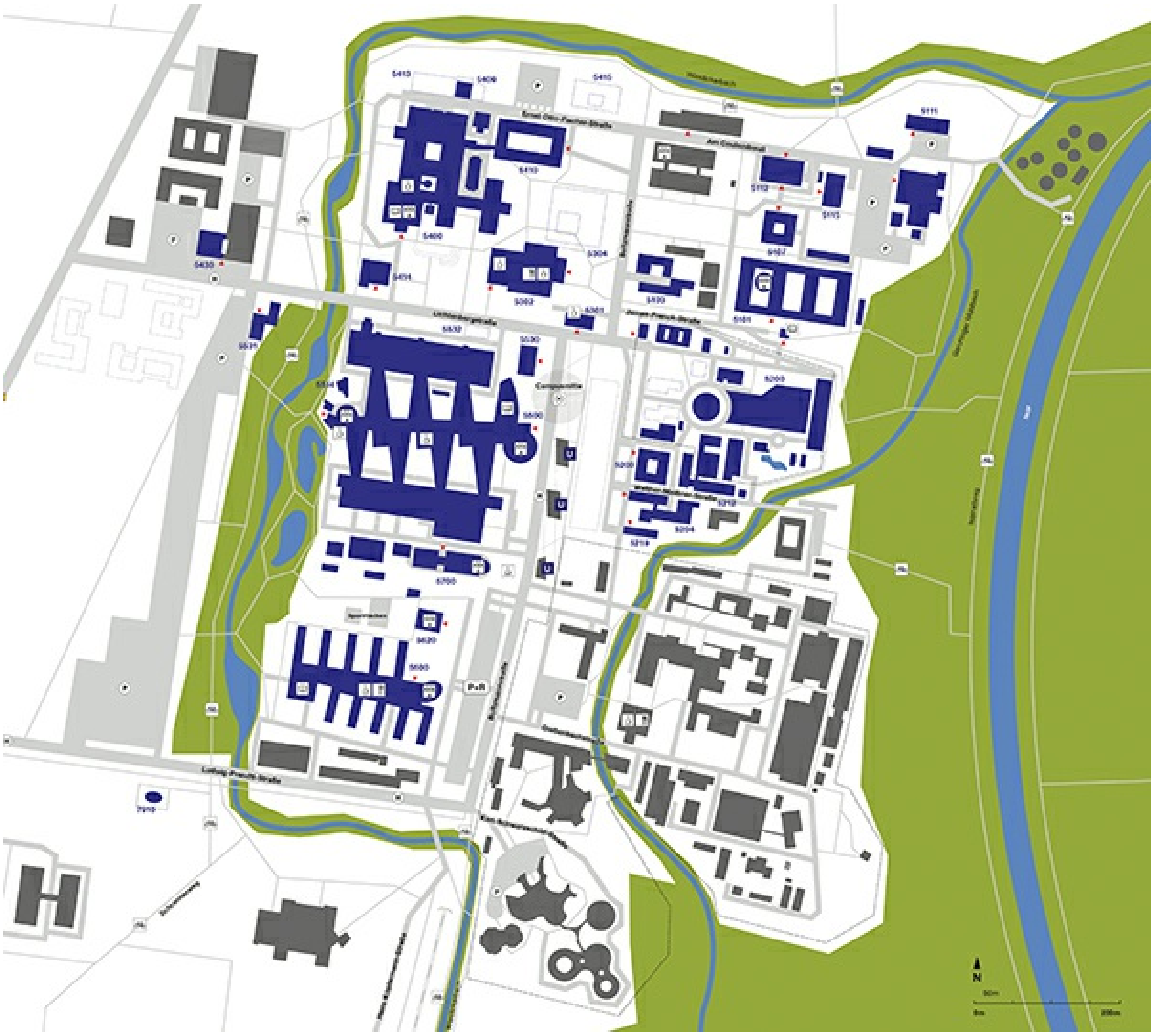
37.51 McMaster University health sciences center, Hamilton, Canada.

(Dan Zen/Wikimedia Commons)



37.52 Site plan, first phase of the University of East Anglia, Norwich, UK.
(Denys Lasdun)

37.53 University of East Anglia, Norwich, 2014.
(John Fielding/flickr/Creative Commons)

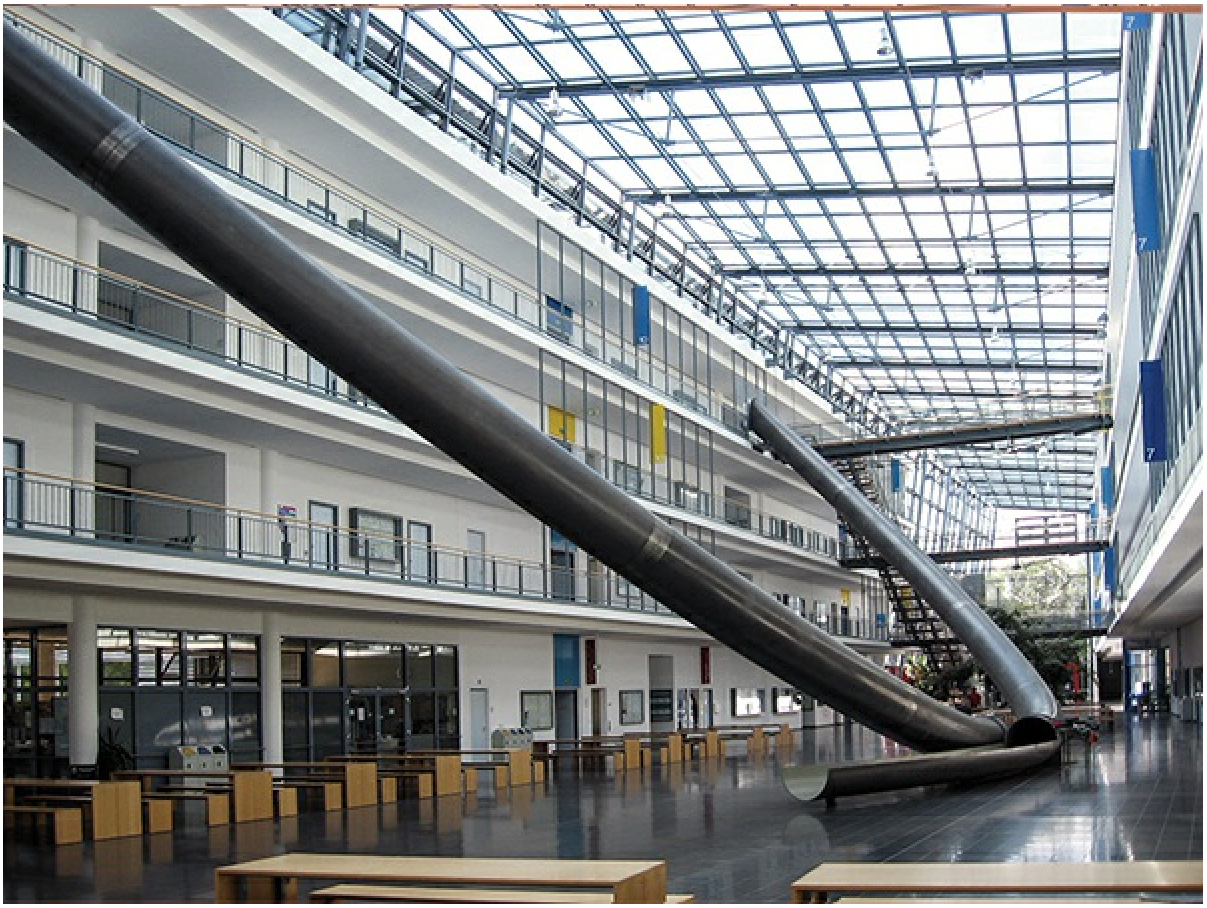


37.54

Campus plan, Garching campus, Technical University of Munich, Germany.
(Edi&Sepp Gestaltungsgesellschaft/Courtesy of Technical University of Munich)

37.55

Aerial view of Technical University of Munich Garching campus.
(Ernst A. Graf/Courtesy of Technical University of Munich)

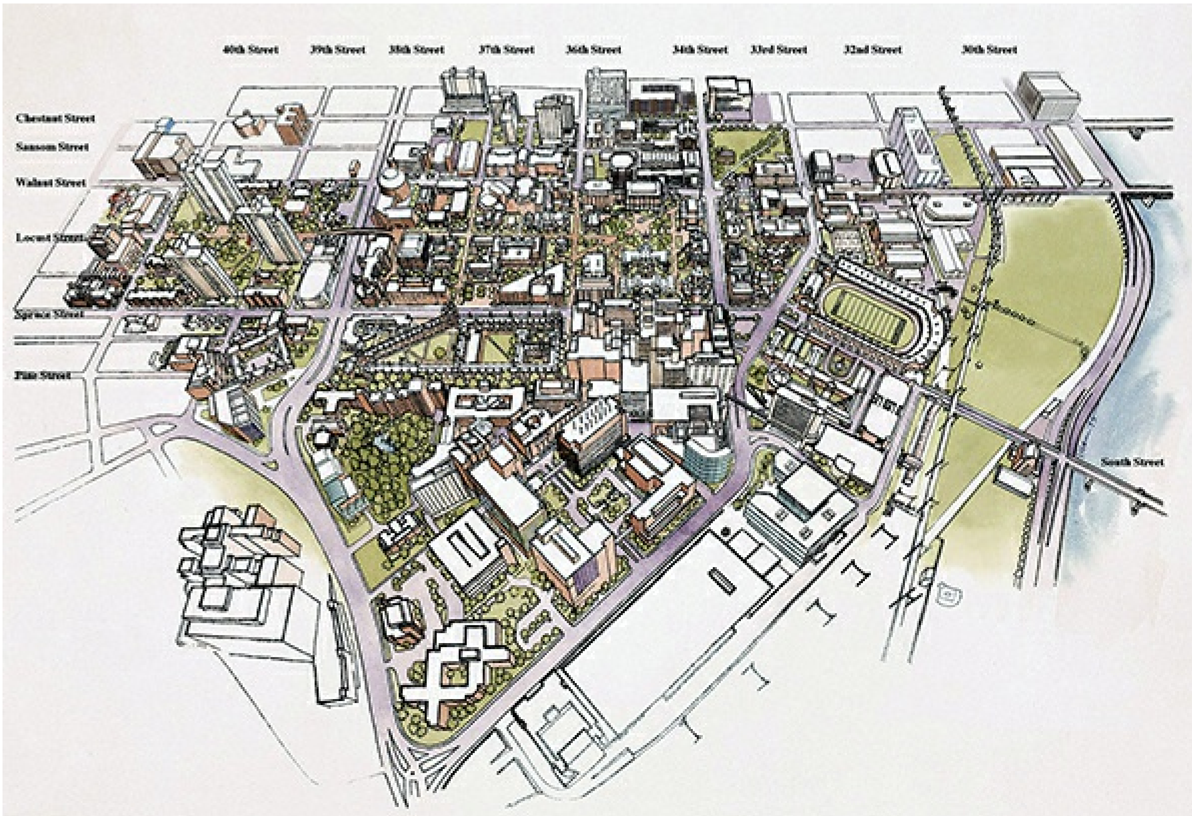


37.56

Atrium, Technical University of Munich Garching campus.
(Church of emacs/Wikipedia Commons)

There are infinite possibilities for the polytechnic model of higher education campuses, which can be applied to research institutions as well as universities. Each distinguishes the permanent elements of the campus, usually the circulation networks and places for face-to-face contact, from the constantly changing educational and research spaces. If they can achieve a century of relevance, as MIT's original buildings have, the strategy will have succeeded.

The City University

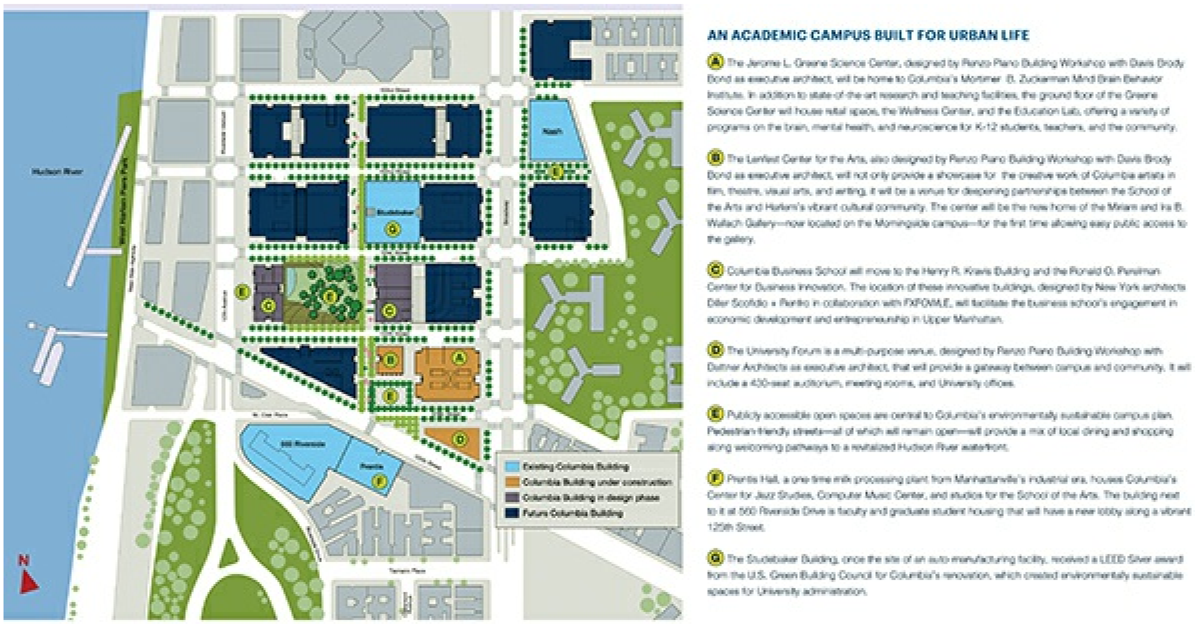


37.57 Sketch of campus of the University of Pennsylvania, created by selectively closing city streets, Philadelphia.
(Courtesy of University of Pennsylvania)

37.58 Blanche Levy Park at the center of the campus, University of Pennsylvania.
(Gary Hack)

37.59 Locust Walk, University of Pennsylvania, created from a city street through the campus. (Kendall Whitehouse/Courtesy of University of Pennsylvania)

37.60 Main campus of Columbia University, centered on its "fields," New York City.
(Courtesy of Columbia University)



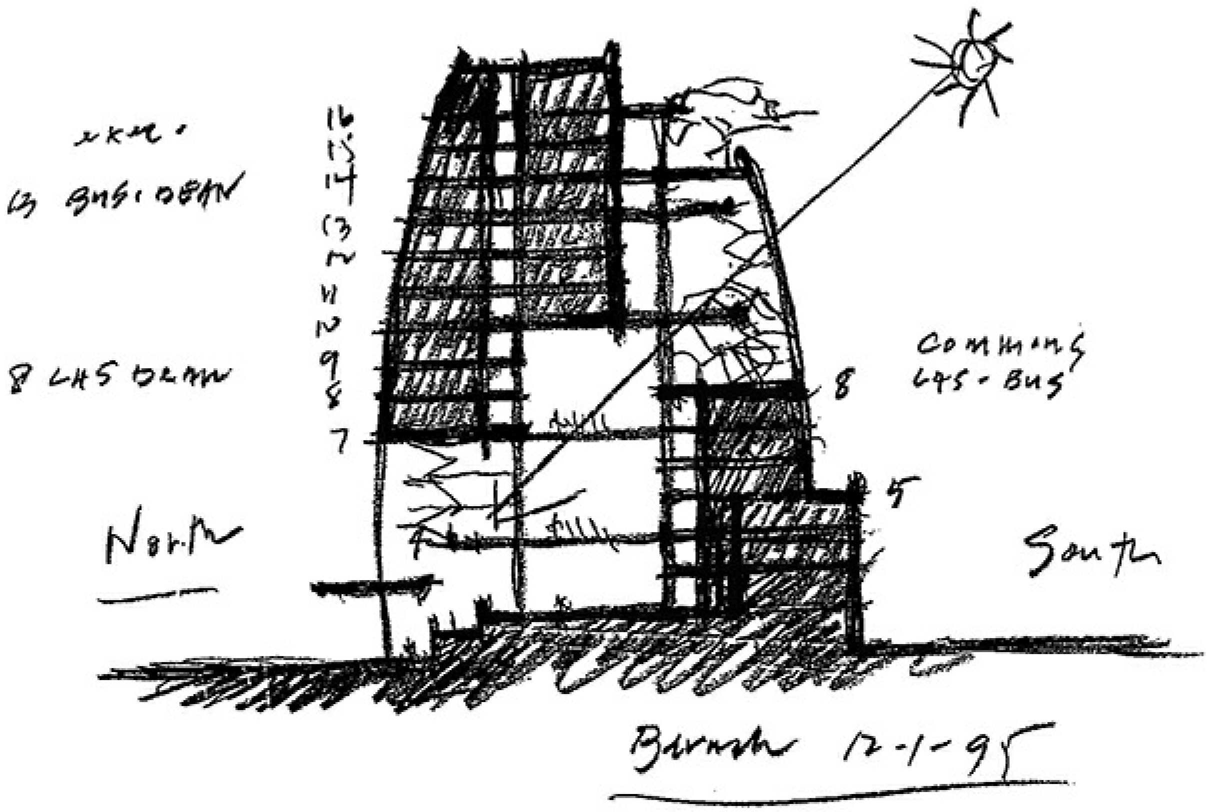
37.61 Site plan of Columbia University's Manhattanville campus, New York City.
(Renzo Piano Building Workshop/Skidmore Owings and Merrill/Courtesy of Columbia University)

Campuses in the densely built-up areas of cities usually don't have the luxury of spreading out as new needs arise, unless they are prepared to displace neighborhoods around them or other functions. Usually they begin as individual buildings along streets, and the notion of becoming a campus evolves over time. At the University of Pennsylvania in Philadelphia, the university tolerated a streetcar and vehicles traversing the center of its campus for almost a century. In a brilliant stroke, the streetcar was routed underground, traffic was eliminated from the streets bisecting the campus, and the newly liberated spaces were combined with lawns to become a campus green and pedestrian way linking all the elements of the campus.

In a few places, universities relocated from the dense commercial centers of cities to the edge where they were able to create some breathing room, only to be engulfed again by development as the city grew. Columbia University in New York is an example, with its Morningside

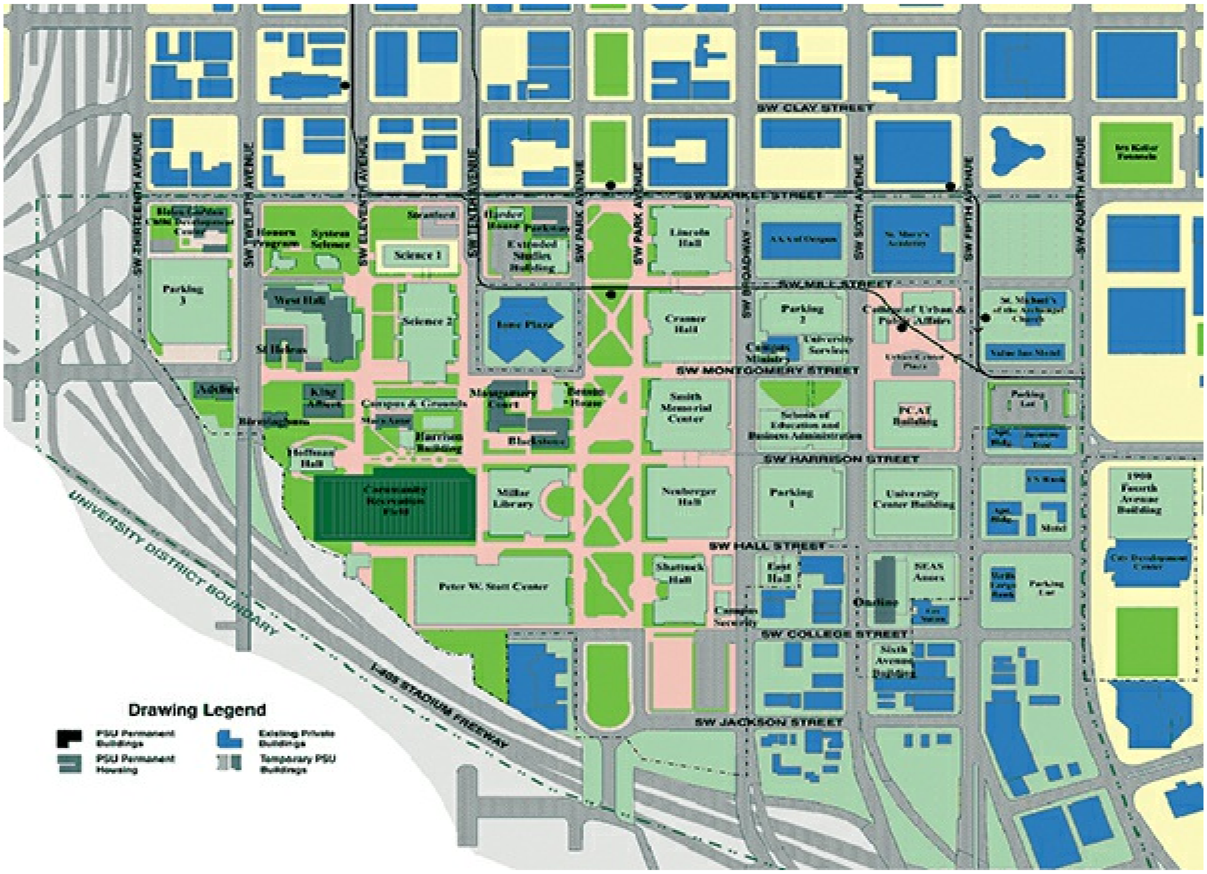
Heights campus designed by Charles M. McKim in 1893. Its centerpiece is its campus green, presided over by Low Library (now the administration building) and Butler Library (its replacement as the main library) at the two ends, with residential buildings on its two sides. Limited in its capacity to expand outward, Columbia has leapfrogged to Manhattanville where it is creating a satellite campus ten blocks to the north, one stop away on the subway, for its research institutes and professional schools. Baker Field, with the university's large playing fields, is located over two miles away, an accommodation that many city universities need to make.

37.62 Future street view, Manhattanville campus, Columbia University.
(Courtesy of FXFOWLE Architects)



37.63 Conceptual sketch for Baruch College's vertical campus, New York.
(Courtesy of William Pedersen/Kohn Pedersen Fox)

37.64 Street view of Baruch College's vertical campus.
(courtesy of Kohn Pedersen Fox)



37.65 Portland State University campus plan, Portland, Oregon.
(Portland State University)

37.66 Streetcar passing through campus building, Portland State University.
(Portland State University)

Most city campuses are the product of the random opportunities to acquire properties for academic purposes as they become available. When large parcels present themselves, they need to be used intensively. In New York, Baruch College seized the opportunity to develop a full block adjacent to its scattered buildings, creating a vertical campus. Academic programs are distributed through the full height of the 15-story campus, and places to see others, be seen, and make casual contacts surround the atria spaces. Most of the students are part-time or combine study with work, and the vertical courtyards come to life in the early evening when the campus is filled with students. While the building fills the entire block, it is shaped to allow more light to reach the surrounding streets, in deference to its neighbors. The ground level contains the college

bookstore, and other retail and eating spaces to make connections with the neighborhood.

Portland State University has embraced its urban setting and designed its campus to become a working part of the city. There are no gates or security barriers, and the original block dimensions are respected for most buildings, although several large recreational facilities have needed to spill over two blocks. Several of the streets have been converted to pedestrian ways, and Park Avenue, the city’s linear park, is the university’s central green as it extends through the campus. The streetcar system penetrates the campus, with an important stop located directly below the College of Urban and Public Affairs. Bridges at the third level or above connect several of the buildings across streets, but only where those links are functional necessities. The Portland State campus demonstrates that a sense of identity can be created by a small number of design policies: consistent heights of buildings; compatible architectural character; a connected public realm with consistent materials; and limiting the amount of through traffic on crosscutting streets.

Virtual Campuses

Online education is currently calling into question the traditional form of university campuses. If education can be delivered anywhere via the Internet, what is the purpose of a campus? Millions of people all over the world are today taking courses without setting foot on a traditional university campus. At the same time, an unprecedented number of new universities are being established, particularly in rapidly modernizing countries. Many of these are branches of established universities that are operated in networked arrangements with the historical campus. At a minimum the new educational technologies will change the functions of campuses and the way education is delivered within them.

Higher education serves many purposes, and it is useful to parse them in order to understand those that require a fixed base of facilities and those that can be conducted in virtual space. The most basic function is acquiring knowledge, from books, lectures, demonstrations, and other sources. A second function is developing skills—how to conduct research, do design, build and test things, conduct experiments, write essays or reports, make arguments, speak in public, resolve conflicts, compete in athletics, and the like. Many of these are acquired through coaching by faculty and mentors. Still a third purpose is acquiring values, and the intellectual basis for them, along with interpersonal skills. Making friends and developing contacts and potential collaborators follow from these. And through the process of acquiring higher education, young people mature socially and intellectually and make important choices about long-term occupations. The people they encounter as faculty, visitors, and guest speakers are influential in shaping careers.

Not all of these functions require a student to be on a university campus for four years or more; in fact some purposes are better served by being in the workaday world, in the field, or in foreign places. It is not a large step to move from textbooks to online sources for the acquisition of knowledge, and the Internet is already displacing many of the functions of libraries. But the types of learning that are difficult to codify, or require coaching, or can only be acquired through intensive face-to-face interaction, surely will justify the continued presence of educational campuses. Experience with massive open online courses (MOOCs) to date suggests that they are most effective if coupled with a tutor who helps students understand and use the knowledge they are acquiring.

In coming years, we will surely see fewer large classrooms and more small-group discussion spaces. Laboratories, workshops, design studios, and performance spaces will continue to be important, although as the digital revolution affects the nature of research through widespread modeling, automation, and simulation, the kinds of spaces will need to keep pace. Places that promote human contact and exchange will be even

more essential. Universities will remain places of residence and collaboration, events and socialization, even while knowledge is acquired from diverse sources.

Some universities such as Bridgewater State University in Massachusetts are reorganizing their campus around the idea of living-learning groups, where learning spaces are integrated with living areas for students and faculty. The idea of hoteling is taking root in other universities—living spaces where students come to a campus for only a few days or weeks, then return to their homes and learn through online courses. The Wharton School of the University of Pennsylvania has constructed identical case teaching classrooms, equipped with screens and cameras, in several cities (Philadelphia, San Francisco, Singapore) where a lecture-discussion can be shared across several time zones and participants can see their counterparts. These and many other innovative learning settings may signal the campus of the future.

Connecting Campuses and Their Communities

Planning places for higher education does not stop at the boundaries of the university's educational facilities. The university's role in its wider environment can take several forms: it may own or collaborate with medical centers which also provide the sites for clinical education; it may depend upon surrounding neighborhoods for student and faculty housing;

semi-independent research institutes may cluster near the campus; and startup firms or large research-centered businesses may locate near the campus to tap the university’s faculty and students. Much of the high tech industry in Silicon Valley, California, was a spinoff of Stanford University faculty and graduates, just as East Cambridge has become the largest cluster of biomedical research in the world as a result of its proximity to MIT and affiliated research institutes. Many universities have taken the lead in creating high-tech research parks to stimulate the commercialization of their intellectual properties, beginning with the creation of the Palo Alto research park near Stanford and the University City Science Center in West Philadelphia, both begun in the 1960s. Today, virtually every university in the US and China is a partner in a high tech research park near its campus. Many universities have also leveraged their land holdings at the periphery of their campuses to create commercial and residential projects for those who wish to live, work, shop, and be entertained nearby. In a wider sense, every university has a stake in the quality of its surroundings, which affects its ability to attract the best students and faculty.

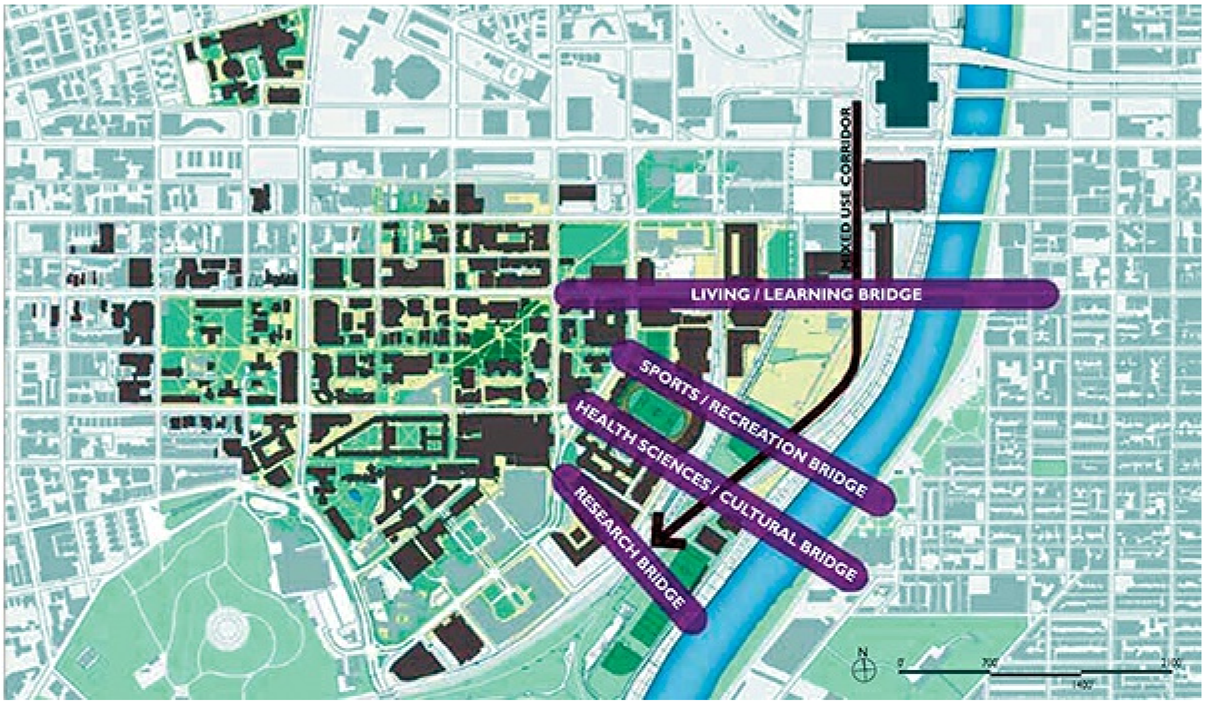
37.67 Tsinghua Research Park, across from the main gateof Tsinghua University, Beijing.

(Gary Hack)

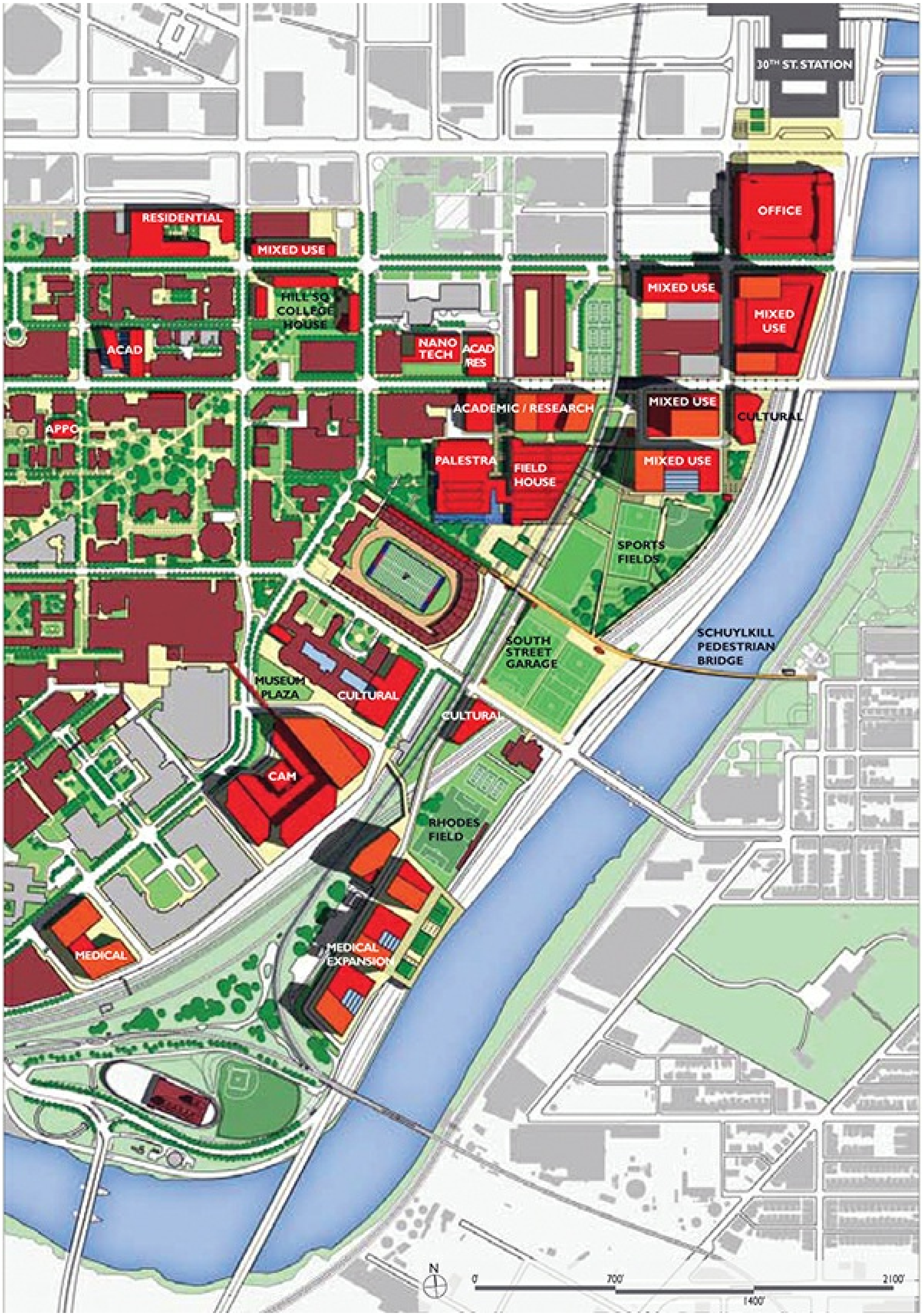
Beginning in 1996, the University of Pennsylvania undertook a major program to improve the conditions in its surroundings, out of both enlightened self-interest and the desire to create opportunities for faculty and businesses to locate nearby. Large parking areas around the perimeter of the campus created a venue for crime and separated members of the university community from the residential neighborhoods where many lived. Using its land bank, the university constructed new commercial, residential, hotel, and office facilities—including a much-needed supermarket, movie theater, and bookstore—as a seam between the campus and the residential areas to its west. Two decades later, the opportunity arose to acquire a large site on the eastern side of the campus, which could fill the half-mile (1 km) gap between the university and the Schuylkill River with its bridges to Center City. The new development plan, Penn Connects, proposed four corridors to link across this site. A portion of the land was devoted to recreation spaces for the university that will be connected to the city by a new pedestrian bridge across the river. Street-level linkages will create new sites for university research spaces, a new hotel, and private office and research space. The projects are well on their way to completion.

Creating a supportive community environment is not only an urban issue. To be competitive, universities in outlying areas also need to be surrounded by opportunities for shopping, living, and connecting with the wider world. In 2004, the Universiti Teknologi Petronas completed a new campus at Seri Iskandar, Perak, Malaysia. This extraordinary campus sits in splendid isolation. As a leading institute for petrochemical engineering, it creates a natural attraction for private corporations to locate nearby, suggesting considerable opportunities for meetings and places of contact between the campus and the surrounding areas. The university's plan for making these connections involves creating a hub at the intersection of the educational and research sites, and an environment that will attract highly skilled graduates to remain near the campus.

Hybrid educational and commercial centers are likely to multiply in the future. They are a recognition that learning and practice are closely linked, and that a rich environment for socialization is a hot spot for ideas.



37.68 Major linkages proposed between the University of Pennsylvania campus and Center City Philadelphia.
(Sasaki Associates/University of Pennsylvania)


30TH ST. STATION
OFFICE
RESIDENTIAL
MIXED USE
MIXED USE
MIXED USE
HILL SQ COLLEGE HOUSE
ACAD
NANO TECH
ACAD RES
ACADEMIC / RESEARCH
MIXED USE
CULTURAL
APPO
PALESTRA
FIELD HOUSE
MIXED USE
SPORTS FIELDS
SOUTH STREET GARAGE
SCHUYLKILL PEDESTRIAN BRIDGE
MUSEUM PLAZA
CULTURAL
CULTURAL
CAM
RHODES FIELD
MEDICAL
MEDICAL EXPANSION
N
0'
700'
1400'
2100'

37.69 Plan of future development along Schuylkill River, University of Pennsylvania.
(Courtesy of Sasaki Associates/University of Pennsylvania)

37.70 Walnut Street corridor connecting the university and Center City, Philadelphia.
(Courtesy of Sasaki Associates /University of Pennsylvania)

7.71 Site plan for development of the university and adjacent research and commercial facilities, Universiti Teknologi Petronas, Seri Iskandar, Perak, Malaysia.
(Courtesy of Sasaki Associates)

37.72 Aerial view of proposed campus hub, Universiti Teknologi Petronas.
(Courtesy of Sasaki Associates)

38 | Public Spaces

Public spaces are the stages for human contact in cities. They are at once places to gather, see, and be seen, and places to rest, get away from crowds, and enjoy the views of the city. They take many forms: plazas, squares, pocket parks, large public gathering spaces, promenades, overlooks, or other spaces open to all. Human contact, of course, also occurs on streets, particularly in the pedestrian zones of cities, as we have noted in chapter 24, and in public recreation areas that have been dealt with more fully in chapter 36. In this chapter we take note of landscapes that make for good urban spaces.

Programs for urban public spaces vary greatly. The largest public spaces have symbolic and ceremonial purposes, such as Tiananmen Square in Beijing, the National Mall in Washington, or City Hall Plaza in Boston. Every urban area should have at least one space that can accommodate thousands of local residents, to celebrate local teams winning championships, hear the president speak, or host a local festival. These spaces run the danger of appearing empty between large events, and their landscape needs to be attractive even when not filled with people. Smaller public spaces may be principally designed to elevate the status of large public or private buildings, such as the plazas at Chicago's or San Francisco's civic centers or the Seagram Building in New York, Equitable Building in Chicago, and the ground-level public space at Hong Kong's HSBC Building. Or they may be consciously designed as a stage for public life, like Place Georges-Pompidou in Paris and Rockefeller Center in New York. They may offer a respite from the intensity of the surrounding city, as does Bryant Park in New York and the public spaces of Tokyo Midtown. Or they may be a quiet sanctuary to be discovered on a side street, like Paley Park in New York, Paul Revere Mall in Boston's North

End, or any number of small piazzas in Venice or Rome. Some spaces become accidental places, designed for one purpose but appropriated for others, like the grand staircase at the Piazza di Spagna in Rome, which becomes an amphitheater in the summer for watching the crowds, or the steps at New York's Public Library or Vancouver's Courthouse, filled with people seated on a sunny day. The key to successful design of public spaces is deciding upon an imaginative program from the outset, while leaving room for the space to be discovered by others and used as people desire.

38.1 Pioneer Square, Portland Oregon.
(Andy Hamilton/Pedestrian and Bicycle Information Center)

38.2 Boston Calling Music Festival 2013, City Hall Plaza, Boston.
(Emma-Jean Weinstein/WBUR)

38.3 Equitable Building Plaza, Chicago.
(Gary Hack)

38.4 Place Georges-Pompidou, Paris.
(© Paris Tourist Office/Amélie Dupont)

38.5 Sitting in the sun, Bryant Park, New York City.
(Gary Hack)

38.6 The waterfall, Paley Park, New York City.
(Courtesy of Jack Carman/Design for Generations LLC)

38.7 People watching, Spanish Steps, Rome.
(Gary Hack)

Successful Public Spaces

Public spaces are easily drawn on a site plan, but ensuring that they work as intended is another matter. The smart planner will also look locally for examples of spaces that are successful and draw conclusions about what contributes to their success. Project for Public Spaces, which has evaluated thousands of public spaces throughout the world, has concluded that

successful spaces have four key qualities: they are accessible; people are engaged in activities there; the space is comfortable and has a good image; and they are sociable places (Project for Public Spaces 2009). When creating public spaces, the planner needs to attend to several factors.

Dimensions

Public spaces need to be large enough to preserve social distances, to avoid being appropriated by individuals or groups whose presence discourages others from entering them. As we have noted, the zone of social space typically extends 3–4 m (10–13 ft) outward from individuals standing or seated. At a distance of 20–25 m (65–80 ft) it becomes impossible for most people to read the facial expression of another individual (Gehl and Gemzøe 1996), so one becomes anonymous. Intermediate zones within larger spaces, with dimensions that range from 6 m (20 ft) to 25 m (80 ft), can be "public" while promoting social exchange.

Most successful public squares are no larger than 70–100 m (230–330 ft) in their small dimension (Gehl and Gemzøe 1996), although in high-density areas of China, activity can be sustained over an area twice that size. Much depends, of course, on the range of activities included. Copley Square in Boston was for many years considered a barren concrete wasteland, but after redevelopment with green lawns, sidewalk cafés, shaded seating areas, and fountains, it has become one of Boston's most popular spaces and is filled with people.

38.8 Copley Square before reconstruction, Boston.
(Gary Hack)

38.9 Fountains added to Copley Square, attracting passersby.
(Gary Hack)

Flows and Eddies

The best public spaces are usually along a well-traveled route. The route may travel through the space or along its edge, with spaces for activities off the beaten path. The flow of pedestrians delivers candidates for activities in the space, while providing an assurance that others are passing by. A useful analogy is to imagine a public space as a river, with areas of flow bordered by eddies. Eddies need to be in scale with the flows. The most difficult public spaces have no flows—dead-end brackish pools that stagnate for lack of casual visitors.

It is also important to get the dimensions of the flow channels right. A

narrow channel leading to a space lined with construction workers eating lunch may deter women from entering a space. A walkway through a space may be too narrow to allow people to stop and talk, or take advantage of the opportunities along it. While it may not be possible to limit the people entering a space, it is essential to provide adequate social distance at the entrances and along its main routes.

38.10 Eddies along walkway, Copley Square.
(Gary Hack)

Sun

In temperate climates, the presence of sun is the most important determinant of where pedestrians will perch. Sitting in the sun is a popular

pastime in its own right, and the presence of good sunlight extends the active season of public spaces by months into the spring and fall. Even a slight slope will increase the sun exposure of an area. Strategically placed walls that store the warmth or reflecting surfaces that warm the air can extend the seasons even further. Sunlight can always be shaded if it is too warm, but there is no real substitute if it is absent. As a result, north-facing public spaces (in the Northern Hemisphere) are seldom as successful as those that face south. San Francisco prohibits new buildings that would reduce the sunlight falling on public spaces to less than two hours during the middle of the day.

In hot, sunny climates, shade is the condition being sought. The cafés in Piazza San Marco, Venice, charge dearly for seats under an umbrella, while in Mexico seats beneath great trees in the Zócalo are at a premium. Awnings that can be extended or retracted as the sun arcs across the sky are a splendid solution, allowing sun to warm the early morning and evening while protecting those seated during the heat of midday. It is always useful to plot the pattern of sun and shadows from surrounding buildings in deciding on the locations for activities in a space. Public spaces that include performance venues need to be sensitive to the sun direction in afternoon and evening, to avoid having the audience blinded by direct sun.

Triangulation

Regular users of a space may have no difficulty in greeting those they know or striking up a conversation with them. Casual users are unlikely to do so. Objects and activities in a space often provide the excuse for contact, however fleeting. A fountain that draws children into its pool will also draw their mothers together at the edge, and may encourage eye contact and a few words between them. The Crown Fountain at Chicago’s

Millennium Park is a virtual magnet, drawing children to the game of anticipating when they will be showered by water, with parents watching on the sidelines. This process of *triangulation*—using objects to bring people together—is a time-honored technique for creating sociable spaces (Whyte 1980).

38.11 Sunning on the lawn, Victoria Public Library, Melbourne, Australia.
(Gary Hack)

38.12 Crown Fountain, Millennium Park, Chicago.
(Gary Hack)

Watching other people is often the best form of triangulation. A group of elderly men locked in a game of bocce (or boules) will undoubtedly draw a knot of casual observers, who will discuss strategy and second-guess the competitors. Chess tables unfailingly attract wannabe chess masters. A clutch of spectators will generally form at the margins of a pickup game of basketball or handball. Street musicians, human sculptures, ballroom dancers, or amateur magicians unfailingly draw a circle of viewers, trading smiles, comments, or embarrassment that they have stopped to watch. Allowing spaces to be animated spontaneously, or by audition (as one must in heavily populated places), provides the excuse for pedestrians to stop, experience, and make contact with others.

38.13 Sardine Family Circus performing at Fisherman's Wharf, San Francisco.
(© BrokenSphere/Wikimedia Commons)

38.14 Food concessions such as Shake Shack in Madison Square Park, New York City, add life to public spaces.
(Courtesy of Madison Square Park Conservancy)

38.15 Restoring the farmers' market to Market Square, Pittsburgh.
(John Altdorfer/Klavon Design Associates, Inc.)

The common denominator of the most successful public spaces is the presence of food. It can take many forms from formal to casual: sidewalk cafés spilling out into the space, pavilions selling food taken to nearby tables, vendors with their carts, hawkers selling treats they carry with them, and the growing number of farm stands that arrive in public spaces on particular days of the week. Introducing food has been the preferred strategy for attracting pedestrians into once-dead public spaces in New York City. At Bryant Park, a sidewalk café and concessions provide eyes on the adjacent green space. Long lines form every lunch hour, rain or shine, at the Shake Shack, a modern-day hamburger stand in Madison Square Park. At Paley Park, a small sidewalk café provides enough life to

draw pedestrians into the quiet confines of the tiny jewel of a space, dominated by its water wall. In indoor public spaces, such as the bamboo forest atrium at the IBM Building in New York, a snack bar provides the excuse to linger with friends, just a few feet from the busy sidewalks.

Public spaces that double as farmers' markets, flea markets, or flower markets change their character through the course of the week. Often this is a way to assure that large spaces are inhabited during hours when they would otherwise be empty, as at Market Square in Pittsburgh or the Grand Place in Brussels. In Bangkok, many large plazas at the base of tall office structures undergo a transformation every evening. Large mobile kitchens, food displays, and tables with chairs are moved into the space after business hours, converting the stiff formal spaces into lively outdoor dining places. By morning, the space is again cleared, cleaned, and ready for the onslaught of businessmen.

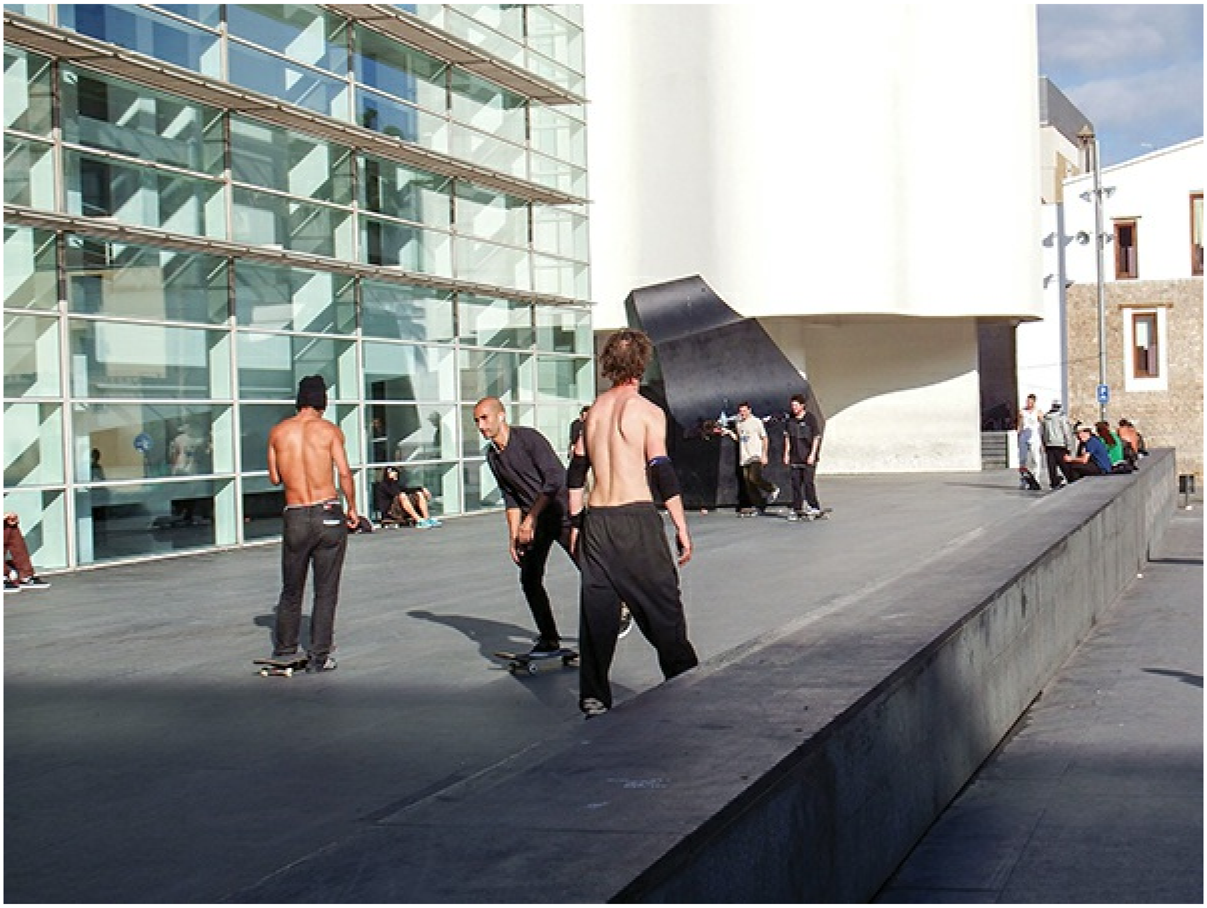
Social Activities

Where or when there is a favorable climate, public spaces can become the outdoor living room of the city. People go to them to meet friends and converse, but they may also serve as the settings for informal or organized events. Public spaces in China are the setting for tai chi gatherings in the early morning, walking the birds later in the morning, card playing and petty gambling in the afternoon, and ballroom dancing in the evening. Large dancing clubs with their distinctive T-shirts often claim public plazas on weekends and evenings, much to the dismay of their neighbors who wish that the music would be dialed down. In good weather, tables for table tennis may be set up and used on a first come–first served basis. Large public spaces will inevitably draw children and adults practicing their kite flying skills and showing off their flyers. All of these activities help create and maintain social ties in the community, and should be

encouraged.

Other activities may not be universally welcome. Teenagers are attracted to public spaces that have steps and walls and seating that will provide a challenging skateboard course; it helps to have places for their friends to perch as they show off. Such activities are hard on surfaces and generally drive others out of the space. The solution, as we have noted in chapter 36, is to create custom-designed skateboard parks. Hawkers can also be a nuisance, invading the privacy of those enjoying the public space or occupying valuable ground space with their wares. Creating a marketplace just off the main space may solve this.

38.16 Ballroom dancing, neighborhood square, Suzhou, China.
(Gary Hack)



38.17 Skateboarders, MACBA Plaza, Barcelona.
(Gary Hack)

Festivals and Spectacles

Regular and programmed festivals are a sure way to attract residents and visitors to public spaces, and spaces need to be designed to accommodate them. These events are also a way to showcase the special activities of the city and to bring residents and interest groups together to meet and converse. Most cities have outdoor art fairs, European cities host Christmas markets, a regular stream of summer concerts occur in public squares in North American cities, and no Mexican Zócalo would be

legitimate without its bandstand. Ferris wheels and carnival rides have become the fashion du jour in city squares, providing light and life in evening hours as well as the day. But the smaller, ever-changing events are at least as important: children’s festivals, antique auto meets, postage stamp fairs, fashion shows, local musical performances, and more.

Many of these events require infrastructure that includes electrical power, water, washrooms, and waste disposal facilities. Temporary cables and lines are dangerous; it is far better to design for events at the time the public space is being planned. Stages for performances can easily be set up and removed for a single event, using modular framing and fabric, but if performances are to be continuous they need to be incorporated into the design of the space. Stage lighting and sound systems can then be integrated into the space, and backstage and storage facilities provided.

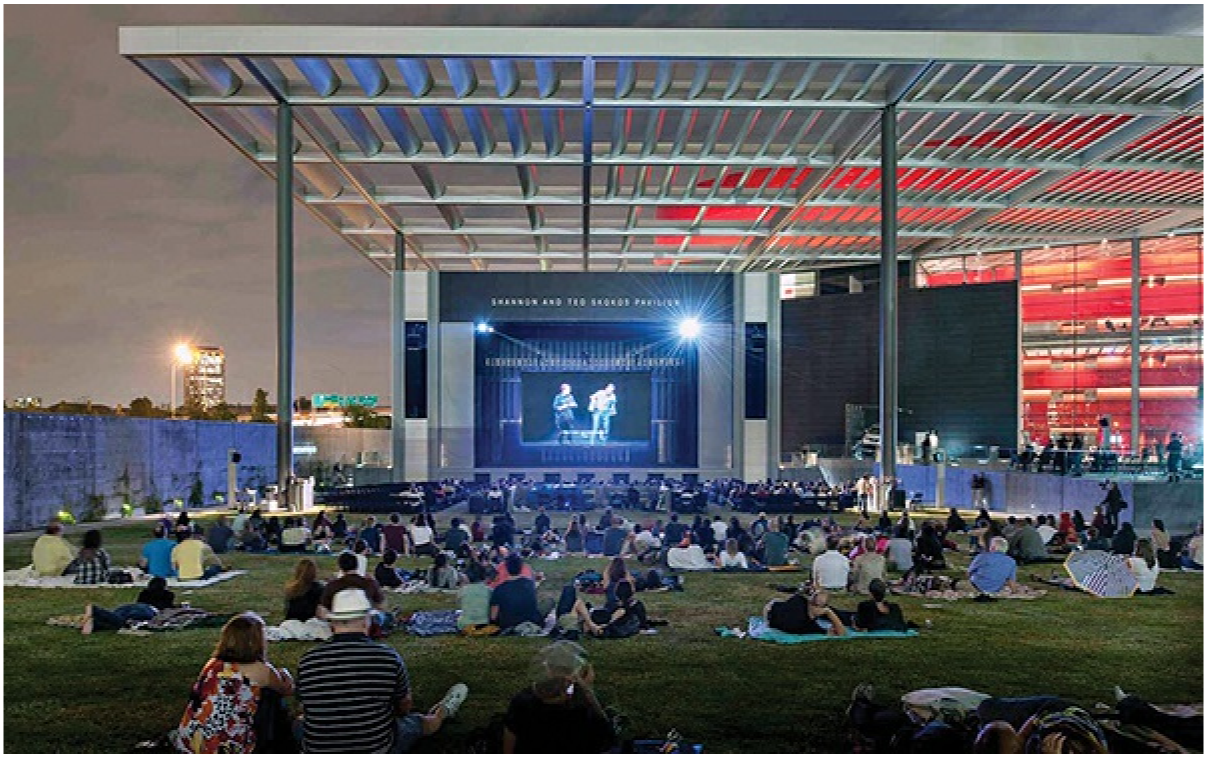
Bordering Uses

Occasional events will bring people to a public space, but spaces that depend on programming may be empty much of the time. Great public spaces draw their energy from their surroundings. The buildings and uses surrounding a historic space such as Piazza San Marco in Venice are integral with the public space. Arcades lined with shops provide cool walkways for window shopping, restaurants spill out into the square, and crowds compete with pigeons for the large remaining central spaces. The busiest retail districts in Asia provide a seam between public and private spaces. Even in the tiniest spaces, cafés can convert a dead sidewalk into a living room.

38.18 Dam at night, Amsterdam.
(Jax Stumpes)

38.19 Outdoor concert, New Bedford, Massachusetts.
(Courtesy of New Bedford Whaling Museum)

38.20 Performers, Plaça de Catalunya, Barcelona.
(Courtesy of Masha Kubysina)



38.21 Performance space, Dallas Arts Square, Dallas, Texas.
(© Nigel Young/Courtesy of Foster + Partners)

Public spaces should be thought about in terms of three zones: the outer edge of the space that is capable of being expropriated by bordering uses during parts of the day and evening (sidewalk sales, cafés, extensions of sales area); portions of the space that are dedicated to particular groups (farmers’ market, booksellers stalls, children’s play area); and portions that should remain flexible and capable of hosting changeable events, performances, and spectacles. Imagining a public space as a stage for activities will help planners avoid designing forlorn spaces claimed by nobody.

Security

In many societies security in public spaces is taken for granted, and there are long traditions of sharing parks and pedestrian areas with diverse groups of people. A casual gendarme on foot may be all that is needed as a symbol of order, prodding street people to move along, stopping sidewalk hawkers from appropriating too much space, and dispersing a rowdy crowd late at night. However, the growth of drug use in public, random acts of violence or terrorism widely reported in the media, and a growing presence of homelessness has forced a new emphasis on security. Particularly in North America, where use of public space is less ritualized, many people are reluctant to enter spaces where they are unsure who and what they will encounter.

There are a number of strategies to make spaces hospitable. One is to act proactively to ensure that the homeless do not appropriate plazas and open spaces. Creating homeless shelters elsewhere, staffing them with street workers who are skilled at encouraging the homeless to move to shelters, and if necessary creating local laws that prohibit homeless from sleeping on sidewalks and public spaces are moves that have proved effective. (They are also essential in cold climates where homeless run the risk of danger from exposure.) A second move is to design public spaces so that they are visible from surrounding sidewalks and lit at night, enabling pedestrians to see the occupants before entering. Sightlines into public spaces also allow them to be patrolled more easily by security officers. The addition of activities and food outlets, as we have noted, can also attract an unthreatening population to the space, even after dark. Finally, security cameras may be installed so that the space can be monitored, and security personnel dispatched to threatening spots. Such monitoring raises thorny issues of privacy; at a minimum pedestrians should be informed that they

are being monitored when they enter a space. Most public spaces are now being monitored remotely, warnings or no. And it is possible to turn the tables by showing what is being seen on the security cameras to those in the space, much as New Year's Eve celebrants in Times Square are shown on the space's Jumbotrons.

38.22 Piazza San Marco, Venice.
(Gary Hack)

38.23 Pedestrian street, Causeway Bay, Hong Kong.
(Gary Hack)

38.24 Corner sidewalk café, Torino, Italy.
(Gary Hack)

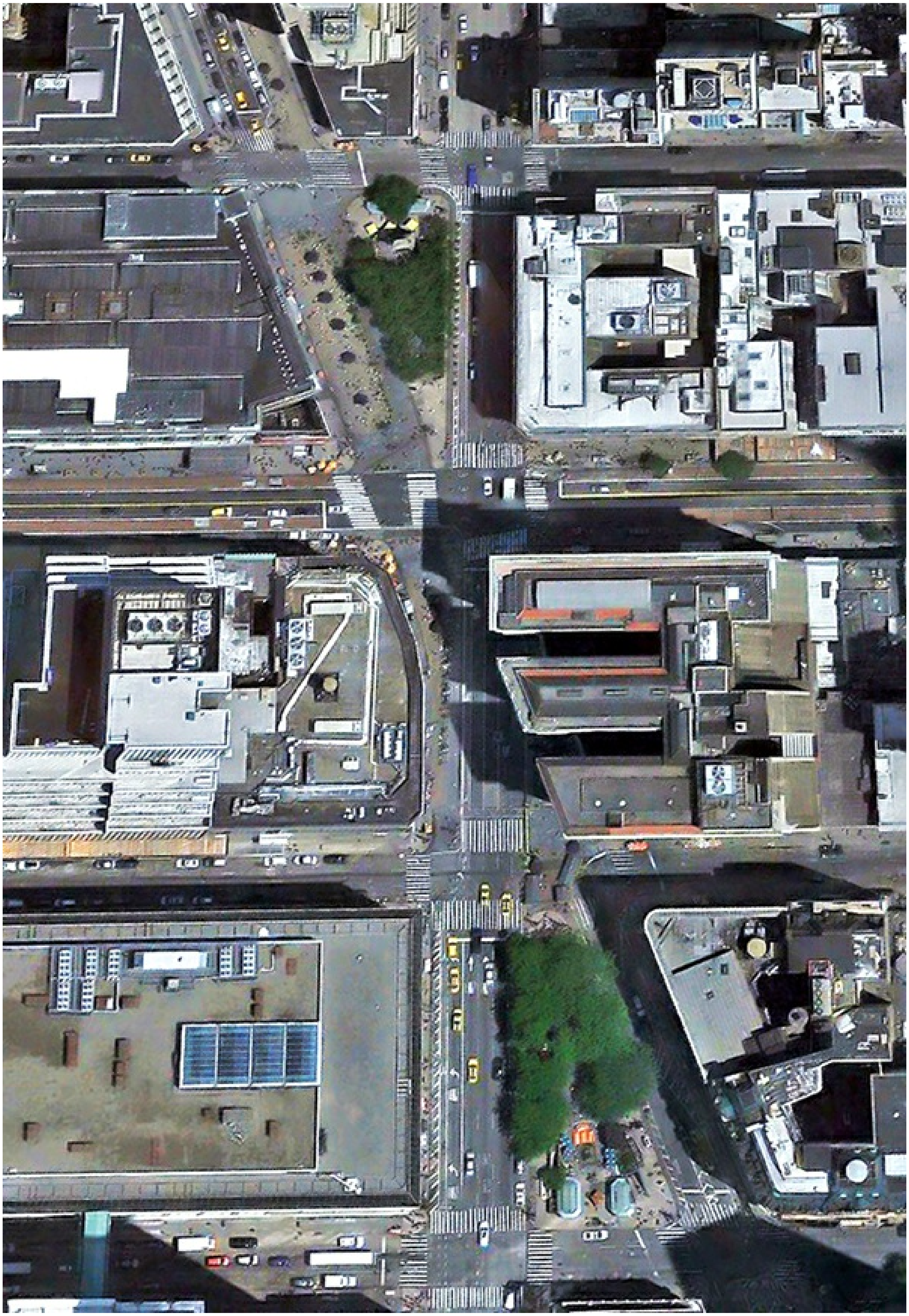
38.25 Security barriers, Wall Street area, New York City.
(Courtesy of Marvel Architects)

Another dimension of security currently needing attention, unfortunately, is ensuring that buildings and crowds are safe from those who would harm them with explosives or other threats. Buildings of high symbolic importance are obvious targets, as are governmental offices, courts, embassies, stock exchanges, markets, and other places where large crowds may gather. Creating barriers to keep vehicles out of public spaces or away from buildings is an essential measure, although many important structures are located directly on sidewalks and only human monitoring is practical. Innovative security barriers need not be oppressive; they can function as seating for pedestrians while protecting against vehicles, they can retract below the pavement when not needed, or they may be integrated into the landscape as at the Washington Monument. All of these measures only protect against the most obvious threats; ultimately the only real security protection is vigilance by those occupying spaces and maintaining public order in cities.

Local Public Spaces

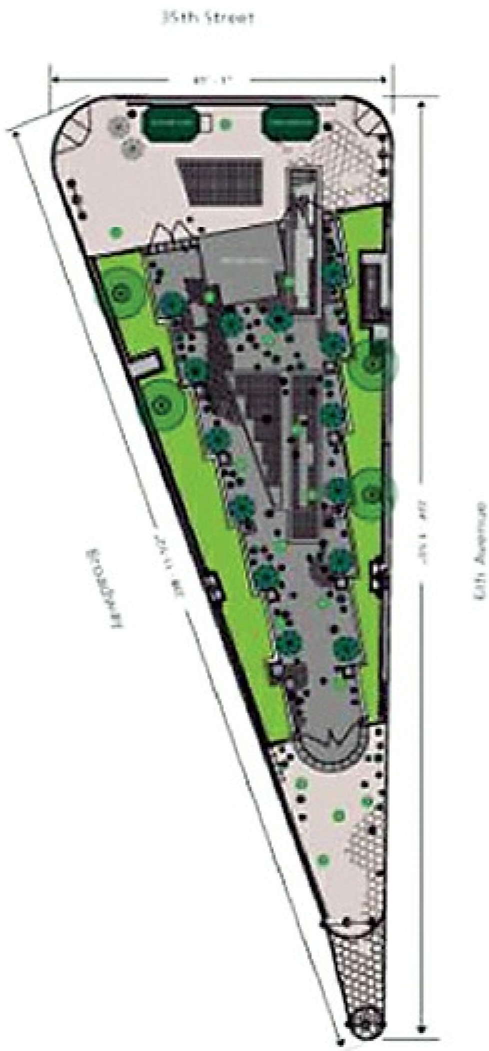
Spaces set in neighborhoods or local commercial districts help anchor the identity of an area, while connecting people through casual contact. They can be as small as a tiny square with a few benches, or as large as Philadelphia’s four squares that give its center city neighborhoods their names. They can be green spaces, as in Savannah’s graceful residential squares, or paved areas as in many of Barcelona’s residential plazas. There are many choices, but all that are successful exhibit the key qualities noted above—they are accessible, attract activities, are comfortable, and support socialization. When they are successful they become an important third place in the lives of residents, complementing their homes (first place) and places of work (second place) (Oldenburg 1989).

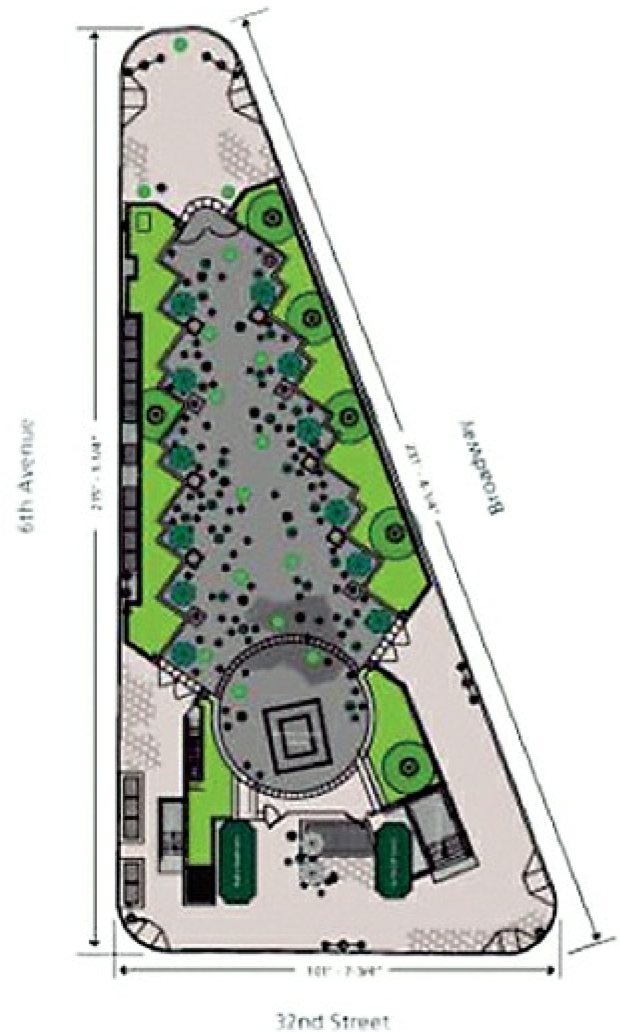
Herald and Greeley Square Parks are two lush triangular miniparks in New York City, each 200 by 100 ft (60 by 30 m) created on lands that had been traffic islands for almost a century. Their form is very simple: greenery added on the perimeter to create a sense of enclosure, walkways through the center, and eddies between, with parasols and movable tables and chairs that users can group as they desire. Each park has a food concession and two public toilets, a welcome convenience in a city largely devoid of them. Although the parks are small, there is considerable area at their entrances for people to meet or to survey the passing flow. Beyond the parks there are overflow spaces on the streets themselves, where traffic has been put on a diet. These small interventions in creating new public spaces have had an outsized impact on the quality of life in the area surrounded by offices, housing, and the city’s largest department store.



38.26 Aerial view, Herald and Greeley Squares, New York City.
(Google Earth)

Herald Square Park





Greeley Square Park

38.27 Plans, Herald and Greeley Square Parks.
(Stantec)

38.28 Lunch hour at Greeley Square Park.
(Gary Hack)

38.29 A quiet respite in Herald Square Park.
(Gary Hack)

38.30 Food concession and public toilets area, Greeley Square Park.
(Gary Hack)

The many pedestrians in Herald Square assure that the park is filled with people throughout the year. In a different climate and culture, St. Alekseyev Square in Harbin, China is a modest-sized (approx. 60 m or 200 ft square) local public space that anchors its neighborhood and is the center of its public life. The form of the square is very simple—a flat main space, raised 1 m (3 ft) above the surrounding sidewalks, defined by a historic church, a small performance stage, a beer garden (in summer), and landscape lining the street that creates eddies of space for separate activities. The main space is used for all manner of activities, including dancing clubs that practice and perform on many summer evenings. Residents stop to watch and may join in, mimicking the members' movements. Others come to enjoy a beer with friends or alone, meet

neighbors, or make new friends. The eddies of space lining the sidewalk at the perimeter offer places for diverse interests: a traditional music group practicing their pieces, a massage specialist promising instant relief for all manner of aches, dog lovers meeting and showing off their beauties, and a bicycle mechanic tuning up vehicles. In winter, the beer garden is taken down and the square becomes a place for local ice sculptures and children's play in the snow. Residents know they can find others there throughout the year, and it is a true third place for all.

38.31 Entrance, St. Alekseyev Square, Harbin, China.
(Gary Hack)

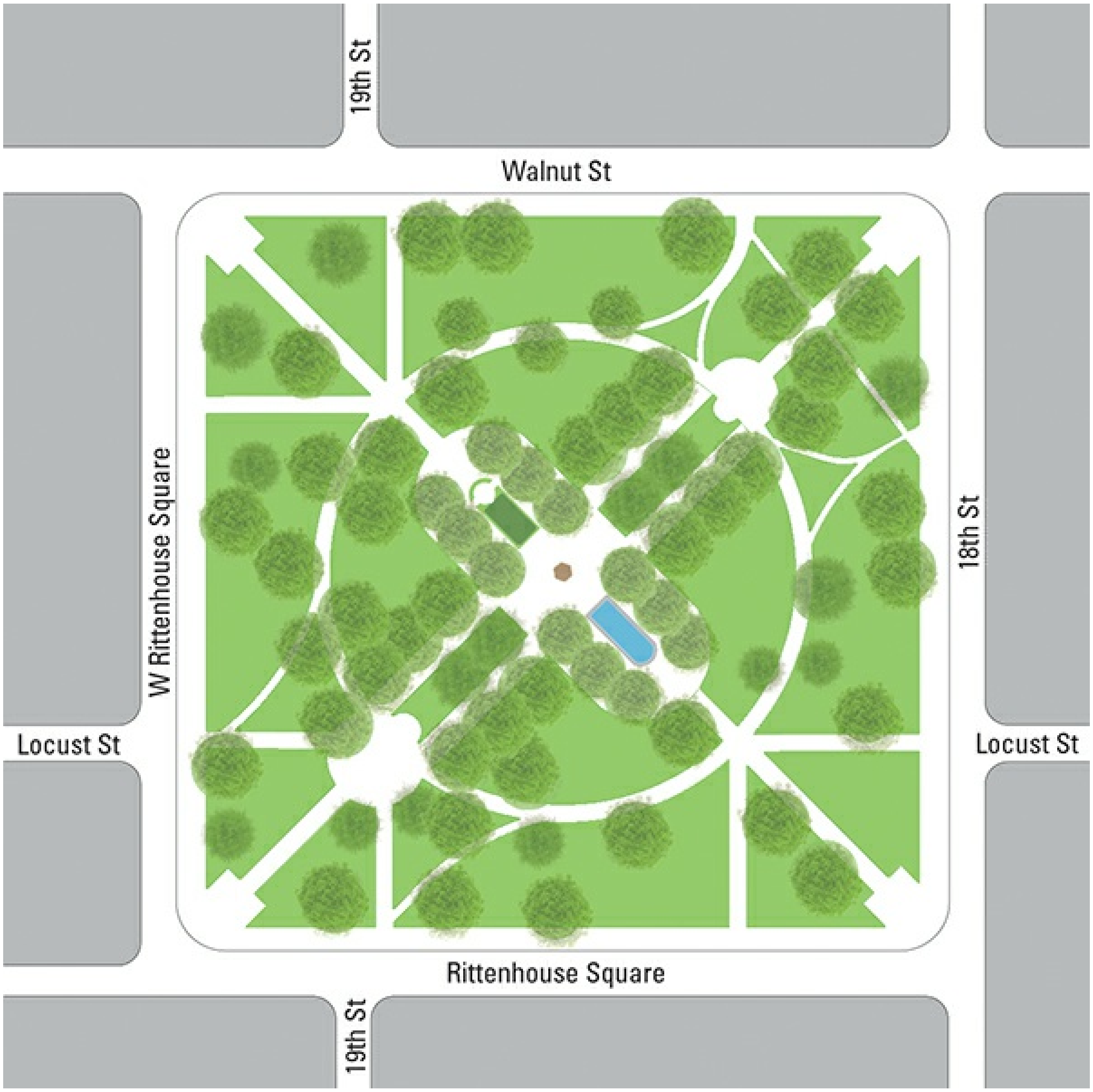
38.32 Aerial view, St. Alekseyev Square, Harbin.
(Google Earth)

38.33 Dancing club, St. Alekseyev Square, Harbin.
(Gary Hack)

38.34 Ballroom dancing at beer garden, St. Alekseyev Square, Harbin.
(Gary Hack)

38.35 Informal music group, St. Alekseyev Square, Harbin.
(Gary Hack)

38.36 Dog admirers, St. Alekseyev Square, Harbin.
(Gary Hack)



38.37 Plan, Rittenhouse Square, Philadelphia.
(Adam Tecza)

38.38 Diagonal walkway, Rittenhouse Square, Philadelphia.
(Jeffrey M. Vinocur/Wikimedia Commons)

Local public squares can offer a respite as well as a setting for activity. Rittenhouse Square in Philadelphia, constructed in the nineteenth century and redesigned by Paul Philippe Cret in 1913, is approximately 475 by 550 ft (145 by 168 m), 6 ac (2.4 ha) in size. The plan is formal: its walkways encourage diagonal movement across the square between the residential neighborhood to the south and the shopping and work environment to the north, and the circular walk lined with benches provides a route within the square to meet and greet others. The tree canopy provides shade in summer and becomes a ceiling of lights during the winter holiday season. Users of the square vary throughout the day and week. Weekdays, residents bring their coffee from the shops surrounding and enjoy a chat with others before heading to work, at noon it is office workers who predominate, filling the

benches, and in evenings families with children congregate in the areas around the fountain and play sculptures. Saturday mornings, market gardeners set up stalls along the Walnut Street sidewalk, and on a sunny weekend day the green lawns are filled with people enjoying the sun or picnicking with families or friends. Rittenhouse Square has been one of the best public spaces in the US for generations, even as the areas around it have changed, bringing new people and activities to its spaces (Jacobs 1992).

38.39 Benches lining the circular walkway, Rittenhouse Square, Philadelphia.
(Gary Hack)

38.40 Sunny spring day, Rittenhouse Square, Philadelphia.
(Mary/Philadelphia Love)

38.41 Nanny goat sculpture, Rittenhouse Square, Philadelphia.
(Boomeresque/Creative Commons)

38.42 Farmers' market on north sidewalk of Rittenhouse Square, Philadelphia.
(Courtesy of Marisa McLellan)

One challenge in creating new public spaces is the lack of routines of use; people are simply not yet familiar with what it has to offer. Exposure can be provided by having a location that draws people through or by the space, but sometimes this is not enough to establish it as a destination. One strategy is to use intensive *activity programming* to get people into and using the space, by creating festivals, events, and special occasions. Harbourfront, on Toronto's waterfront, spent ten years animating its public spaces through events and scheduled activities, inviting people to discover an area that many had never visited. Temporary venues were constructed for these purposes, and over time those that were successful were made permanent. A similar strategy is being used to animate Chavasse Park, the centerpiece of Liverpool's regeneration project, Liverpool One. Its gorgeous open space, undiscovered by local residents, has become a fine venue for concerts and events, using demountable structures to support activities. As more people experience the public space, it should attract return visitors seeking a respite from the dense urban surroundings, or looking for a place to socialize.

Civic Spaces

Civic spaces belong to all. They are the shared provenance of all who have gone before and those who use the spaces today. They go by various names: *civic square*, city or *town square*, *people's (renmin) square*, *piazza*,

plaza mayor, *campo*, *zócalo*, and others, or they are named after the founder of the settlement or its favorite son. They are the place of ceremonies, mass gatherings, and of political protests. We identify cities by the character of their civic spaces.

38.43 Amsterdam street festival, Harbourfront, Toronto.
(Gary Hack)

38.44 Aerial view, Liverpool One and Chavasse Park, Liverpool, UK.
(Courtesy of Grosvenor)

38.45 Outdoor concert, Chavasse Park, Liverpool.
(Courtesy of Grosvenor)

In medieval European towns, the civic space was most often just outside the cathedral, a relationship that was codified in the Laws of the Indies, the instructions that guided the planning of Spanish towns in the new world (Mundigo and Crouch 1977). “The size of the plaza,” the Laws prescribed, “shall be proportioned to the number of inhabitants, taking into consideration … the growth the town may experience. [It] shall be not less than two hundred feet wide and three hundred feet long [60 by 90 m], nor larger than eight hundred feet long and five hundred and thirty feet wide [240 by 160 m].” They thought of the plaza as integral with its surroundings. Article 126 of the Laws of the Indies prescribed:

> In the plaza, no lots shall be assigned to private individuals; instead, they shall be used for the buildings of the church and royal houses and for city use, but shops and houses for the merchants should be built first, to which all the settlers of the town shall contribute, and a moderate tax shall be imposed on goods so that these buildings may be built.

Latin American cities generally remain centered on their plazas, surrounded by the cathedral, government buildings, and markets. During the nineteenth and twentieth centuries, when cities expanded and were rebuilt, the civic square usually fronted the city hall and courthouse or house of justice. In many US cities built during the westward expansion, the house of justice occupied the center of the courthouse square, surrounded by the main businesses of the city and civic buildings.

It is not often that new civic squares are designed, but the design leaves an indelible impression, for better or worse. San Francisco’s Civic Center Plaza, built in 1915 as the centerpiece of the Panama-Pacific Exposition, serves as the venue for festivals, demonstrations, celebrations of sports victories, and everyday use as a passive open space. Its pollarded tree lines complement the neoclassical city hall but also provide shade in summer, and its soft flat surfaces, grass and compacted stone, make it an easy place to set up tables, booths, and other temporary uses.

38.46 Old Town Square, Prague.
(Gary Hack)

38.47 Town square, Vigevano, Italy.
(Gary Hack)

38.48 Plaza Bolívar, Bogotá, Colombia.
(Pedro Szekely/Wikimedia Commons)

38.49 Civic Center Plaza at San Francisco City Hall, San Francisco, California. (Supercarwaar/Wikimedia Commons)

38.50 City Hall Plaza, Boston in 1973, shortly after its completion.
(Ernst Halberstadt/US National Archives)

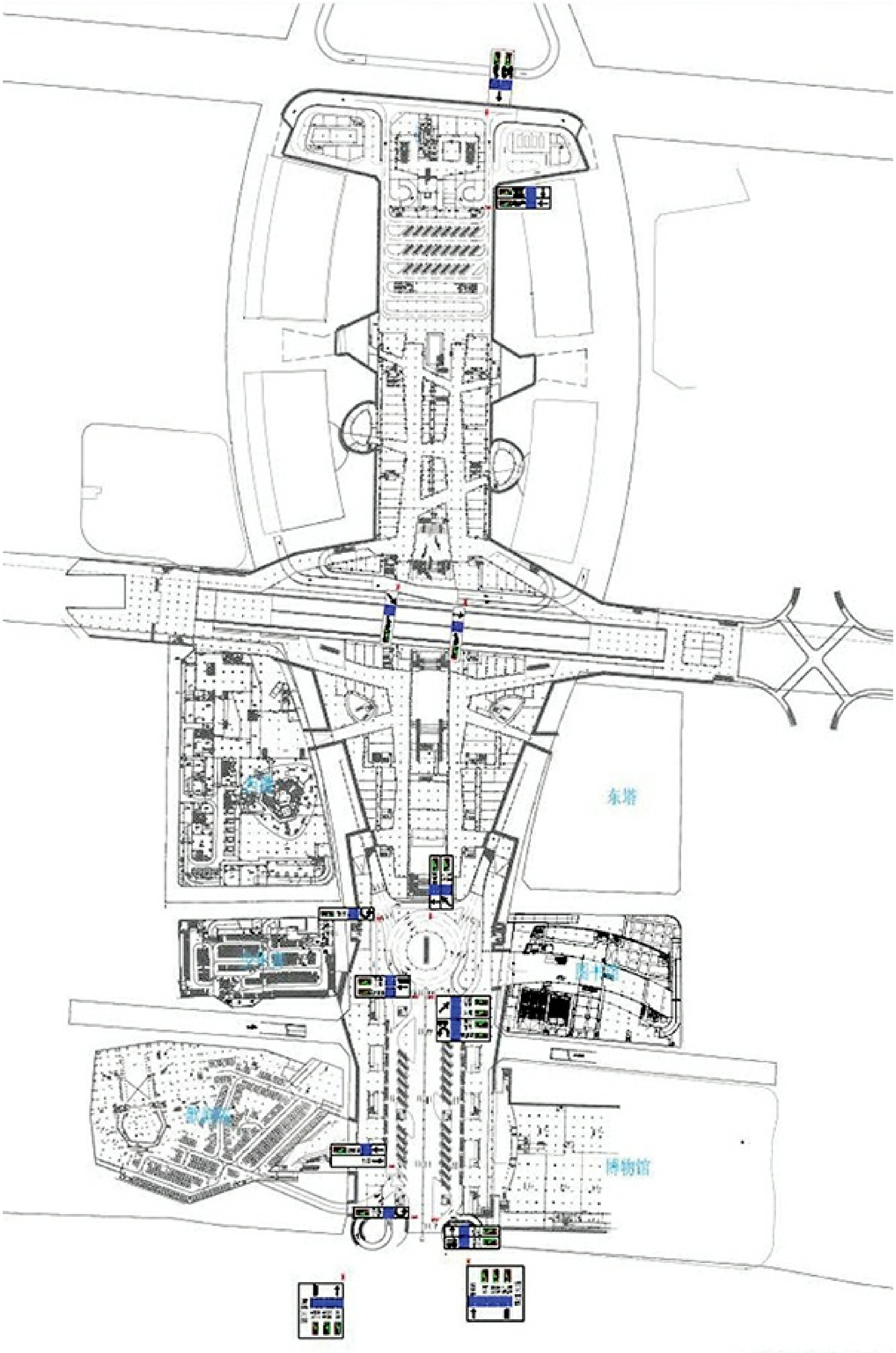
Sidebar 38.1

New central axis, Guangzhou, China

The master plan for Zhujiang New City, of which this is the centerpiece, consists of layers of development, both vertically and horizontally. Hotels and office buildings face directly on the public space, backed up by housing, shops, and additional workplaces. Running below the full length of the plaza is a layer of shopping, parking, and a mass transit shuttle line. Thus, people emerge from below and walk from nearby buildings to enjoy the green space and a regular diet of programmed activities. The central nexus of the public space is a crossroads linking four important cultural facilities—a new public library, a children's science center, the regional museum of art and culture, and the city's new extraordinary opera house. The central portion of the plaza is hard-surfaced and used for programmed activities that include consumer

shows, children's festivals, and special events. Along the waterfront, fountains and mist makers are a welcome antidote to the hot summer days, and at night a choreographed spectacle. Further beyond, a performance stadium and the Guangzhou Tower attract millions of visitors that add to the mix in the central axis.

38.51 New central axis, Shujiang New City, Guangzhou, China.
(Courtesy of OBERMEYER)


东塔
博物馆

38.52 Underground shopping level, central axis, Guangzhou.
(Courtesy of OBERMEYER)

Sidebar 38.1 (continued)

New central axis, Guangzhou, China

38.53 Underground shopping and subway entrance, new central axis, Guangzhou.
(Gary Hack)

38.54 Children’s science center, new central axis, Guangzhou.
(Gary Hack)

38.55 New public library, new central axis, Guangzhou.

(Gary Hack)

38.56 Children skating on ramps to New Opera House, new central axis, Guangzhou.
(Gary Hack)

38.57 Car show, new central axis, Guangzhou.
(Gary Hack)

Boston's City Hall Plaza, on the other hand, is a hard-surfaced, stepped brickyard that has bedeviled the city almost since it was opened in 1968. It is a relentless heat island in summer and windswept cold spot in winter, only coming alive when filled with people celebrating an athletic championship. The most important fault in its plan is that it gains nothing from its surroundings. It is along few people's pathways, and only a small fraction of its perimeter is inhabited by active uses. Over the years there have been various attempts to energize the square—introducing a farmers' market, programming events, setting up dining areas on the edges, among others—but the sheer size of the square, approximately 8 ac (3 ha), has defeated the efforts. It is a cautionary tale about the design of civic spaces.

The new central axis in Guangzhou couldn't be more different. Filled

with people every day, it draws life from its surroundings and demonstrates how successful public space and surrounding development are intimately related. Guangzhou has built its new civic square out of activities that make it a public destination for a broad cross section of residents as well as visitors. It avoids the pitfalls of excessively formal spaces that are largely empty, and if it errs on the side of offering too many distractions, that is a small price for creating an immediate destination.

38.58 In-line skating on the esplanade, Battery Park City,

New York City.
(Gary Hack)

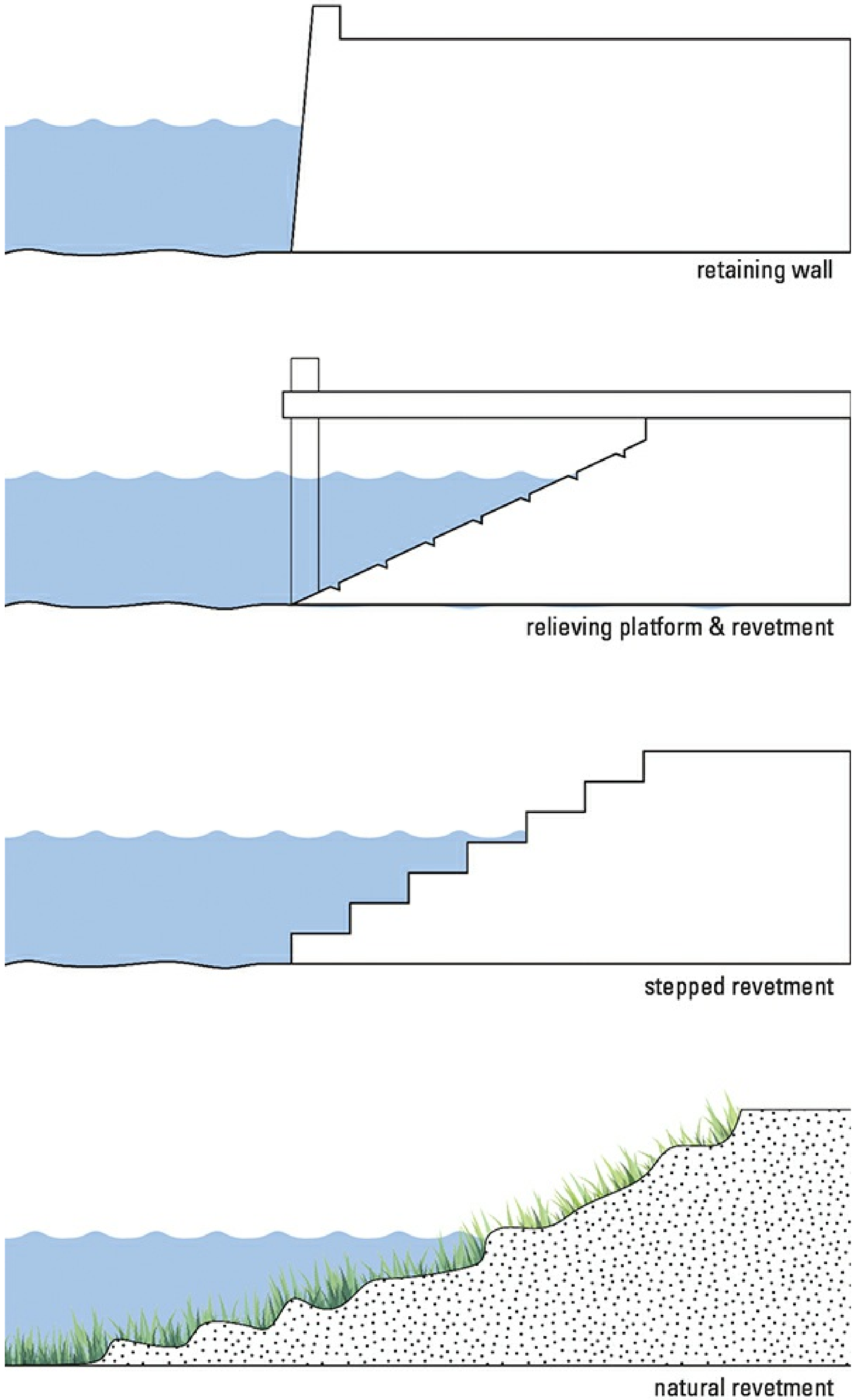
38.59 Canal in 8 Shape Bridge neighborhood, Shaoxing, China.
(Gary Hack)

Waterfronts

Public spaces can be created in many locations in cities, but the water's edge holds a special attraction as a gathering place. It may be along the banks of a creek or river or canal, or at the ocean or lakefront. The magic

of such places is primordial. Water is celebrated in song and verse, heightening its surroundings through reflection and expanding the horizon. Its presence changes the climate, cooling in summer but also sharpening the sting of winter. Being at the water's edge offers a glimpse of a workaday world of waterborne commerce and fishing, and in favorable seasons access to boating and recreation. Cities have seized upon their waterfront resources to create unique places to gather and get away from everyday routines. In other cases, waterways are part of the natural movement systems.

Creating public spaces on the water poses several problems. How to secure the water's edge against erosion, flooding, and the longer-term threat of sea level rise? How to reconcile water-based commercial uses and the desire of waterfront residents for exclusive use of the edge with the desire for public access? How to maintain an area that is heavily used and bears the brunt of storms and seasonal changes of temperature? These and other issues create the challenges, but the potential benefits of well-planned waterfronts far outweigh them.


retaining wall
relieving platform & revetment
stepped revetment
natural revetment

38.60 Alternatives for the water's edge.
(Adam Tecza/Gary Hack)

38.61 Hardened edge along the Seine river quay, Paris.
(Gary Hack)

38.62 Stepped coastal protection at low tide, Margate, UK.
(Acabashi/Wikimedia Commons)

38.63 Coastline protection, Brooklyn Bridge Park, New York.

(© Elizabeth Felicella/Esto/Michael Van Valkenbergh Associates)

38.64 Natural edge, Southeast False Creek Waterfront, Vancouver, Canada.

(Courtesy of PWL Partnership Landscape Architects, Inc.)

38.65 Walkways at stream's edge, Riverwalk, San Antonio, Texas.
(Gary Hack)

The first decision that must be made is the form of the interface between land and water. There are many options that include retaining walls of concrete, stone, or sheet piling, relieving platforms, stepped revetments, and natural revetments. The technology chosen will depend upon the space available, variation in water levels, danger of storms, resources, and desire to get pedestrians down to the water level. There are many advantages to natural revetments, including their support of marine and aquatic plant life in the intertidal zone. Sloped revetments are especially suited to river edges, since they allow the capacity of the river to expand considerably to accommodate seasonal surges in volume. Maintaining a stable water level is difficult, except where watercourses have been tamed with water control gates or diversion conduits, but it offers the opportunity for intimate

contact with water, with minimal danger. The Riverwalk in San Antonio, Texas is made possible by a massive underground tunnel that diverts floodwaters around the calm stream in the center of the city.

Public spaces along the water's edge should be sized to meet expected flows, although overly wide promenades will feel empty most of the time if they are dimensioned for peak crowds. A walkway of 3 m (10 ft) will comfortably accommodate two couples meeting, but the width will need to be increased if bicycles or in-line skaters share the path. Added to this will need to be space to stop to enjoy the view or socialize. The Battery Park City esplanade is organized with a fast lane nearest the water and a slow lane a few feet above it lined with benches, which seems a good response for a heavily used public space. Where massive numbers crowd the esplanade on weekends, as along the Bund in Shanghai or at the edge of the lake in the Suzhou Industrial Park, 15–20 m (50–65 ft) may be the necessary dimension.

The experience is heightened when people are able to get as near as possible to the water. Sometimes there is only a narrow ribbon of land available, but there remain several options. With some creativity, it may be possible to create a continuous walkway by extending the path around bridge abutments and other impediments, as Pittsburgh has done on its riverfront. Or a walkway may be constructed directly over the water, as in the Schuylkill River Walkway in Philadelphia. Floating structures may also be constructed along the waterfront, an especially good solution where there are tides that alter the water elevation. Copenhagen's floating swimming pool and deck structure is a delightful example.

38.66 Walkway along Jin Ji Lake, Suzhou Industrial Park, Suzhou, China.
(Gary Hack)

38.67 Allegheny Riverfront Park walkway, Pittsburgh, Pennsylvania.

(Courtesy of Michael Van Valkenburgh Associates)

38.68 Schuylkill River Trail, Philadelphia.

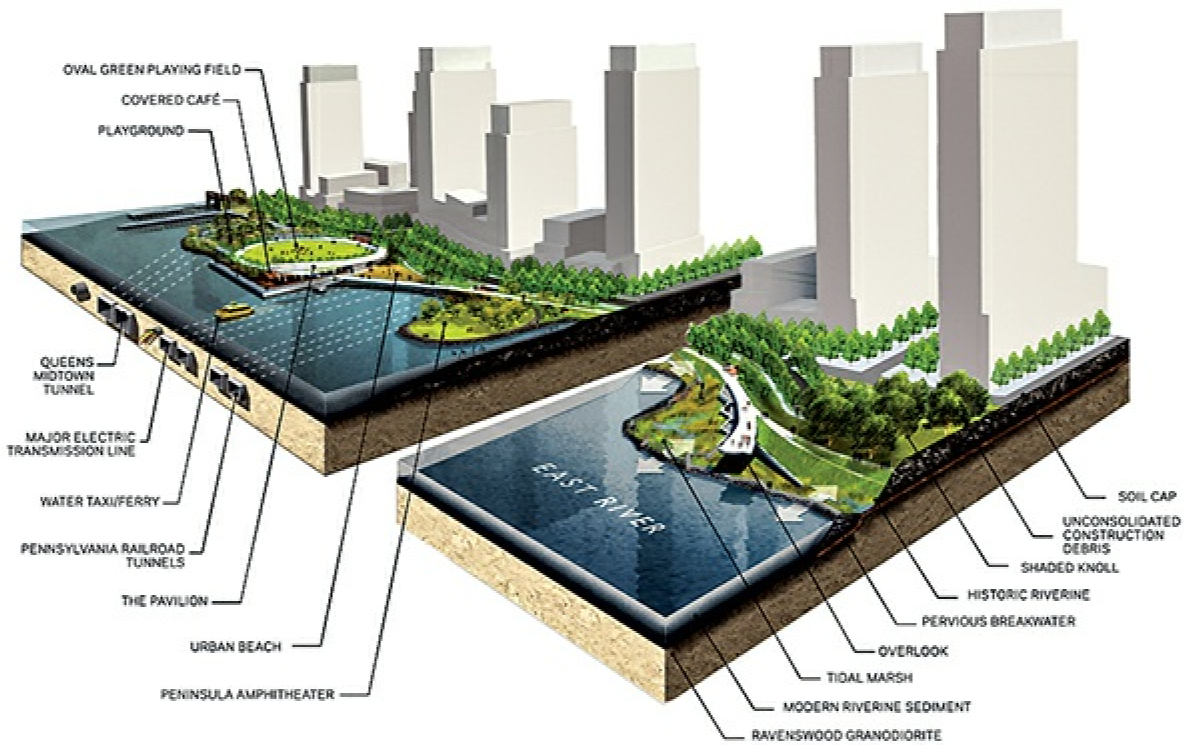
(Courtesy of Lane Fike/Schuylkill River Development Corporation)

38.69 Floating swimming pool, Copenhagen, Denmark.

(Courtesy of © BIG—Bjarke Ingels Group/Julien de Smedt photo)

The real potential of a waterfront public space is realized when activities are joined with sensitive treatment of the water's edge. Among the best recent examples is Hunter's Point South Park in Queens, New York. Constructed over multiple tunnels and sensitive conduits under the East River, the park needed to tread lightly on the land, largely respecting the existing water edge profile. Much of the site had been used for loading from barges to rail cars, and the design of its new life retained memories of earlier times. The park has large lawns for gathering and casual picnicking, children's playgrounds, seating areas, and lush areas for horticulture. Threaded through the upland area of the park is a continuous gabion wall that protects the adjacent housing areas from storm surges, a strategy that

proved its worth during Hurricane Sandy, shortly after the park was inaugurated. This waterfront gem is the public commons of Queens' rapidly developing new urban neighborhoods.



38.70 Complex relationships to natural and manmade elements, Hunter's Point South Park, Queens, New York.
(Courtesy of Thomas Balsley Associates/WEISS/MANFREDI/ARUP)

38.71 Plan, Hunter's Point South Park.
(Courtesy of Thomas Balsley Associates/WEISS/MANFREDI/ARUP)

38.72 Central green, Hunter's Point South Park.
(Gary Hack)

38.73 Remnants of railroad tracks incorporated in park, Hunter's Point South Park.
(Gary Hack)

38.74 Gabion wall providing flood protection to park, Hunter’s Point South Park.
(Gary Hack)

39 | Mixed-Use Development

Cities that grow organically have a rich texture of activities, mixing residences with commercial spaces, workplaces, cultural facilities, education, and even production activities. On a single block of West 67th Street in New York—one of the most desirable places in the city, stretching between Central Park and the Lincoln Center cultural facilities—may be found exclusive residences overlooking the park, loft apartments for artists and actors, fine restaurants, a boutique, a residential college, a production center for a television company, and ordinary apartments for a wide variety of residents. This variation is sought by many people, and not only in dense urban centers. Older residential areas undergoing revival invariably include restaurants, recreation centers, shops, institutions, and schools within easy walking range of a variety of housing choices. Neighborhoods with *walkable commercial areas* typically are more valued than those that require automobiles (Hack 2013). There are long traditions of living above the shop that date to preindustrial times, and rows of *shop houses* continue to line the streets of Hangzhou, Guangzhou, Singapore, Taipei, Bangkok, and other Asian cities, many now converted to tourism districts. Behind them are alleyways filled with restaurants, convenience shops, and local services—and new apartments towering over them. These streets and alleys provide the fabric for vibrant 24-hour neighborhoods.

39.1 Mixed uses along 67th Street, New York City.
(Gary Hack)

39.2 Italian Village, now a restaurant and entertainment district, Tianjin, China.
(Gary Hack)

39.3 Shop house district, Hangzhou, China.
(Gary Hack)

39.4 Mixed-use commercial complex, Jiang Jing SOHO, Beijing, China.
(SOHO)

39.5 City Center mixed-use area, Las Vegas, Nevada.
(Jahn Architects)

39.6 Mixed-use downtown, Kentlands Town Center, Gaithersburg, Maryland.
(Gary Hack)

Nonetheless, a large proportion of new development, especially in the US, involves only a single use. The separation of uses is mostly the result of development regulations and the organization of the development industry that tends to specialize in *product lines*. Zoning in the US restricts the types of uses that can be located on sites, particularly in residential districts. In other countries like Japan and Taiwan this rigid differentiation does not exist, since development regulations focus on building form, not uses, a strategy that is the basis for recent US form-based codes (see chapter 15). Christopher Leinberger has identified 19 standard real estate product types that are conventions in the US development industry, including: the build-to-suit office, the office park, medical office buildings,

grocery-anchored neighborhood centers, the budget motel, garden apartments, and other familiar types (Leinberger 2008). Developers know how to finance and build these uses, and may have *prototypical plans* they adapt to each new site. Residential developers tend to stick to their knitting, and developers who build commercial or office projects rarely venture into the world of residential real estate. The sources of construction and permanent financing are also different, as are the brokers selling or leasing space in completed buildings. Mixing uses is a challenge that requires working across boundaries in both design and development practices.

The virtues of mixing uses are being rediscovered in dozens of *new urbanist town centers* in the US, urban complexes in Japan and China, and urban redevelopment projects in Europe. Among the US examples is City Center in Las Vegas, which demonstrates that mixing uses vertically as well as horizontally can result in a higher-density commercial center that attracts residents as well as visitors. The much smaller center at Kentlands, in Gaithersburg, Maryland, also successfully combines shops, restaurants, and housing and is coupled with a larger shopping center beside it. There are physical efficiencies in mixing uses that include sharing expensive parking, marketing advantages in being able to sell not just a unit but a lifestyle, and internal synergies through creating patronage for commercial shops among the residents or workers above or next door. All of these make it worth the effort needed to go against the grain of separate uses.

Planning Principles

Designing effective mixed-use areas requires careful planning of access patterns, parking, and layers of privacy. In most situations, each of the components needs to function independently—commercial areas need to capitalize on the logic of shopping which is to attract passersby, while office and residential areas need strict controls over access for privacy and security. But the site also needs to harvest the advantages of co-location. This is a delicate balancing act, which requires considerable trial and error.

39.7 Frank Lloyd Wright's innovative live-work building, Price Tower, Bartlesville, Oklahoma.
(Courtesy of Alex Ross)

39.8 An early mixed-use building, Edificio Pluriusi, Rome.
(Norbert Schoenauer)

Horizontal versus Vertical Mixing

Visionary architects have been fascinated by the opportunity of devising *live-work buildings* that break the hegemony of single uses on a site. Frank Lloyd Wright's Price Tower, in Bartlesville, Oklahoma, completed in 1955, is a 19-story tower with offices and housing on each floor. Apartment dwellers have their own elevator that opens directly into each unit, and at least in theory the mix on each floor can be shifted over time to more housing, offices, or other uses. Part of the tower was recently converted to a hotel. A more common pattern is to locate offices below and housing on the upper floors of buildings, where they can benefit from views and return higher sales prices to the developer. Hazelton Lanes in Toronto was one of the first such examples in North America, and the elegant Edificio Pluriusi in Rome with housing over offices became an exemplar in Europe. In San Francisco, Golden Gateway Commons on Davis Street consists of a carpet of two- and three-story housing located over three stories of offices, parking, and shops.

Sidebar 39.1

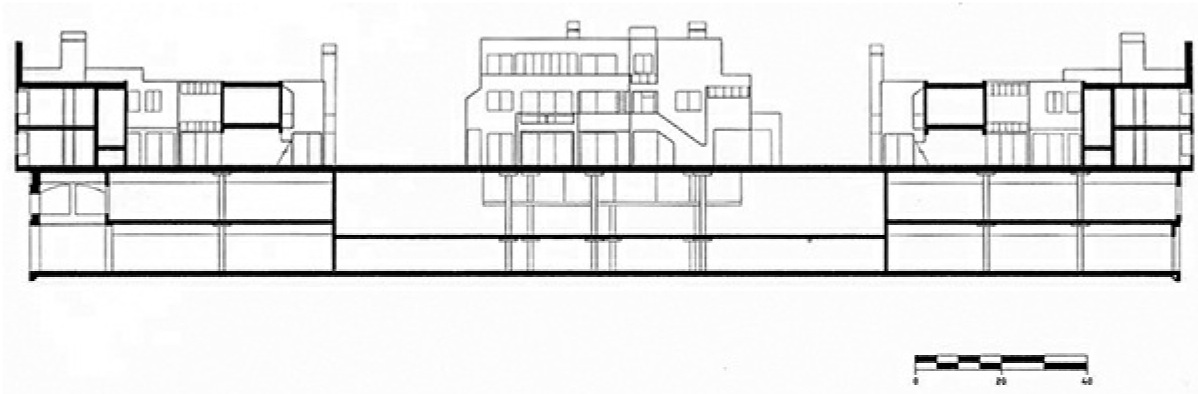
Golden Gateway Commons, San Francisco

Golden Gateway Commons (renamed Embarcadero Square), near the San Francisco waterfront, consists of three blocks with a carpet of housing and open spaces above two levels of retail and office space. A total of 155 condominiums have private and group-private open spaces, and the perimeter of each block is ringed by ground-level retail space and second-level offices, totaling 250,000 sq ft (23,200 m2). Separate elevators are provided for the

office and residential spaces. It is among the most treasured live-work-shop complexes in the city.

Architects: Fisher-Friedman Associates, 1976

39.9 Golden Gateway Commons, San Francisco, aerial view.
(Fisher Friedman Associates/Courtesy of NBBJ)



39.10 Section through structure.
(Fisher Friedman Associates/Courtesy of NBBJ)

39.11 Street-level view.
(Gary Hack)

39.12 View of housing courtyard.
(Gary Hack)

The John Hancock Building in Chicago topped all other *mixed-use buildings* at the time of its construction in 1968. Its 100-story envelope contains vertical slices for shopping, parking, offices, apartments, and other functions. With about 4,000 workers, 1,700 residents, and 4,000 visitors a day, it functions as a vertical city, smoothly transporting people from the ground to sky lobbies for each use, then on a local elevator to their ultimate destination. Only a small number of the residents work in the structure, but the mix adds immeasurably to the life and density of the area. *Vertical mixing* of uses is now the standard formula for supertall buildings, including the Burj Dubai, Jin Mao Tower in Shanghai, and Taipei 101.

One of the key challenges in mixing offices, housing, and other uses vertically is how to reconcile the differences in the preferred *building footprints* of each use. Offices in the US are typically about 45 ft (14 m) deep from elevator core to exterior wall, while it is difficult to design

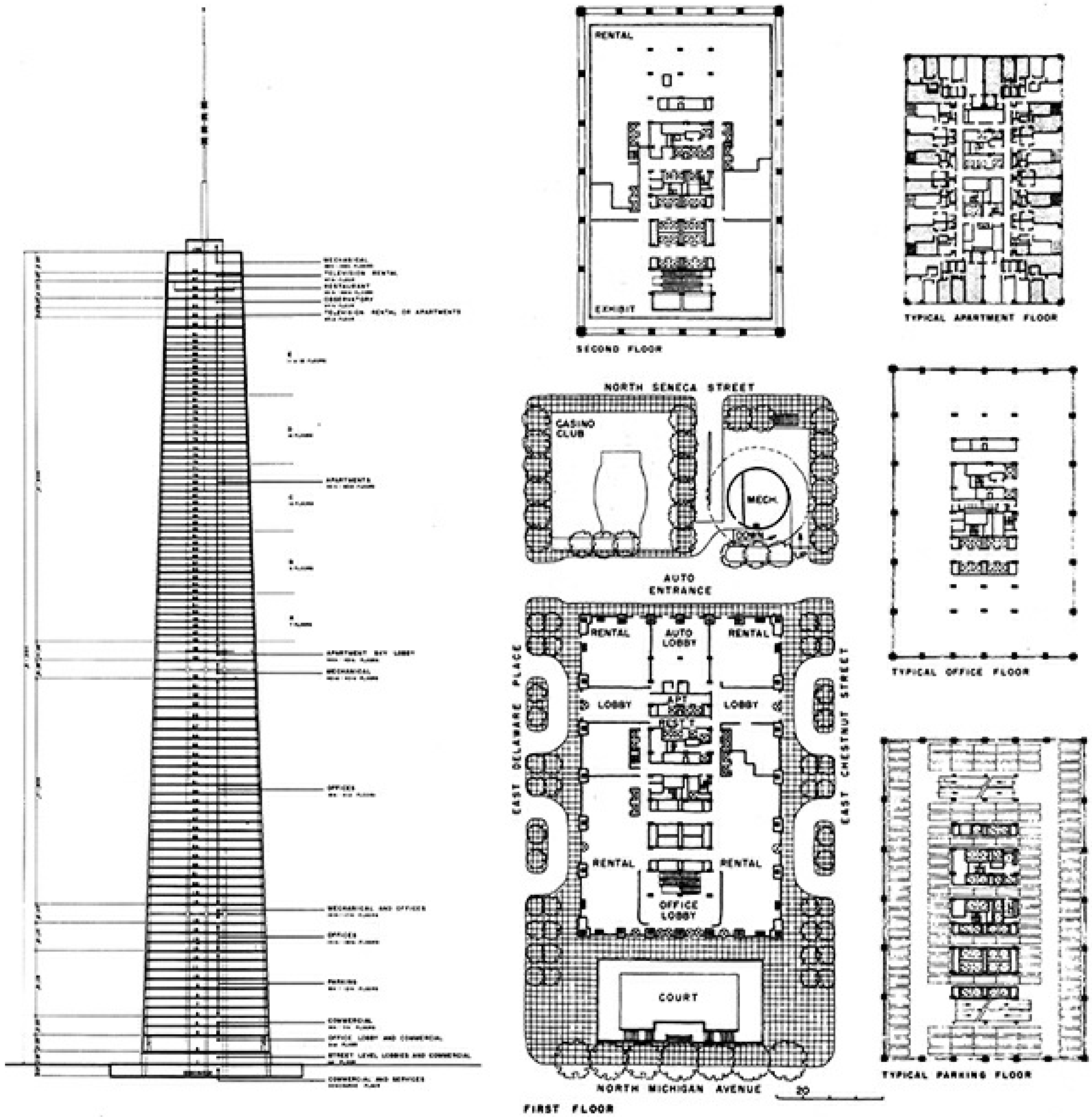
conventional apartments with more than 35 ft (10.5 m) depth and most hotels have a preferred depth of 25–30 ft (7.5–9 m), although suite-style hotels are deeper. There are a variety of strategies for arbitraging these differences. Housing can be stepped back from the line of the offices by inserting balconies, or the structure may be tapered. The John Hancock building tapers from base to top, with the commercial zone at its base measuring 180 by 275 ft (55 by 84 m) and typical apartment floors above only 125 by 210 ft (38 by 64 m). Housing above offices can also be reshaped to yield greater perimeter and provide more views, as has been done in the innovative Heritage on the Garden in Boston. Where hotels are stacked over offices, a successful strategy is to create an atrium in the hotel area, as in the Jin Mao Tower. In European cities, where building codes restrict the depth of offices to 8 to 10 m (26 to 33 ft), apartments fit neatly over office buildings.

Mixing housing and commercial uses in the same structure is quite common in Asia, since there is less devotion to single-use zoning and greater tolerance of sharing elevators and stairways with people in the building for different purposes. Structures may change their use over time, as the district where they are located shifts in its function. A sensible convention has evolved in Taipei: new offices cannot be established above housing. This rule reduces the nuisance of sound transmission from floors above, and the heavy demands on residential elevators by visitors. In Tokyo, where setback planes usually require upper stories to be smaller than lower ones, there is a natural gravitation of housing to the areas above offices, although the great variability in block sizes means that there is considerable mixing of functions on each floor.


BEST BUY

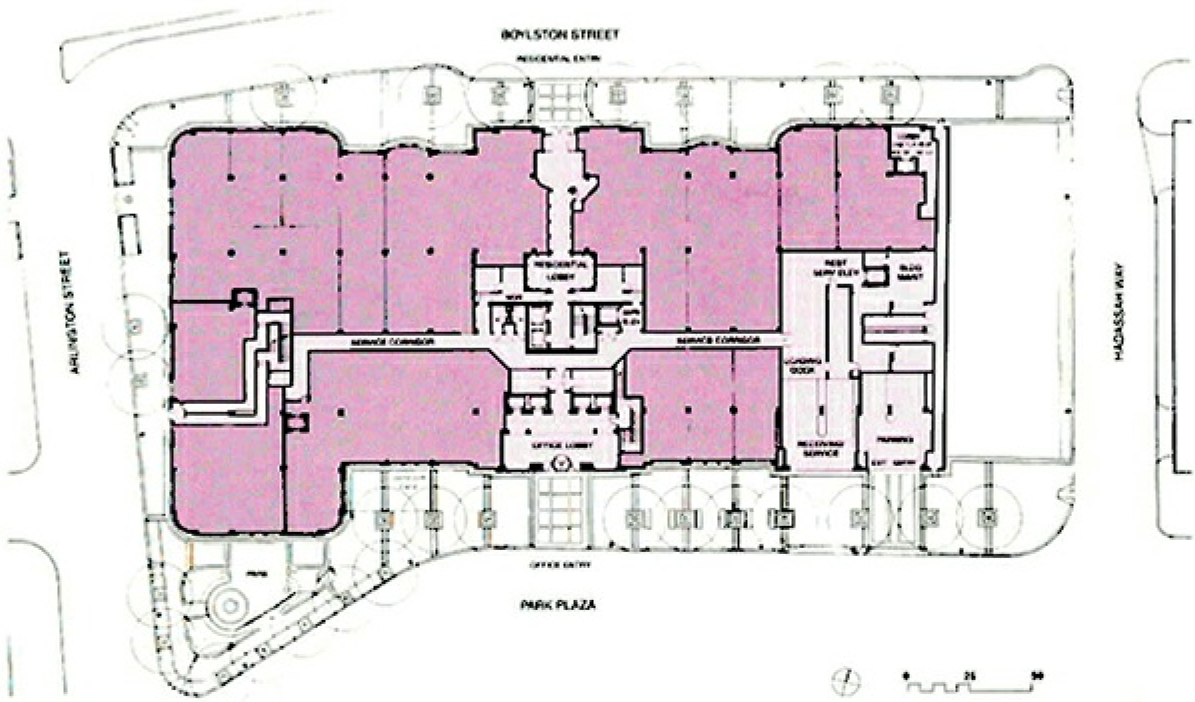
39.13 John Hancock Building, Chicago.
(Courtesy of © Royce Douglas)

Vertical mixing, even in small buildings, requires solutions to a variety of mechanical issues. If housing is over offices or retail uses, sanitary drains need to be consolidated from the many locations in apartments to a few vertical stacks, so the large open areas needed by commercial uses are not interrupted. Similarly, ventilation systems need to be segregated to avoid transmitting odors between the various uses. In very large buildings, this may require dedicating floors as transfer levels. Elevator systems also need to be separated to provide the level of security needed for each use in the building, and to respect the fact that some uses are accessible 24 hours a day while others close down. Elevators to belowground parking typically terminate at the lobbies rather than connecting with residential or office floors, for security reasons.



39.14 John Hancock Building, Chicago, plans and section.
(Oswald Grube)

39.15 Housing stepped back from the larger office footprint below it, Heritage on the Garden, Boston.
(Gary Hack)

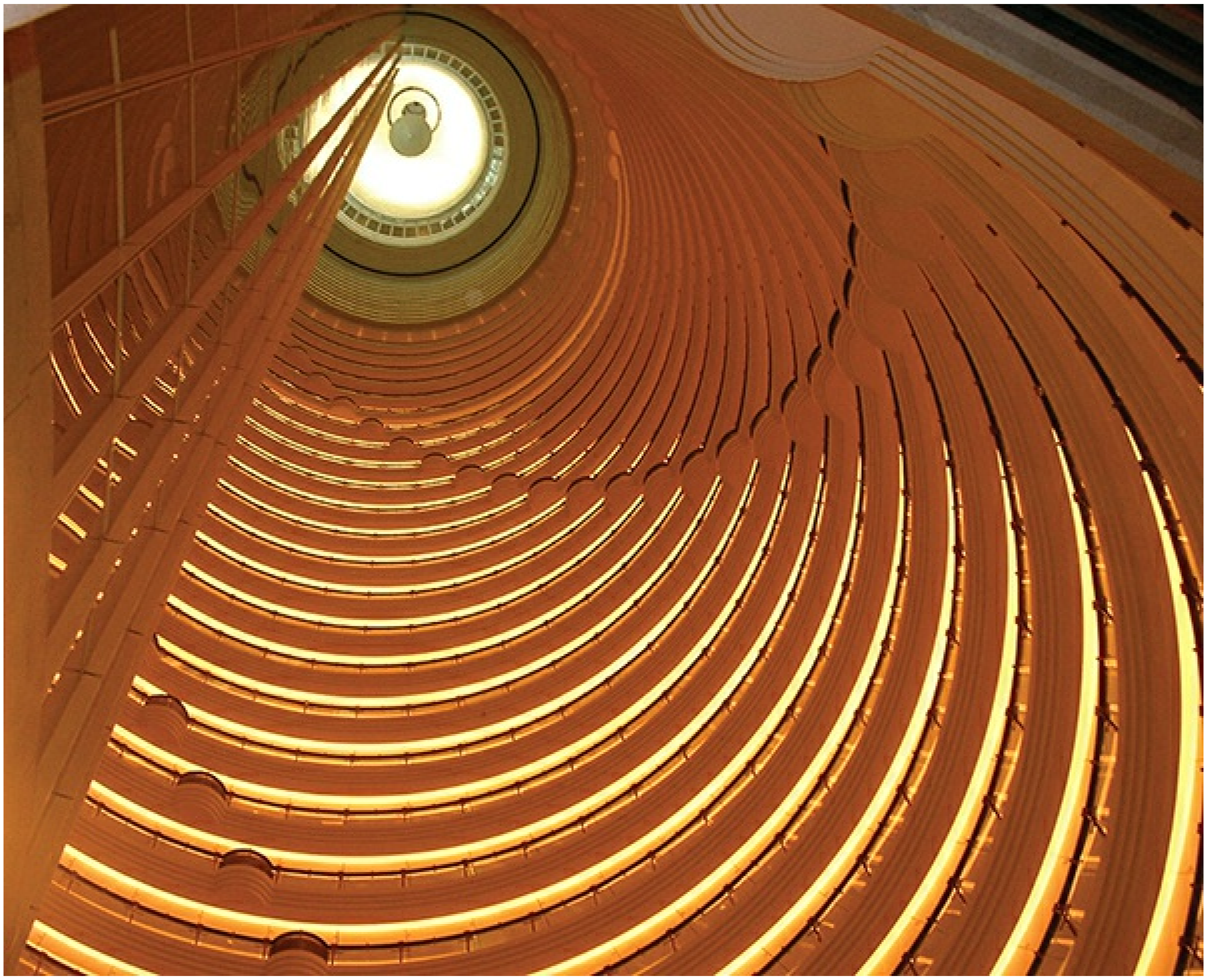


Site Plan

39.16 Dual elevator lobbies approached from opposite sides of Heritage on the Garden, Boston. (The Architects Collaborative)


LIFE
大厦88层观光厅欢迎您

39.17 Offices with hotel above, Jin Mao Tower, Shanghai (on left).
(Gary Hack)



39.18 Atrium in the Grand Hyatt Hotel begins on 40th floor, Jin Mao Tower, Shanghai.
(Lawrence Lavigne/Wikiimedia Commons)

The alternative to vertical integration of uses is sharing a site horizontally. This greatly simplifies the structural and mechanical systems, at least above any common infrastructure, and usually is more cost-effective. It may also allow the development to be more easily phased, if market conditions do not support a continuous construction process. Often a shared parking deck below or above grade will unify the complex, or there may be a 3–4-story *podium* containing shopping, restaurants, and

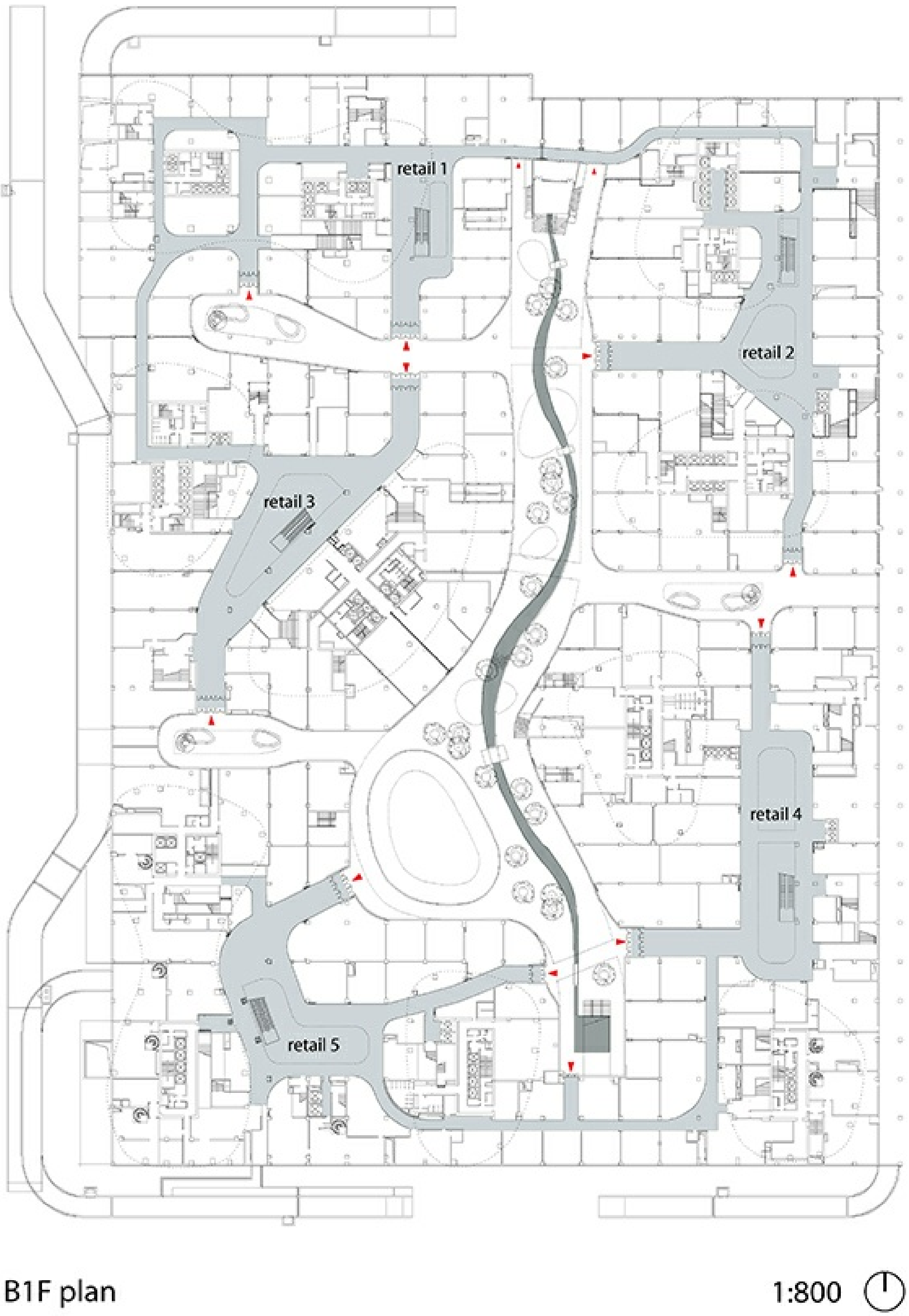
public uses out of which tall towers rise. This formula has become conventional in Hong Kong and other Asian cities, where large blocks can accommodate two or more towers, and there is advantage in creating a network of elevated walkways from block to block. The Sanlitun SOHO complex in Beijing, Union Square in Hong Kong, Sony Center in Berlin, and Prudential Center in Boston are all excellent examples of horizontally separated mixed-use developments with a matrix of retail uses below.

Sidebar 39.2

Sanlitun SOHO, Beijing, China

The Sanlitun SOHO complex, located in one of Beijing's most desirable areas, is a live-work-shopping environment. It consists of five office towers and four residential towers on a foundation of three levels of retail spaces, parking, and service spaces, totaling 465,000 m2 (5 million sq ft). Below-ground shopping covers much of the site, connected visually to the towers by generous open-air atria animated by a skating rink, performance spaces, and casual landscaped areas. The lower two floors of each tower are also devoted to shopping and services. Each tower has a distinct shape, color, and identity, rising to a maximum of 97 m (318 ft) in height. Individual entrances to the towers are located belowground in dedicated parking areas and on ground level.

Site planners: Kengo Kuma & Associates



B1F plan

1:800

► retail public entrance

sanlitun soho
kengo kuma and associates

39.19 Belowground retail space, Sanlitun SOHO, Beijing.
(Courtesy of Kengo Kuma & Associates)

Sanlitun SOHO, Beijing, China

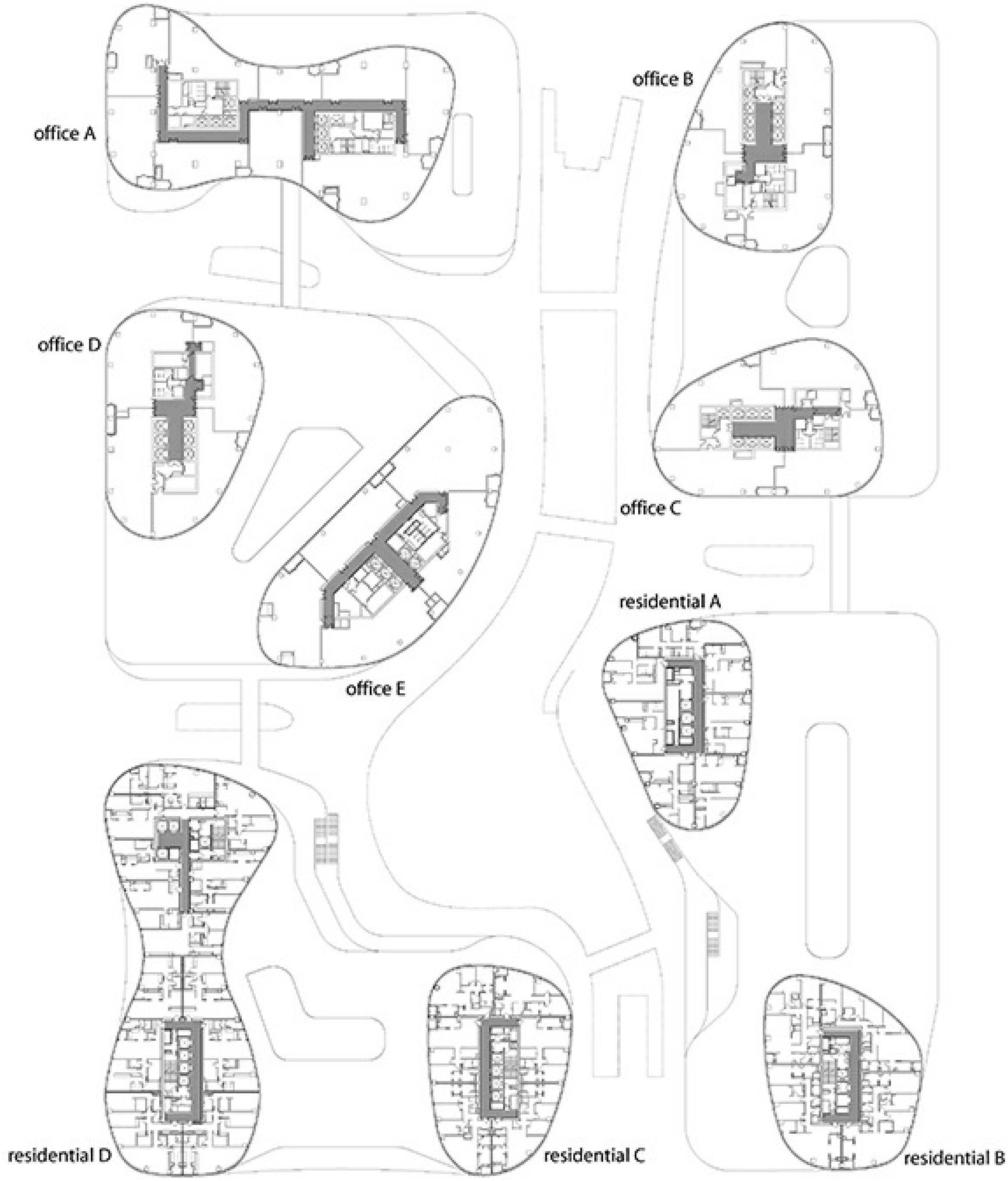
F1 plan

1:800

- retail public entrance
- office lobby entrance
- residential lobby entrance

sanlitun soho
kengo kuma and associates

39.20 Street-level retail space.
(Courtesy of Kengo Kuma & Associates)



office/ residential tower typical floor plan
(above F7)

1:800

sanlitun soho
kengo kuma and associates

39.21

Typical floors of office and retail towers.
(Courtesy of Kengo Kuma & Associates)

39.22

View of central entrance to plaza.
(Gary Hack)

39.23

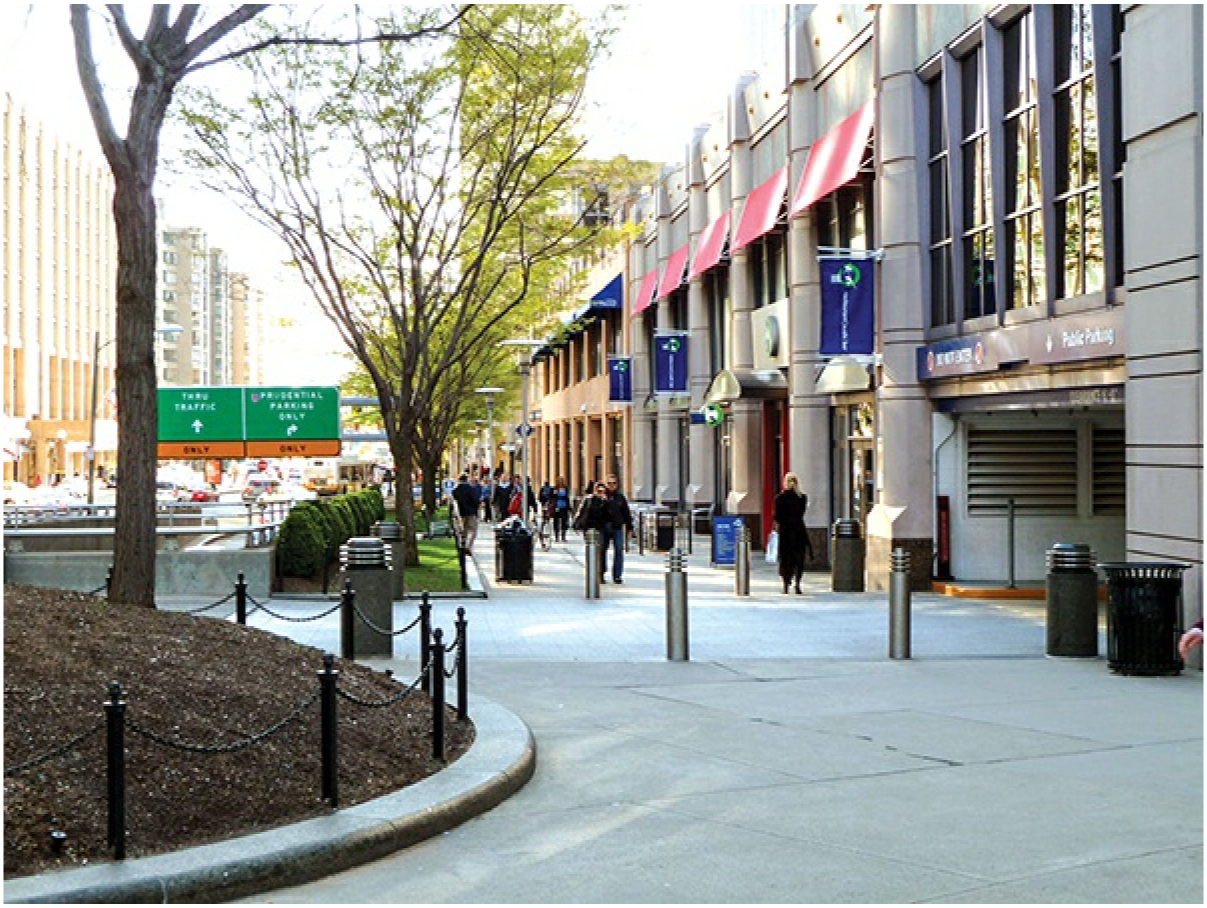
View of lower-level shopping area.
(Gary Hack)

39.24 International Finance Centre, Hong Kong.
(WING/Wikimedia Commons)

39.25 Street view of Sony Center, Berlin, mainly lined by offices.
(Courtesy of © Rainer Viertlbock)

39.26 Residential structure facing inward, Sony Center, Berlin.

(Courtesy of Dirk Verwoerd)



39.27 Residential and office towers with retail spaces below, Prudential Center, Boston. (Gary Hack)

Access

Each use needs its own doorways. Residential buildings and hotels will require drive-up access to each lobby, while in commercial areas it may be more important to limit the number of entrances to key locations along streets and make direct connections with public transit. Most large office buildings also desire independent street-level access, even if their elevator lobbies are on upper levels, in part to allow for security checks of those arriving. Where there is an adequate street dimension, a separate service

road may be warranted, but this should be the exception rather than the rule, since it disrupts the continuity of street-level activities. A better solution is to locate the automobile entrance to housing or hotels on side streets, as is common in New York City. Security issues must be carefully considered so that residents' lobbies and balconies are not accessible to casual visitors; but if there are adjacent commercial areas, residents will undoubtedly wish to have weather-protected access to and from them as well. Solving the flows of people while providing adequate security is the most important access challenge.

Offices and residential uses generally desire separate lobbies and entrances. One solution in mixed-use buildings is to locate lobbies for residences and offices on opposite sides of the building while placing elevator cores back to back. The Heritage on the Garden configuration is an excellent example of how this can be handled (see figure 39.16).

Shared Parking

In dense mixed-use complexes, parking is a costly investment, particularly if located belowground, that needs to be used efficiently. An obvious advantage to combining uses is the prospect of doubling up parking use—as an example, between residents and hotel patrons who need overnight parking, and shoppers and workers who are mainly present in the daytime. But this is often frustrated by the residents' desire to have dedicated parking spaces in a protected area. It is sometimes possible to reserve spaces (say, one space per unit) on the top floor of underground garages for residents, using independent card access, while on other floors combining visitor parking and additional spaces required by residents with areas for shoppers or office workers.

Providing valet parking can also be an effective way to share expensive

garage space. Since cars parked by attendants can be stacked two or three cars deep (or vertically stacked on mechanical lifts), parking needs can be satisfied in less than half the normal amount of space during peak hours. The cost of employing valets will be easily offset by the increased revenues and reduced costs of constructing parking (see chapter 21).

Privacy and Noise

When tall structures are clustered on a site, how far apart should they be to maintain the privacy of uses? There is no single answer, since personal space dimensions vary across cultures, and some uses, particularly housing and hotels, seek higher levels of privacy than others such as offices and retail spaces. Nonetheless, it has become conventional to set as a minimum space between buildings the typical dimensions across city streets, on the grounds that this has become an accepted distance. In most US situations this means spacing structures at least 50–65 ft (15–20 m) apart. Some cities regulate these dimensions: Vancouver requires a minimum distance between structures of 18.3 m (60 ft) if they are on the same block and 24.6 m (80 ft) if they are across a street. Even with this spacing, it may be desirable to orient residential buildings so that they do not directly face their neighbors, or provide privacy screens that limit views.

39.28 Spacing of high-rise towers, North False Creek, Vancouver.
(Gary Hack)

Residents generally prefer quiet environments, particularly during the evening hours, while commercial and entertainment uses often thrive on buzz. Even those residents who may wish to overlook events in spaces on the site may want their bedrooms oriented in quieter directions. At Sony Center in Berlin, where the central space is used for film festivals and performances, living rooms of residential units face on the active space while bedrooms face the opposite direction (see figure 39.26). Separating uses by tolerable noise levels is also possible, with a residential enclave located at a distance from entertainment and performance areas.

Service Areas

Building operators generally prefer having loading docks for each building located near each elevator core, which may be efficient from an operational standpoint but requires a large proportion of the frontage of the site to be devoted to loading areas. If at all possible, it is desirable to consolidate loading docks, which has the added benefit of reducing the total number of bays required. They may be paired for adjacent buildings, or a single large loading area may be created. In some cases, a large project may justify loading materials from large trucks to electric vehicles used to distribute goods to the various cores.

Collection of garbage is another important servicing consideration, particularly where waste materials are separated at their source for recycling. The use of vacuum collection facilities is one solution; another is special-purpose vehicles that can move from floors of buildings directly to storage and loading areas (see chapter 28).

Severability of Uses

Most mixed-use complexes need to be *severable* into a series of separate units for purposes of leasing, financing, and ultimately ownership. At the outset of planning, it is important to think through where the *demising lines* will be, both horizontally and vertically. Who will bear the long-term responsibility for maintaining the open spaces on the site? How will decisions be made on future replacement of heating or air conditioning systems that serve multiple types of tenants or owners? Since uses will change at different rates in the future, issues of access need to be considered. If retail areas need renovation and need to be closed in the future, will this disrupt access routes between public transit and office lobbies or residential areas? There are solutions to each of these issues, and it is unfortunate if planners shy away from a mixed-use complex as a way of avoiding immediate problems.

One approach is to create a condominium or strata title scheme for the uses, clearly distinguishing between shared common spaces and systems and those that are individually controlled. Where there are residential uses or individually owned shops or office spaces, separate condominium entities may be necessary to distribute responsibilities within individual structures. Cross easements are a tested solution for access to or use of service facilities. A complicated formula for assessing (and agreeing on future assessments) may be necessary to avoid future conflicts over costs and arrangements. All of these arrangements need to be planned for from an early stage.

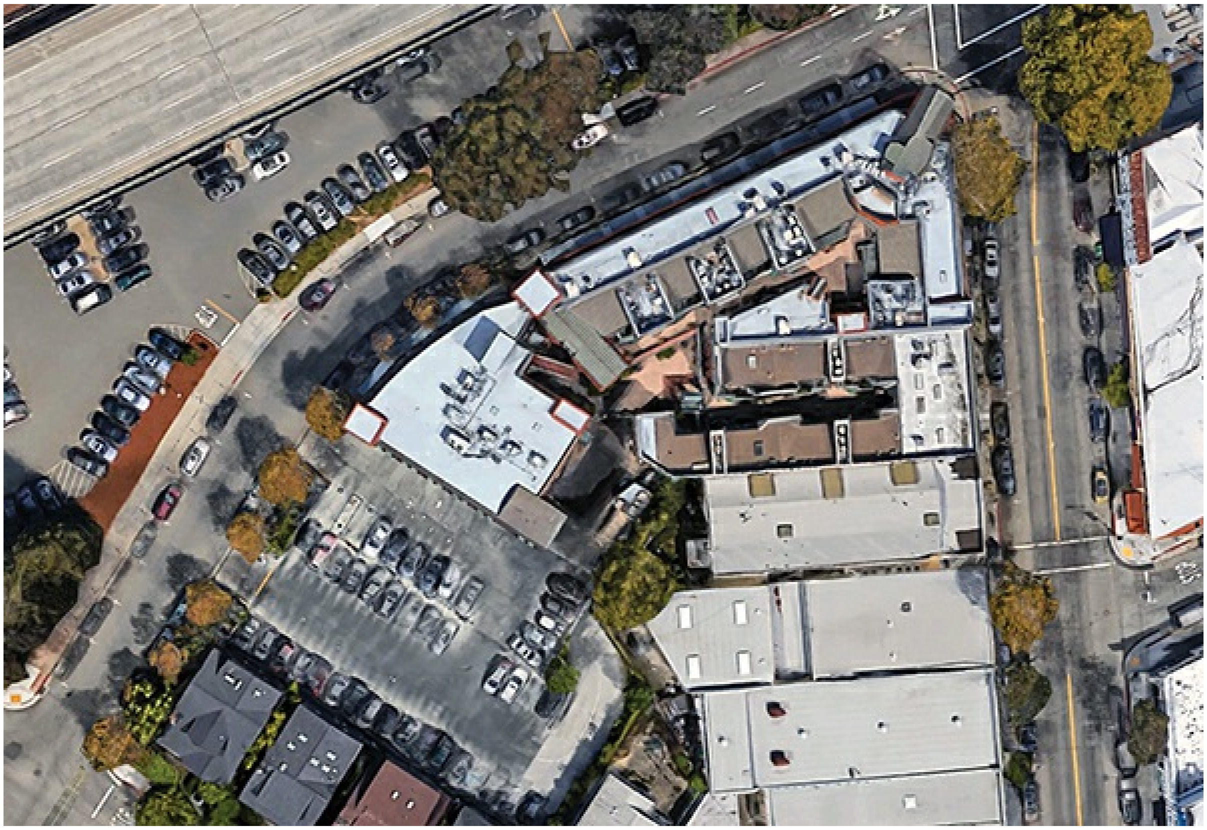
Mixed-Use Prototypes

Single-Building Mixed-Use Projects

Small mixed-use projects can lead the way to neighborhoods becoming active throughout the day and evening. They are especially appropriate as a seam between commercial and residential areas and near public transit stops, where there is a built-in market for commercial uses. Retail areas with shops and housing above existed in most US, Canadian, and European cities half a century ago, particularly along streetcar lines, but many hurdles need to be overcome to reproduce them today, including excessive parking demands of tenants, zoning restrictions, and the fear of adjacent

residential neighbors that they will be impacted by the development. Several examples, however, illustrate how these may be addressed.

The Rockridge Market Hall in Oakland, California is a small mixed-use project (approx. 100,000 sq ft or 9,200 m2) that has been a commercial success and has had a transformative impact on the area around the Rockridge mass transit station. The motivation was a desire to create a market hall for fresh foods and other specialty food outlets that would entice potential shoppers exiting the transit station across the street (Childress 1990). Shops, including a market hall, occupy almost the entire ground floor, served by a common off-street loading area at the rear. With a three-story height limit and an unproved market for housing and offices, the upper floors were designed so that they could be lived in or easily converted to professional offices. Upper-story uses are entered through an outdoor lobby that leads to an elevator and stairway. An outdoor roof terrace above the market hall serves as an open space for the upper-floor units. A small parking area serves the retail customers, and parking near the adjacent transit station serves those who drive to the complex.

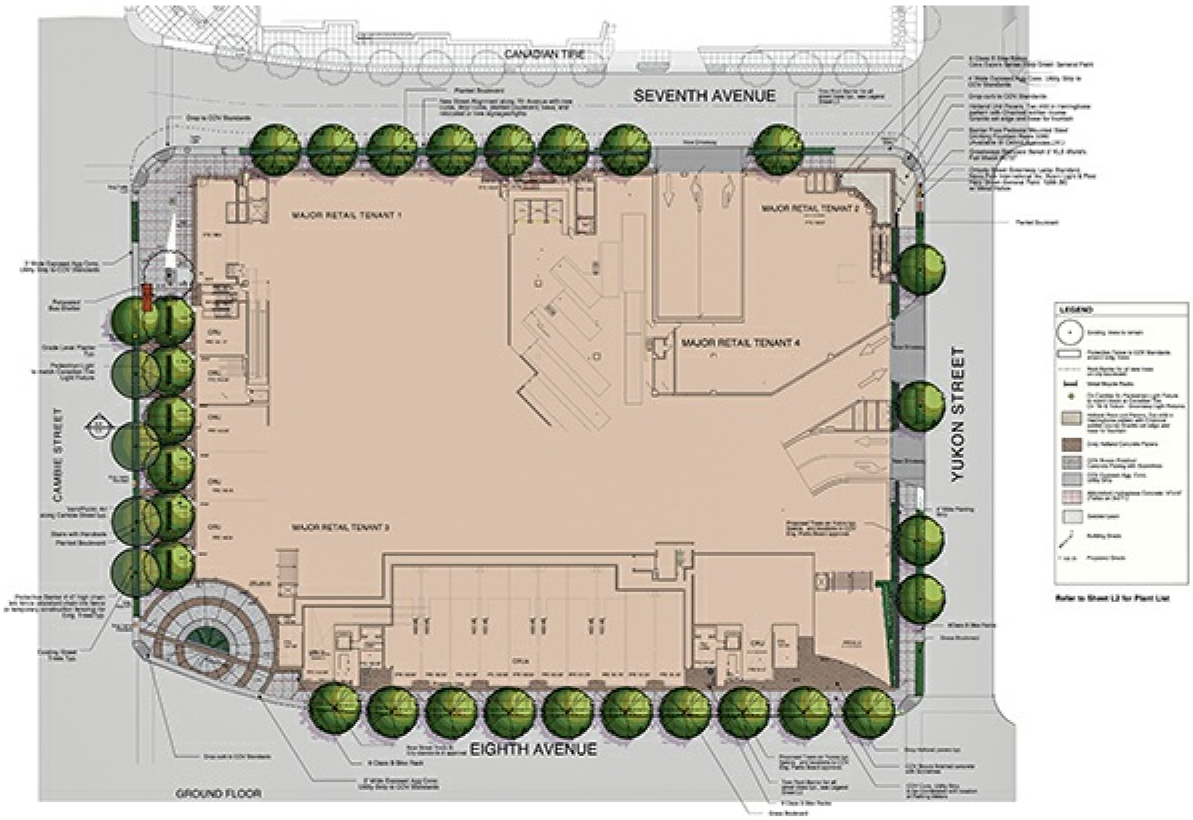


39.29 Aerial view, Rockridge Market Hall, Oakland, California.
(Google Earth)

39.30 Street view, Rockridge Market Hall, Oakland.
(Gary Hack)

39.31 Stairway to upper-level uses, Rockridge Market Hall, Oakland.
(Gary Hack)

39.32 Street view, The Rise, Vancouver.
(Gary Fitzpatrick/Courtesy of Grosvenor Americas)



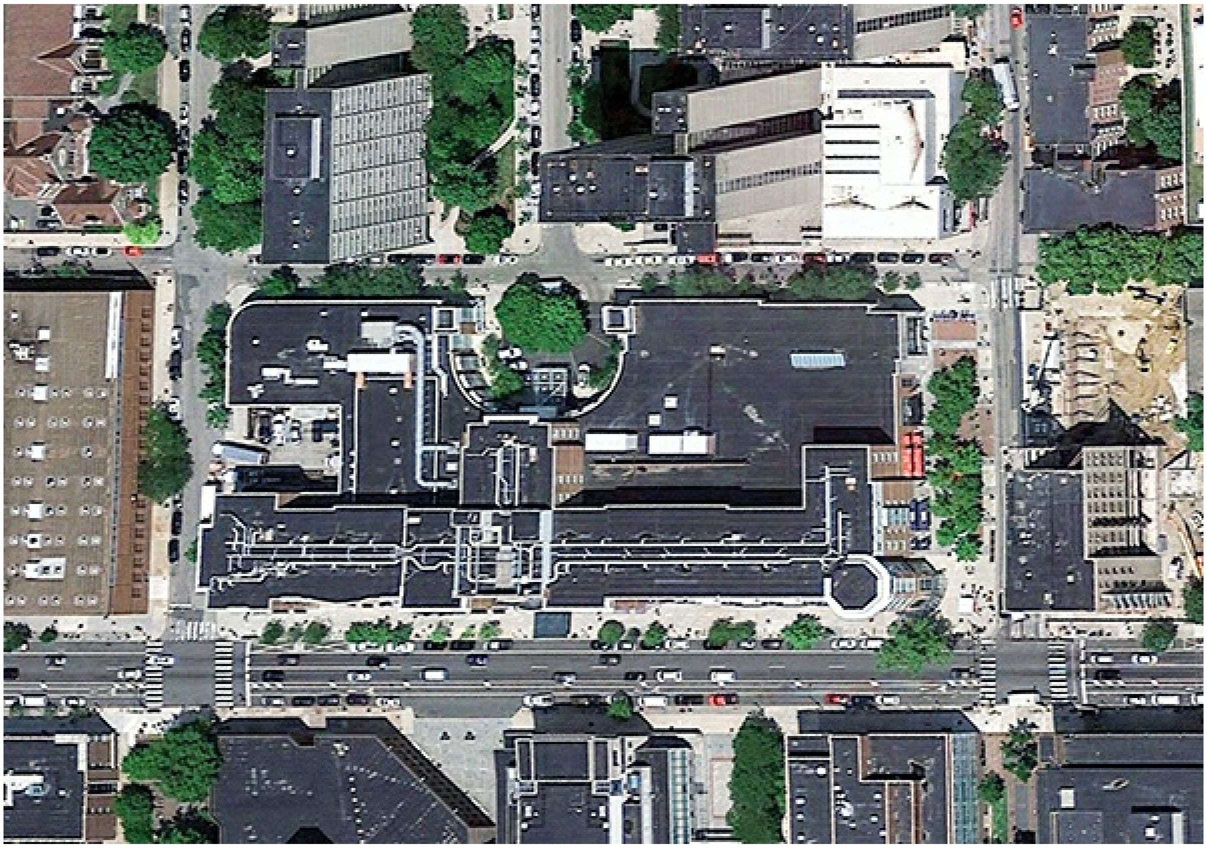
39.33 Ground-level plan with entrances complementing surrounding streets, The Rise, Vancouver.
(Courtesy of Grosvenor Americas/Durante Kreuk Ltd.)

39.34 Housing courtyard on level 4, The Rise, Vancouver.
(Larry Goldstein/Courtesy of Grosvenor Americas)

Introducing larger commercial outlets and office space in a low-scaled residential neighborhood requires the utmost sensitivity in siting and scaling a project. New automobile and pedestrian traffic will be attracted to the site, and will need to be handled so that they don’t erode the quality of life in the residential neighborhood. The Rise, in Vancouver, is a project that offers lessons for the site planner (Urban Land Institute 2014). Three large-format stores are located on the site—a supermarket, a building supply outlet, and a home goods store—stores that are usually located as freestanding outlets some distance from residential areas. The idea of the development, occupying a full block in the transition zone between a commercial corridor and a rapidly intensifying residential neighborhood, was to promote walk-in patronage and ensure that the block did not become a dead zone after business hours. The program for the site, totaling 26,000 m2 (280,000 sq ft) of gross leasable area, consists of retail anchor

stores, smaller retail shops, offices for local services, 92 live-work townhouses arranged around a fourth-level rooftop open space, and 640 belowground parking spaces. The site planning challenge was to organize the access around the perimeter of the block so that each use had a pedestrian frontage. Major entrances to the large retail outlets face the commercial street. Residential lobbies were sited on the streets linking to the residential neighborhood. Parking access and loading for pickup of building materials are on a perpendicular street, out of sight of pedestrians. The U-shaped housing area was sited to take advantage of the magnificent views to downtown and the distant mountains. A masterful stroke!

In Philadelphia, the University of Pennsylvania transformed a full-block site adjacent to its campus that had been a parking lot for 25 years into a mixed-use shopping, restaurant, and hotel complex. Called University Commons, it consists of 300,000 sq ft (27,870 m2) devoted to a large bookstore, street-oriented shops, three restaurants, and a 228-room hotel with 18,000 sq ft (1,670 m2) of meeting space. The challenge of the project was to energize the main streets surrounding the site. This required a careful analysis of the potentials of the four block frontages. Contrary to intuition, the main entrance to the hotel was not located on the major pedestrian street but on the quieter alley street on the opposite side, to avoid cluttering the commercial frontage on Walnut Street with drop-off and loading activities. A secondary entrance is located on Walnut, allowing access to the conference and hotel facilities. A consolidated loading area was created for the complex on a dead end service street. Adjacent to the transit stop and bookstore entrance, a plaza was created and is active throughout the year as a casual meeting place, outdoor dining area, farmers' market, and place for other activities. The height of the mixed-use structure was limited to 90 ft (27 m) to respect the scale of the campus and adjacent buildings. The project has not only been a commercial success, spurring other commercial developments, but has filled a large gap in the neighborhood with activity and life.



39.35 Aerial view, University Commons, Philadelphia.
(Google Earth)

39.36 Street view, University Commons, Philadelphia.
(Courtesy of Inn at Penn)

39.37 Automobile drop-off for hotel, University Commons, Philadelphia.
(Courtesy of Inn at Penn)

39.38 Plaza at entrance to bookstore, University Commons, Philadelphia.
(Gary Hack)

These three projects illustrate an important principle in designing small urban infill projects: they must be designed from the outside in, reflecting the scale and activity on surrounding streets. On larger sites it may be possible to create an independent center of activity away from the street, but it is usually a mistake to attempt this on small sites. The exception, of course, is when the street environment is noisy and hostile to pedestrians and there is a need to create a respite from the surrounding chaos. The Waterfall Lofts project in Vancouver is a fine example of how to do this: the street is lined with retail and studio office uses, while every housing unit faces on a quiet courtyard created within the block.

39.39 Street view, Waterfall Lofts, Vancouver.
(Courtesy of Stephen Hynes/Nick Milkovich Architects)

39.40 Central courtyard, Waterfall Lofts, Vancouver.
(Courtesy of Steven Hynes/Nick Milkovich Architects)

39.41 Aerial view, Renaissance Center, Detroit.
(Robert Thompson/Wikimedia Commons)

39.42 New city interface with people mover and pedestrian entrance, Renaissance Center, Detroit.
(Gary Hack)

39.43 Waterfront face, Renaissance Center, Detroit.
(Brosnhoj/Wikimedia Commons)

Vertical Mixed-Use Urban Complexes

Vertical mixed-use projects require ingenious architectural configurations to accommodate the several access, service, and parking needs. Site planning considerations sometimes take a back seat, and too often the result is a project with soaring internal spaces that turns its back on its surroundings. Examples that both resolve internal dynamics well and connect to adjacent areas are rare. The original Renaissance Center in Detroit had interesting (but disorienting) interior atria and was almost

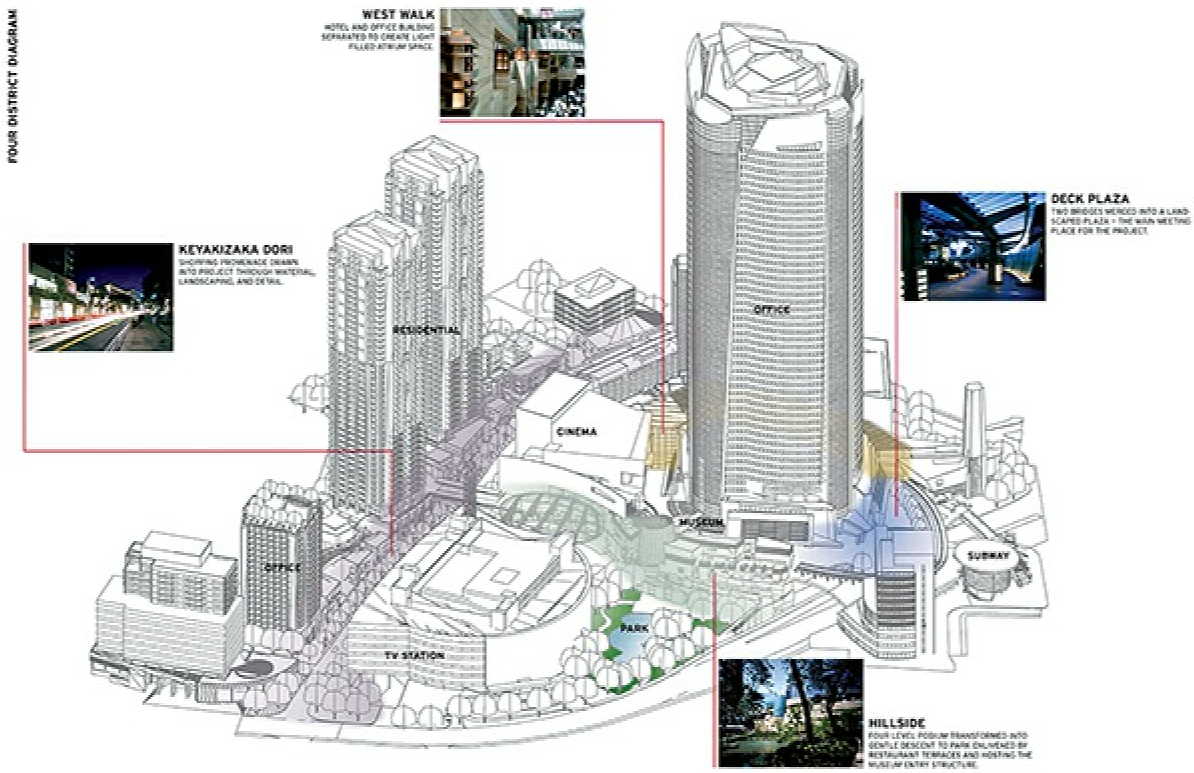
impossible to reach on foot from downtown. Between the two areas was a dead zone, cluttered with drop-off areas, air conditioning exhausts, and other barriers. Fortunately, creative additions to the perimeter and a reconfiguration of access patterns have brought life to the linkage, and made the project a more integral part of the city center. They have also opened up the complex to the adjacent waterfront, dispensing with a ring road that encircled the site. It would have been far better to design it properly at the beginning.

Sidebar 39.3

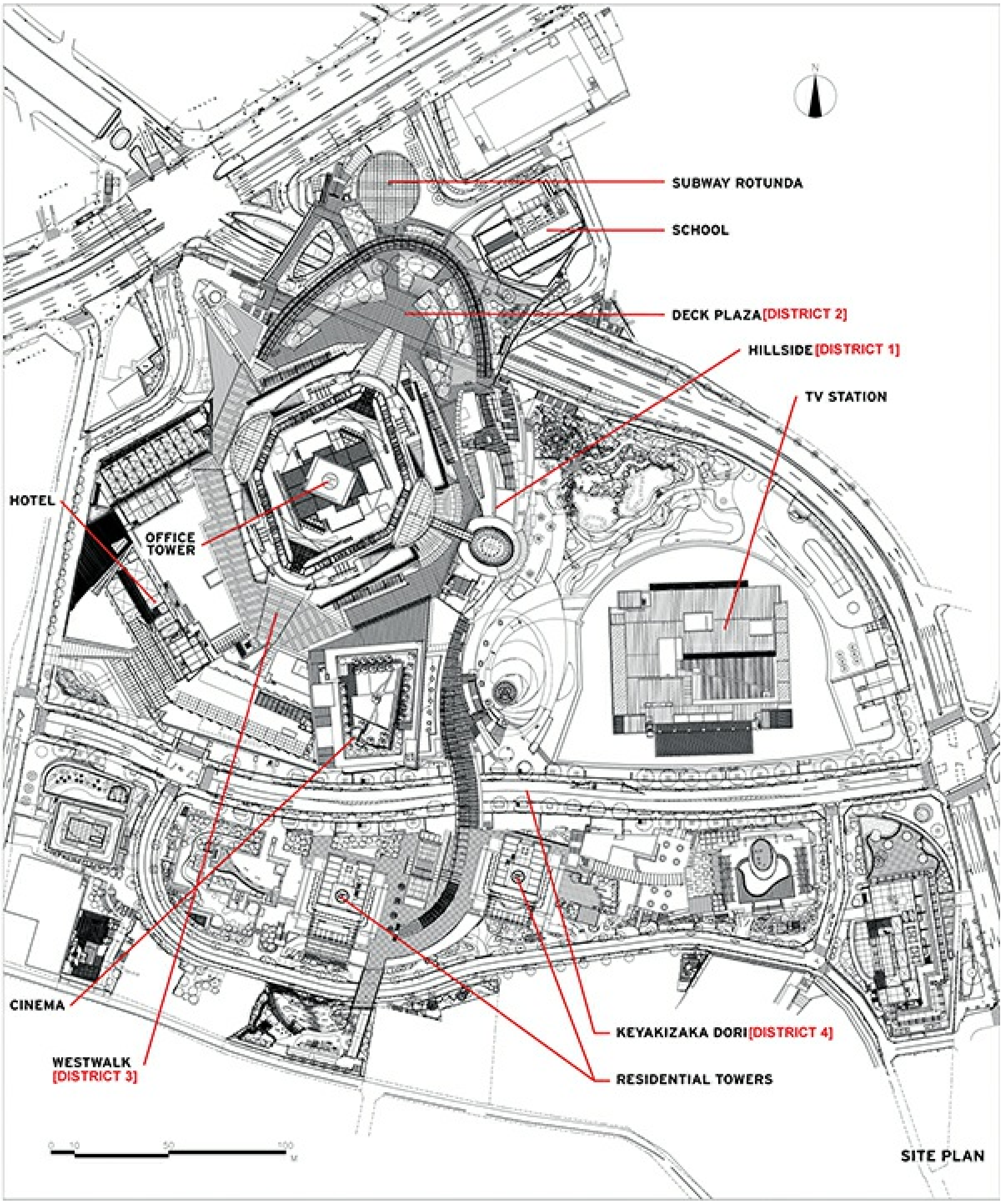
Roppongi Hills,Tokyo, Japan

Built on a 115,000 m2 (28.4 ac) site that had been assembled from 400 individual parcels, the project includes a 54-story tower containing offices, a hotel, and an art museum at its top, wrapped by a six-level retail and restaurant complex that also extends into the tower base. With the main shopping spine located adjacent to the main tower rather than under it, separate entrances and security checkpoints are maintained for each of the tower uses. Adjacent structures include two tall towers for housing and two mid-rise structures, a large cinema and theater, the Asahi Television main production facility, and additional office and retail spaces. The built space totals 724,000 m2 (7.8 million sq ft).

Site planners: KPF and Jerde Partnership

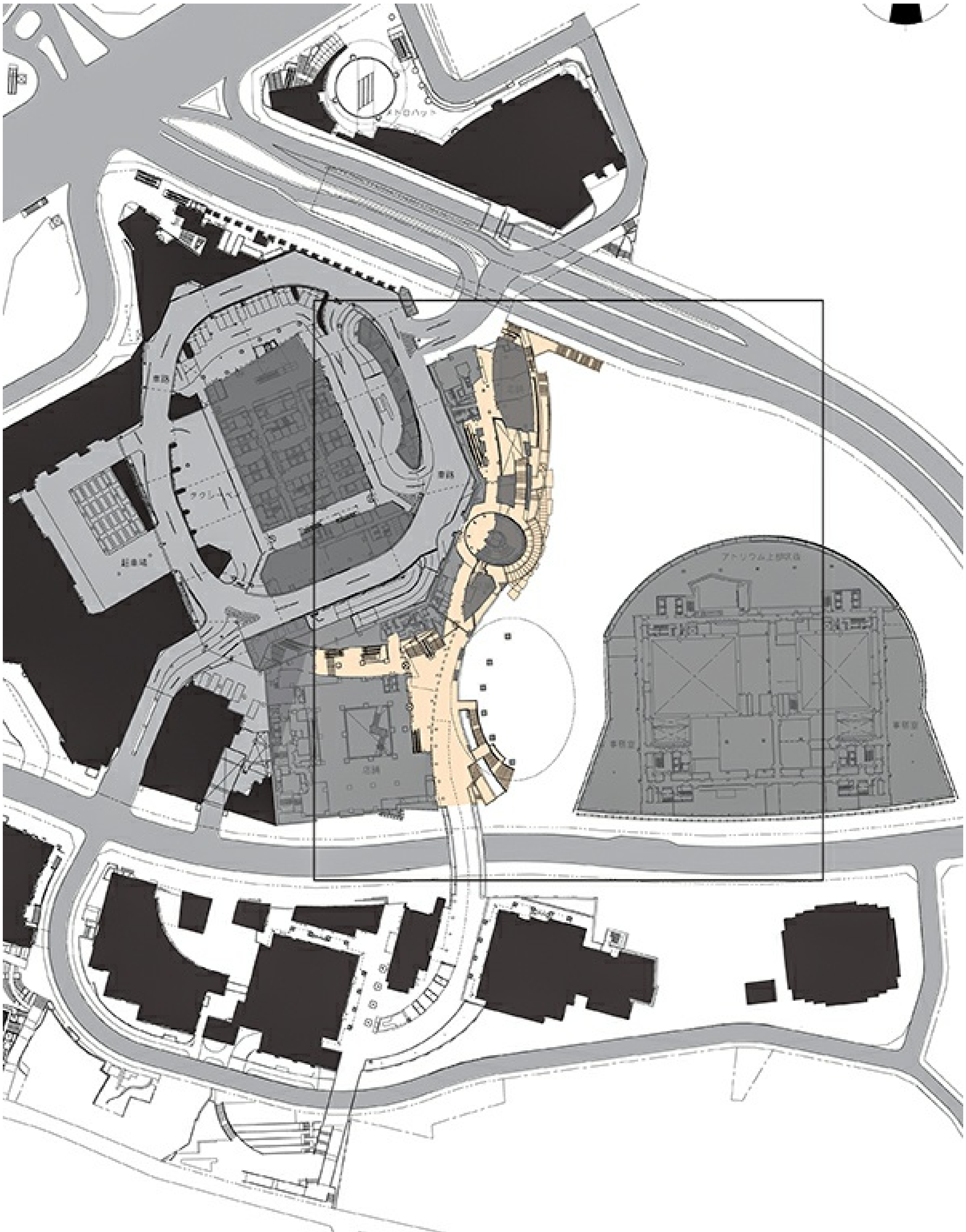


39.44 Diagram of organization of Roppongi Hills, Tokyo.
(Courtesy of Jerde Partnership)



39.45
Site plan, Roppongi Hills.

(Courtesy of Jerde Partnership)



39.46
Lower-level site plan, Roppongi Hills.

(Courtesy of Jerde Partnership)

39.47
Deck plaza, Roppongi Hills.

(Gary Hack)


FURLA

39.48
West Walk shopping area, Roppongi Hills.

(Gary Hack)

39.49
Keyakizaka Dori entrance to shopping.

(Gary Hack)

39.50

Keyakizaka Dori, Roppongi Hills.

(Gary Hack)

Roppongi Hills in Tokyo is a complicated project of interlocking uses that takes full advantage of approximately 25 m (80 ft) of topography in one of Tokyo’s most desirable neighborhoods. The site plan is organized around four outdoor and indoor public spaces. People arriving via the metro travel by escalators through a rotunda to the Deck Plaza, a large hard-surfaced public space. From there they can enter the Mori Tower

offices, the Mori Museum entry structure, and the West Walk, the second major space that arches around the tower and is the heart of the shopping complex. Taking advantage of the topographic differences, the Hillside is an outdoor park and performance area, with both programmed and casual spaces. Keyakizaka Dori is the fourth public space, lined with shopping and restaurants and connecting to the fabric of the city. For special events and occasions (such as the city's film festival), it is closed to vehicles and extends the pedestrian realm. Roppongi Hills is an example of how a large mixed-use complex can fit comfortably in an existing urban district.

Horizontal Mixed-Use Urban Complexes

Many of the advantages of mixed-use development can be obtained by carefully organizing an array of uses side by side rather than vertically. The financing of a development is simplified when each use occupies its own site and the site can be easily parceled to allow individual ownership of buildings. Earlier we saw how Battery Park City adopted this strategy and has become a very successful new city neighborhood (chapter 2).

Sidebar 39.4

University Park at MIT, Cambridge, Massachusetts

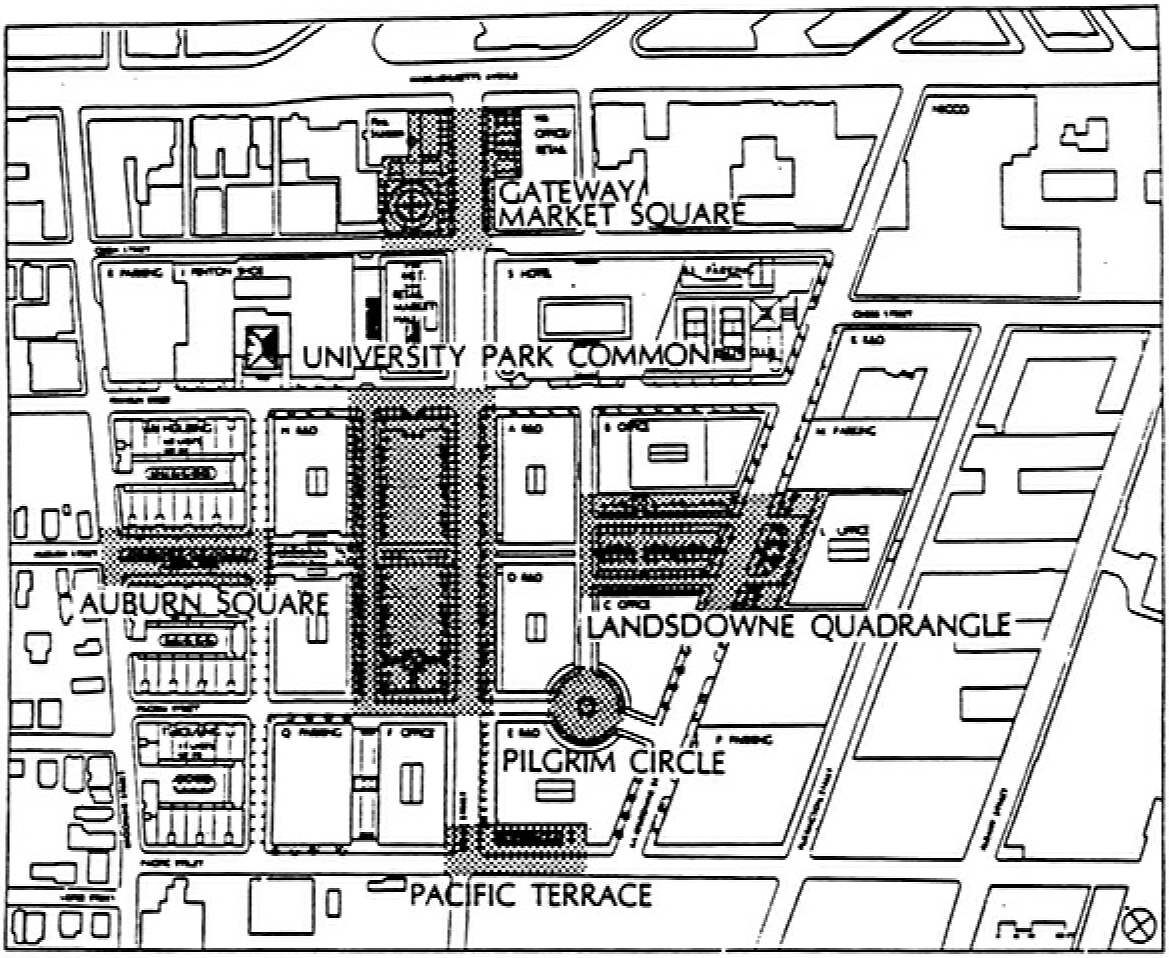
Planned and privately constructed on a 28 ac (11.3 ha) site that MIT assembled adjacent to its campus, University Park integrates 1.65 million sq ft (153,000 m2) of research and office facilities with more than 670 residential units, a hotel and conference center, a supermarket, and other retail facilities. The site is organized into city blocks, with all parking accommodated in structures on the perimeter. Residential uses are distributed and integrated throughout the development, with more family-oriented housing providing a buffer between the office and research uses and the adjacent Cambridgeport neighborhood.

Site planners: Koetter Kim Associates

Developers: Forest City Realty Trust

39.51 Plan, University Park at MIT.
(Courtesy of Forest City Realty Trust)

B. OPEN SPACES AND STREETSCAPE



OPEN SPACES AND STREETSCAPE

University Park is organized around a street system and interlocking open space system, which together constitute a framework around which development will occur.

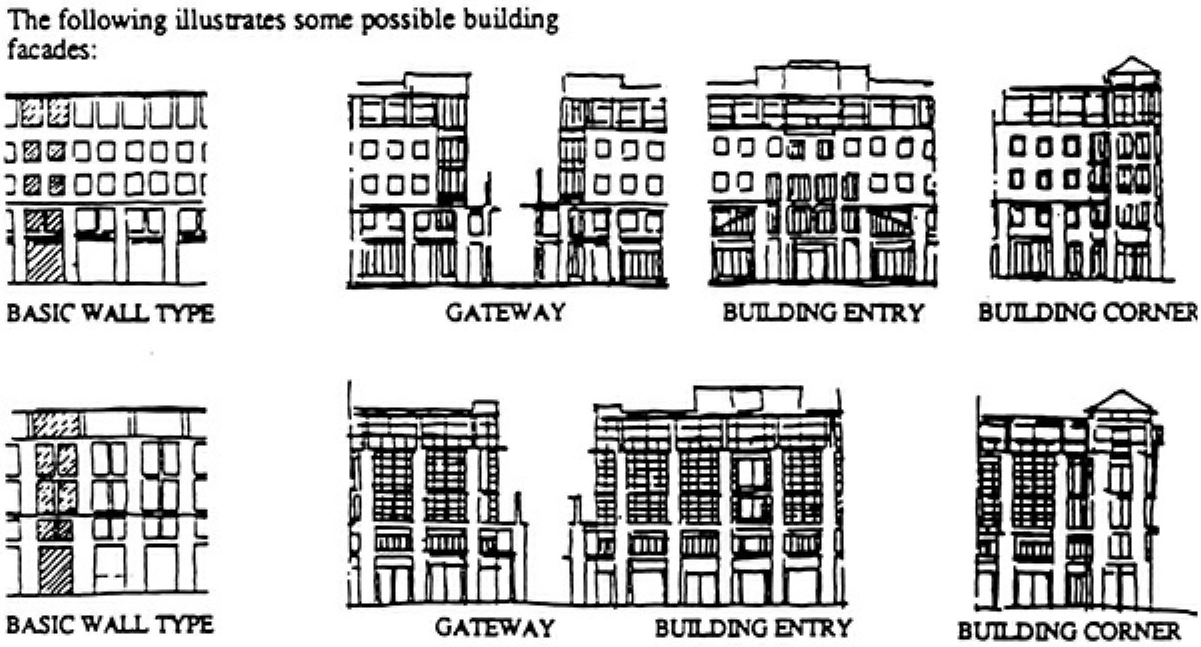
The overall design goal is ease of pedestrian flow all the way from the Brookline Street neighborhood edge, through the new mixed-use development, across the railroad tracks where feasible, and to the Charles River open space system.

OPEN SPACES

Open spaces at University Park are to be developed in coordination with the street system and are intended to help support and focus the various activities which surround them. Design and programming of the open space should reflect the zoning ordinance requirement that such space be publicly beneficial and accessible.

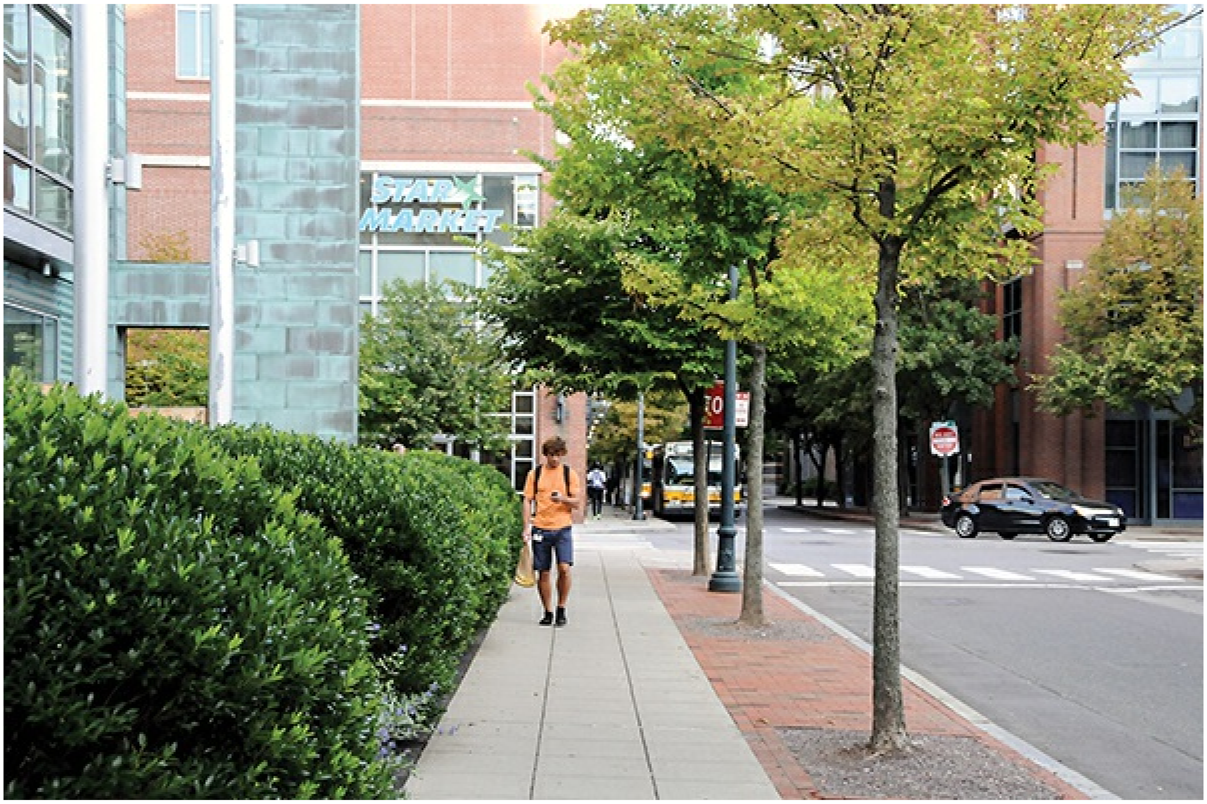
These open spaces will be developed and programmed in detail as they are brought to realization individually over time. However, the following elements have been identified for the Gateway/Market Square, University Park Common, and Auburn Square.

39.52 Design guideline for open spaces at University Park.
(Koetter Kim Associates/MIT)



39.53 Design guideline for building facades at University Park.
(Koetter Kim Associates/MIT)

39.54 View of park, University Park.
(Gary Hack)



39.55 Supermarket and other services integrated into office and research buildings.
(Gary Hack)

39.56 Research buildings, University Park.
(Gary Hack)

39.57 New residential loft building, University Park.
(Gary Hack)

39.58 New low-rise housing adjacent to Cambridgeport neighborhood.
(Gary Hack)

University Park at MIT, in Cambridge, Massachusetts, demonstrates how a clear pattern of blocks and consistent guidelines for development can result in an attractive moderately scaled inner-city development. The plan for the development emerged from a lengthy dialogue with the city and residents of the adjacent Cambridgeport neighborhood, an area with a long history of opposing new development. Design guidelines, which were adopted into the local zoning, called for a large open space, street-oriented buildings with limited heights, parking enclosed in structures, and housing adjacent to the existing neighborhood, among other rules. Other conditions were imposed by MIT, which leases the site to a master developer and ultimately to owners of individual buildings, and thus had a long-term interest in assuring the quality of the results.

University Park is a rare example of a development that follows the design guidelines but also goes beyond them to enrich the site. With limited frontage available on Massachusetts Avenue, the main commercial street in the area, the development's supermarket was sited one block away but designed to be visible from the avenue. It is located on the second floor of a mixed-use structure to allow other commercial uses to capture the ground-level flow, and is topped by three floors of housing. Buildings surrounding the central park have been designed so that the ground levels can be used as office space until the market for additional commercial space emerges, as the area reaches its full occupancy. Heights in the area were a contentious item in the negotiation of the plan. Old abandoned loft factories on the site were five stories, and it was agreed that new research and office structures would match that height, while housing adjacent to the neighborhood would be held to three stories. One residential structure, in the middle of the site facing the park, was allowed to rise to 17 stories. A standard palate of brick and an aesthetic of punched windows was adopted for the commercial buildings of University Park, while residential buildings were allowed to develop separate identities. Parking structures

were carefully sited so that drivers could reach them without traveling on neighborhood streets. The overall result is a mixed-use district that takes advantage of synergies to support a lively, 24-hour community, serving the adjacent neighborhood, university, and new employees and residents.

Mixed Uses Connected by a Podium

A common prototype for developing mixed-use structures involves the creation of a podium (also called a *plinth*) of three to five levels of space for retail shops, food and beverage, and parking, above which rise individual towers for housing, offices, hotels, or other specialized uses. This pattern has been common in Asia for many years, and often the podium element fills an entire city block. The roof of the podium is typically devoted to recreation or green spaces, in effect replicating the ground level several levels above the street. A typical example is Landmark Centre in Hong Kong, constructed over 30 years ago and recently renovated, with high-end shopping on three levels in a podium, topped by a hotel structure and office building.

As projects have expanded in scale, podium development has become the organizing concept for some of the largest mixed-use complexes in the world. Perhaps the most impressive is the Union Square complex that includes the International Commerce Centre in West Kowloon, Hong Kong. It has exceptional access, constructed on a 13.5 ha (33.5 ac) site located over the Kowloon Station on the rail link to Hong Kong International Airport and a transfer point with other subway and regional rail lines. The podium consists of six levels: two levels belowground devoted to the rail station and parking, the ground level which accommodates all drop-offs, taxis, and loading, two levels of retail uses above, and a large park above it for the enjoyment of all who use the site. The podium provides 82,750 m2 (891,000 sq ft) of retail space and over

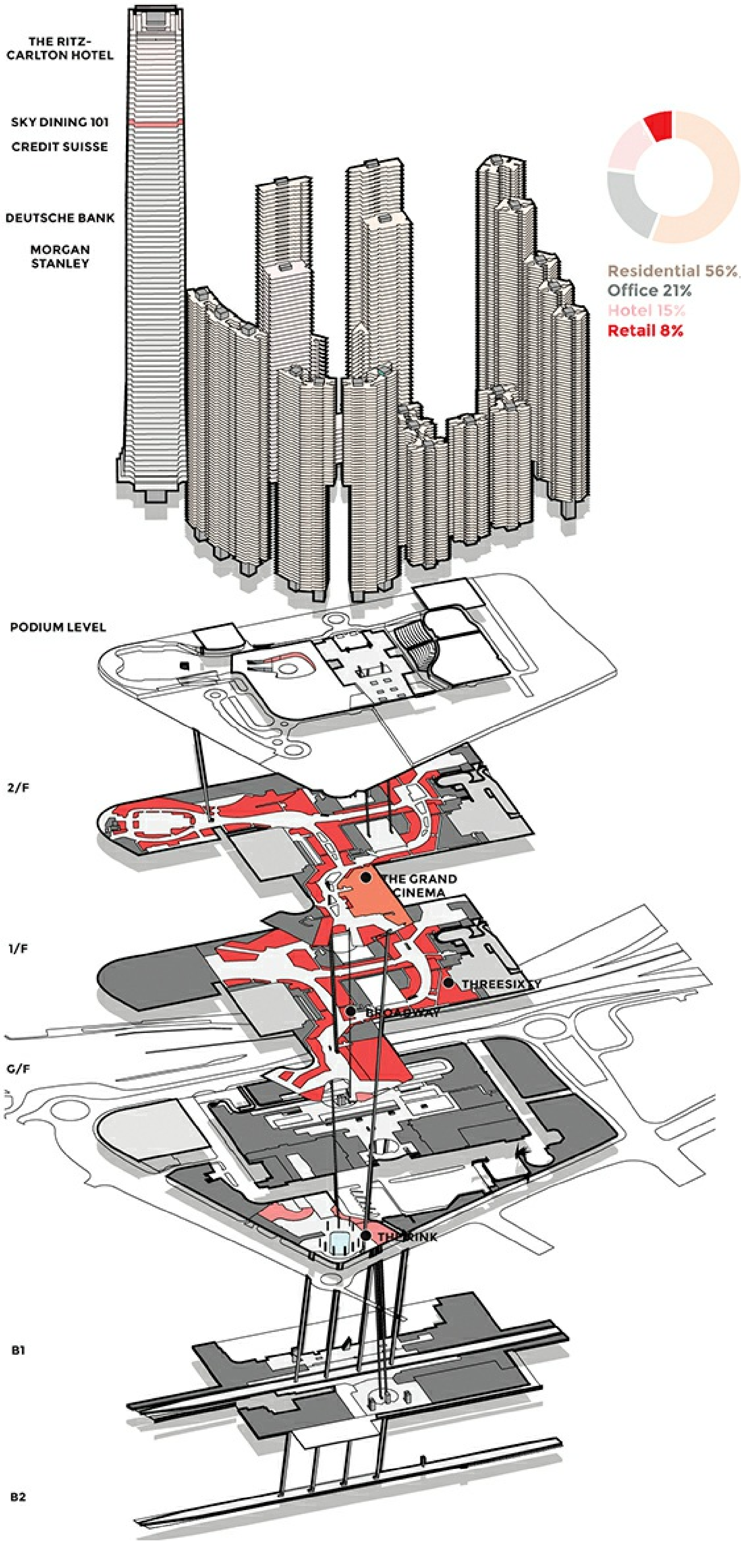
6,000 parking spaces that serve the uses above. The 18 towers that rise above the podium include a 110-story office and hotel structure, additional offices, 5,866 housing units, 4,710 hotel and serviced apartment units, and a full range of recreational and service facilities needed for a district that attracts half a million people or more each day. The overall built area of the project totals 1.1 million m2 (11.7 million sq ft) of space.

The site plan for Union Square is instructive. The high automobile flows to and from the complex and the Kowloon Station require devoting a full level (the ground level) to circulation. Most of the tall towers are located on the perimeter of the site so that their foundations do not conflict with the station and rail lines below, which also allows for separate entrances for each tower around the edge of the site and a relatively uninterrupted floor area for the commercial complex. Generous skylights in the center of the complex admit light down through the commercial complex to the station, unifying the complex. However, the complex currently has little connection with its surroundings, since most pedestrians are two or three levels above-ground. Ultimately, the planners propose that bridge connections be created to the waterfront and adjacent development projects.

39.59 Podium at Landmark Centre, Hong Kong.
(Unidentified)

39.60 Interior atrium of podium retail space, Landmark Centre, Hong Kong.
(Courtesy of © China International Travel CA, Inc.)

39.61 View of International Commerce Centre, Union Square, Kowloon, Hong Kong.
(Ritz Carlton Hong Kong)


THE RITZ-CARLTON HOTEL
SKY DINING 101
CREDIT SUISSE
DEUTSCHE BANK
MORGAN STANLEY
Residential 56%
Office 21%
Hotel 15%
Retail 8%
PODIUM LEVEL
2/F
THE GRAND CINEMA
1/F
THREESIXTY
BROADWAY
G/F
THE RINK
B1
B2

39.62 Plan and vertical layering, International Commerce Centre, Union Square, Kowloon, Hong Kong.
(Courtesy of Stefan Al)

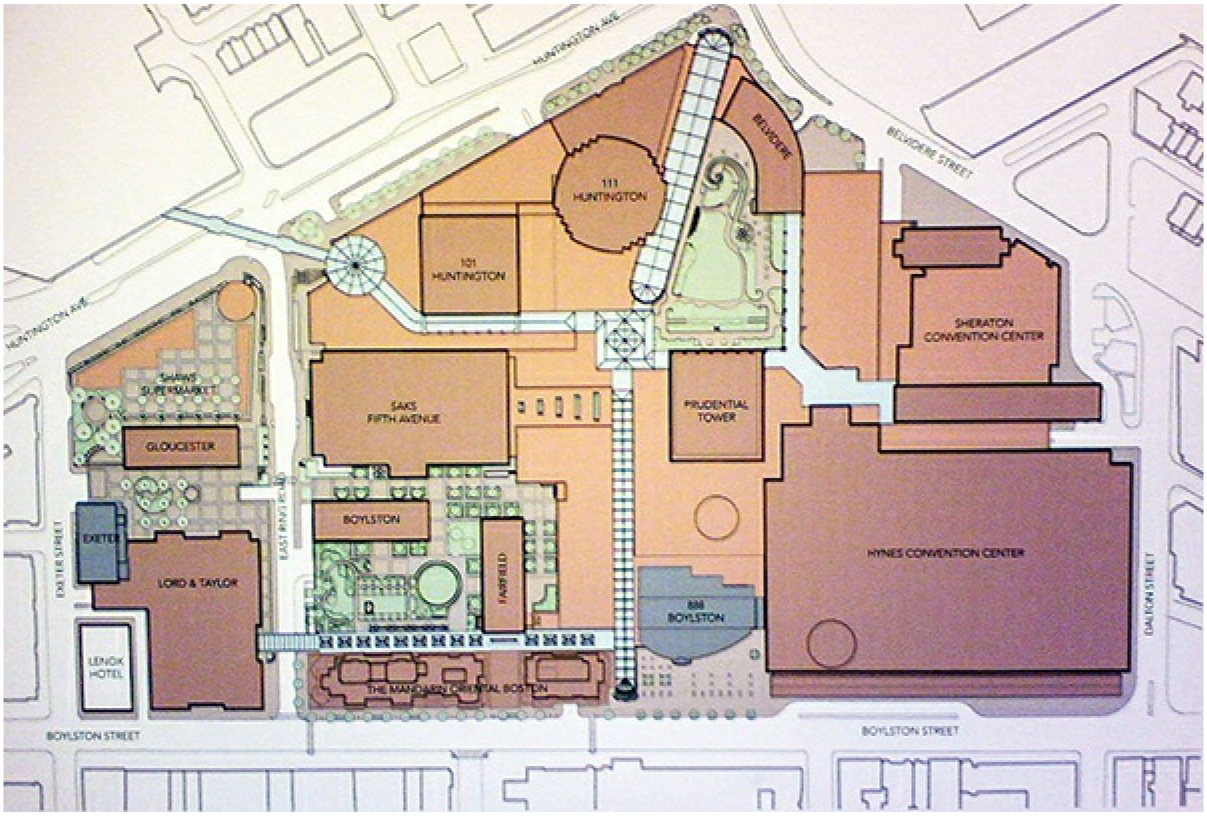
Separation of pedestrians from the ground level is a common issue in cities with podium-based development linked by *skywalks*. Skywalks provide the rationale for creating a multistory retail space below towers in dense urban areas. In Minneapolis, upper-level pedestrian walkways function as the main circulation arteries during winter months, and podium developments such as that of the IDS Center provide the vertical connections to the street level. Differentiating the retail uses and activities between the street level and upper levels is critical. In many cities, the street level becomes the domain of those taking mass transit, while pedestrian flows from block to block use the upper level *pedways* (see chapter 24).

39.63 Interior of retail area in podium, Union Square, Hong Kong.
(Gary Hack)

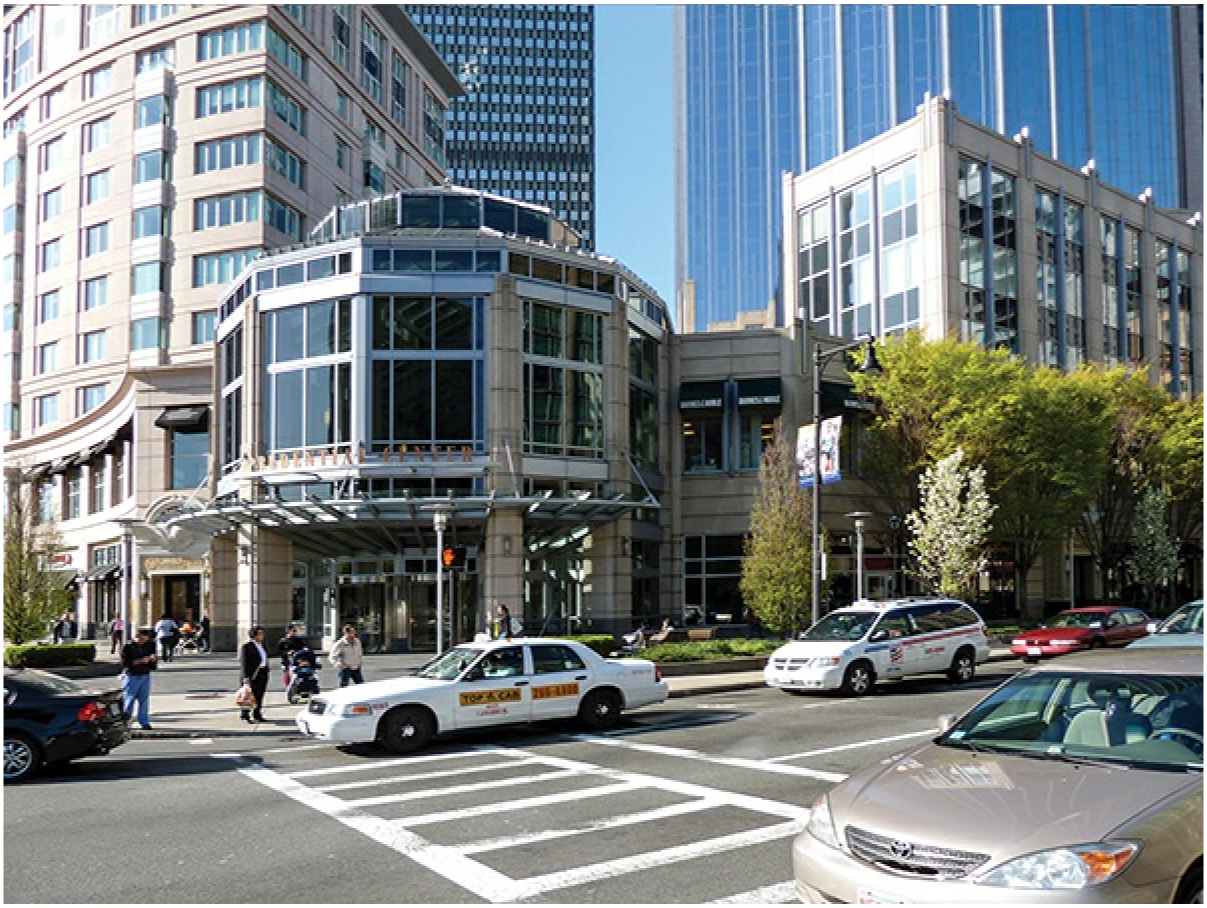
39.64 Rooftop park over the Union Square podium, Kowloon, Hong Kong.
(Gary Hack)

39.65 IDS Center atrium which connects upper-level pedestrian ways to the ground level, Minneapolis, Minnesota.
(Gary Hack)

39.66 Original Prudential Center complex, Boston, Massachusetts.
(Prudential Insurance Company)



39.67 Prudential Center plan after redevelopment, Boston.
(Boston Properties)



39.68 New entrance, office tower and condominiums along Huntington Avenue, Prudential Center, Boston.
(Gary Hack)

39.69 New housing and hotel above retail lining Boylston Street, Prudential Center, Boston. (Gary Hack)

39.70 Interior, glass-covered arcades, Prudential Center, Boston.
(Gary Hack)

The Prudential Center in Boston, Massachusetts is an unusual case because its elevated walkways were necessitated by site infrastructure. The development was built over a former rail yard with a datum less than 10 ft (3 m) below the level of surrounding streets; the continuing use of the rail tracks and the Massachusetts Turnpike parallel to them forced all roads and pedestrian walkways traversing the site to be about 18 ft (5 m) above the surrounding street level (which varies across the site). This allowed three levels of parking with 3,000 spaces to be constructed below the pedestrian ways in areas not occupied by rail lines and the Turnpike. The original Prudential Center complex, completed in 1968 on 23 acres (9.3 ha), consisted of 4.5 million sq ft (418,000 m2) of space divided among two office towers, three housing towers with 810 apartments, a 1,000-room

convention hotel, two department stores, and a one-level outdoor commercial space of 190,000 sq ft (17,650 m2) occupying spaces between the towers. The city's new convention center was built on a portion of the site. The Prudential Center was planned as a freestanding complex, with a ring road providing access to its garages and drop-off points, creating a separation of 150 ft (45 m) or more from active uses on the surrounding streets. It hardly seemed to be connected to the two vibrant neighborhoods, the Back Bay and the South End, that depended upon the Prudential deck as their main route between.

By the mid-1980s, the owners of the site believed it was underutilized and wished to add more towers while remedying its windswept commercial areas and open spaces. After a multiyear debate with residents of the apartments on the site, a new site plan was agreed upon which utilized the ring road areas for new housing, a hotel, offices, retail space, and apartments. Residents of adjacent areas got new commercial uses at ground level, including a new supermarket, and weather-enclosed 24-hour walkways between the neighborhoods. Prudential acquired the right to build a further 1.8 million sq ft (167,000 m2): two office structures, condominium housing, new open spaces, and an enclosed shopping arcade that has proved to be the city's highest-earning shopping area. The shopping arcades, limited to one story by the capacity of foundations, were modeled on the wonderful arcades in London and Melbourne, Australia, and have become one of the city's most popular walking destinations. Entry points are graced by generous rotundas, which also provide indoor access to public transit (Hack 1994). A bridge connects the complex to Copley Place, an adjacent multilevel shopping mall with two hotels and office structures. After completing the project, Prudential sold the complex at a handsome profit, and its successor has added two additional office towers, filling small gaps in the perimeter.

The Prudential Center, and the other projects highlighted above, demonstrate how mixed-use complexes can add to the vitality of a city while respecting traditional patterns of streets and development. They need

to be viewed both from the inside out and the outside in, regardless of scale. The best mixed-use projects blend seamlessly into the city fabric and also add new enclosed spaces that extend city life.

40 | Communities

Ultimately, a livable neighborhood, district, or city is more than a random collection of houses, shops, institutions, and mixed-use projects, however innovative and varied they may be. The form of a new residential community reflects attitudes toward nature, urbanity, neighboring, automobile use, social contact, and privacy. It must respond to the market for housing and other uses in its area and the prevailing economics of land and building. Every new development is also greatly affected by the standards for providing roadways and public services mandated by government agencies that must approve the project. Too often, large new community developments are the mindless result of responding to government demands and repeating patterns tried elsewhere. But the best new communities go beyond simple practicality and are a creative response to all the factors that make a place livable.

Components of a New Community

How large does a development need to be to qualify as a *new community* or a *new city*, *town*, *village*, or *neighborhood*? Generally, a large new development that contains most functions of everyday life—housing, shops, institutions, recreation opportunities and workplaces—is called a

new city or *new town*. Post-World War II new towns built in the UK typically set as their target accommodating 75,000 residents with a full range of services and work opportunities, although this size proved too small to create the quality of life many residents desired, and the last of the new towns, Milton Keynes, was planned for 250,000. A survey of 30 new towns constructed in the US over the past 50 years indicates that they have ranged in size from under 1,000 residents to over 88,000, and in area from 80 ac (32 ha) to 38,000 ac (15,400 ha) (Community Planning Laboratory 2002). At the low end, these might better be called *new villages* or *neighborhoods*.

Optimal size depends on what one means by community or neighborhood or town. The US *neighborhood unit* first found its form in Radburn, New Jersey, where a community was planned on 235 ac (95 ha) with 1,000 clustered housing units, 100 apartments, an elementary school, shared open spaces and play facilities, and shops for everyday needs. Only part of the development was built, but it has exerted a broad appeal as a planning module. The area required for such a self-contained neighborhood has grown in size as schools and supermarkets have become larger, densities of suburbs have declined and greater mobility has meant less dependence on local resources. However, the *danwei*, a living-working community that was the fundamental unit of Chinese society for 50 years, might house only a few thousand people but be a self-contained environment, providing shops, clinics, schools, and all the daily needs of those who live within the gates, subsidized by the business or institute it was built around (Bonino and De Pieri 2015). New developments, such as the SOHO MOMA residential complex in Beijing, have tried to reproduce this, although not always successfully, since there is an inherent conflict between the desire to support market-based functions such as shopping and the wish to internalize these in a *gated community*. Most new developments are simply not large enough to support a commercial complex alone. The size of a desirable community will also vary by density and layout: a high-density development with schools and services,

such as Stuyvesant Town in New York, is a distinct neighborhood of 25,000 residents on an 80 ac (32 ha) site, while a lower-density sprawling suburban area may be four times that size and still not seem like a neighborhood.

40.1 Aerial view of Livingston new town, West Lothian, Scotland.
(Kim Traynor/Wikimedia Commons)

40.2 Aerial view of central Milton Keynes, England.
(Milton Keynes Council/Green Digital Charter)

Because the definitions are so slippery, we will use the term *community* to span across scales. Striving to create a community, rather than just a development, usually signals the desire to create a diverse area catering to a variety of types of households, and organizing its form and components so that they support face-to-face contact, neighboring, and local ties between residents through institutions they share. It also generally means encouraging walking by locating facilities so that they are in easy range of most residents, also making possible chance contacts with friends and neighbors. A typical objective is ensuring that schools, shops, and public transportation are no more than a 10-minute walk from every home in a community, which translates to 1 km or half a mile. The typical components of a new community include:


PLAZA ROAD NORTH
ERIE RAILROAD
TENNIS COURTS
HOWARD AVENUE
RADBURN ROAD NORTH
FAIRLAWN AVENUE
TO PATERSON
FUTURE APARTMENTS
PLAZA ROAD SOUTH
RADBURN ROAD SOUTH
LEGEND
BUILDINGS COMPLETED OR ABOUT TO BE CONSTRUCTED
GROUPS PROPOSED FOR FUTURE DEVELOPMENT
SCALE
RADBURN N.J.
REGISTERED TRADE MARK
PLAN OF NORTHWEST & SOUTHWEST RESIDENTIAL DISTRICTS
NOVEMBER 1929
CLARENCE S. STEIN & HENRY WRIGHT
ARCHITECTS ASSOCIATED

40.3 Plan of Radburn, New Jersey, 1929.
(Clarence Stein and Henry Wright)

Housing for a broad range of households—singles, families with and without children, seniors; those wishing autonomy and others seeking places which encourage neighboring; cohousing; a hotel or guest house if the area is large enough to support it.

Shops and services for everyday or weekly needs—groceries, laundries, bottle shops, restaurants, bars, shoe repair, hardware, gift and card shops, salons, pet care shops, and the like.

Medical services—clinics for routine and emergency visits, dentists, pharmacies.

Recreation places—playgrounds, playfields, parks for casual recreation; commercial recreation such as movie theaters, workout spaces, indoor tennis, water park; community gardens.

Local institutions—governmental service spaces; places for worship; community centers; cultural spaces; clubs and organizational spaces.

Work spaces—nearby employment centers; live-work areas; business incubator centers.

40.4 MOMA SOHO linked hybrid housing complex, Beijing.
(Courtesy of © Shue He/ Steven Holl, Architect)

40.5 Aerial view of Stuyvesant Town and Peter Cooper Village, New York.
(Melpomen/123RF Stock Photo)

The number and amount of space for each of these components will depend upon the location, size of the project, market for spaces, and intentions of those developing the community. Not all of the spaces may materialize at the start, since *social capital* and institutions take time to form and businesses materialize as needs are sensed by entrepreneurs. Hence, flexibility for future development is important. A useful target is to think in terms of the kind of community being sought 10–15 years in the future.

Some Principles

Creating a community requires a mindset of striving for qualities of place that go beyond the value of the buildings that occupy a site. While it is easier to lease or sell space in a development that has a desirable environment, some of the virtues of a community only become obvious well after the initial developers of a site have departed. Fine communities share several attributes:

Identity—they are recognizable by their buildings and landscapes, and are different from other areas of the city.

Walkability—they minimize the distances that residents and workers need to travel for everyday needs. Promoting effective public transit within a 10-minute walk of homes and workplaces is essential.

Diversity—they accommodate a diverse set of residents and workers, and make it possible for people to remain in the community as they move through the life cycle.

Places for contact—the strength of community ultimately depends on forming traditions and institutions that bring people together in public; spaces where this can occur are essential.

Synergy—the uses reinforce each other. Shops and restaurants benefit from high-density housing and employment areas nearby; community buildings serve educational as well as social functions; open spaces double as casual and organized recreation areas.

Adaptability—the form of the community makes it possible to adapt uses over time. Parking areas in shopping areas can later be consolidated into structures, releasing land for new housing or offices; sites are deliberately held open for future development.

Maintenance and management—parks, public spaces, and shared facilities need long-term arrangements for maintenance. Creating the organizations and financial means for this is as essential as planning the site and will ultimately determine whether spaces are well used or avoided.

Each of these principles needs to be operationalized for a particular site. Integrating shops, workplaces, and housing in a single structure may be possible on one site but not another. The form of places for human contact will vary by climate and traditions. However, beginning with a list of aspirations is essential, and these need to be touchstones throughout the planning.

Form and Structure of Communities

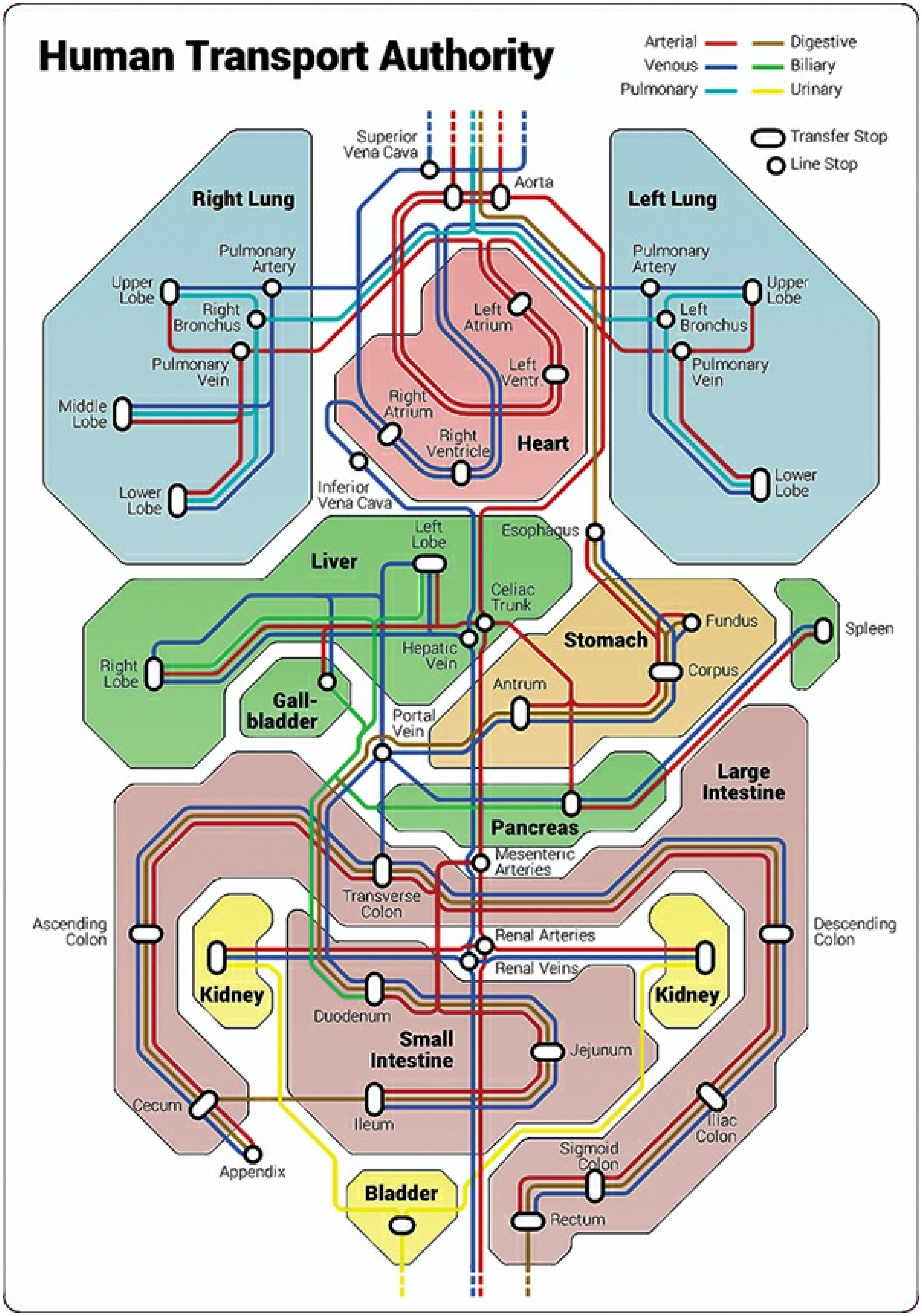
A common point of departure in planning new communities is to think of them in organic terms, as a set of vital organs or cells connected by arteries and networks to central functions, much as the human body is organized. Victor Gruen's diagram for an ideal new city is composed of small compact local communities with neighborhood facilities at their center, connected by transit and roadways to major commercial centers and employment areas. Around the perimeter, separated from the residential

areas by greenbelts, are industrial areas, airports, and other links to the larger world. This form of organization rationalizes commerce into three levels of facilities—local, district, and central shopping areas. The organic idea is easy to grasp and sell to others, which is part of why it has persisted for so long in thinking about designing communities.

The new city of Reston, Virginia, near Washington, DC, was organized in this manner, with five villages, two district centers, a dense city center, and several independent employment areas near the expressway. The form, not quite as neat as Gruen's diagram, has been fitted onto the topography of the site and the principal access routes that bisect the community. Much of Reston consists of low- and moderate-density housing clusters, separated by fingers of green spaces that preserve streams and watercourses and provide recreation trails throughout the community. The mixed-use city center provides an urbane counterpart to the sylvan neighborhoods.

Open-space networks often provide an armature for structuring new communities and providing separate identity to each of the neighborhoods. At Columbia, Maryland, also near Washington and built during the same period as Reston, fully 35% of the site was set aside for open spaces (5,000 ac, 2,025 ha), separating the community's five main villages, each of which has a local shopping area where religious structures, secondary schools, major playing fields, and community centers are also clustered. A regular system of arterial streets, landscaped as parkways, and collector streets provides access to local residential areas. Single-family detached housing and higher-density forms are never mixed on a local street; each has a separate entrance from a collector street. Open spaces and community facilities are managed by the Columbia Association, which also operates dozens of recreation facilities, provides social service programs, and organizes a myriad of arts and cultural activities for the city. These are paid for by an annual levy on all real estate in the city, including commercial properties, that amounts to approximately 0.35% of the value of each property. Without a local government for the new city—it relies

upon the county for schools and other essential services—the Columbia Association has become an important social and political outlet for residents.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Venous
Pulmonary
Digestive
Biliary
Urinary
Transfer Stop
Line Stop
Superior Vena Cava
Aorta
Right Lung
Left Lung
Pulmonary Artery
Upper Lobe
Right Bronchus
Pulmonary Vein
Middle Lobe
Lower Lobe
Left Atrium
Left Ventr.
Right Atrium
Right Ventricle
Heart
Pulmonary Artery
Upper Lobe
Left Bronchus
Pulmonary Vein
Lower Lobe
Inferior Vena Cava
Esophagus
Left Lobe
Liver
Celiac Trunk
Fundus
Stomach
Spleen
Right Lobe
Hepatic Vein
Corpus
Gall-bladder
Antrum
Portal Vein
Large Intestine
Pancreas
Mesenteric Arteries
Transverse Colon
Ascending Colon
Descending Colon
Renal Arteries
Renal Veins
Kidney
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Duodenum
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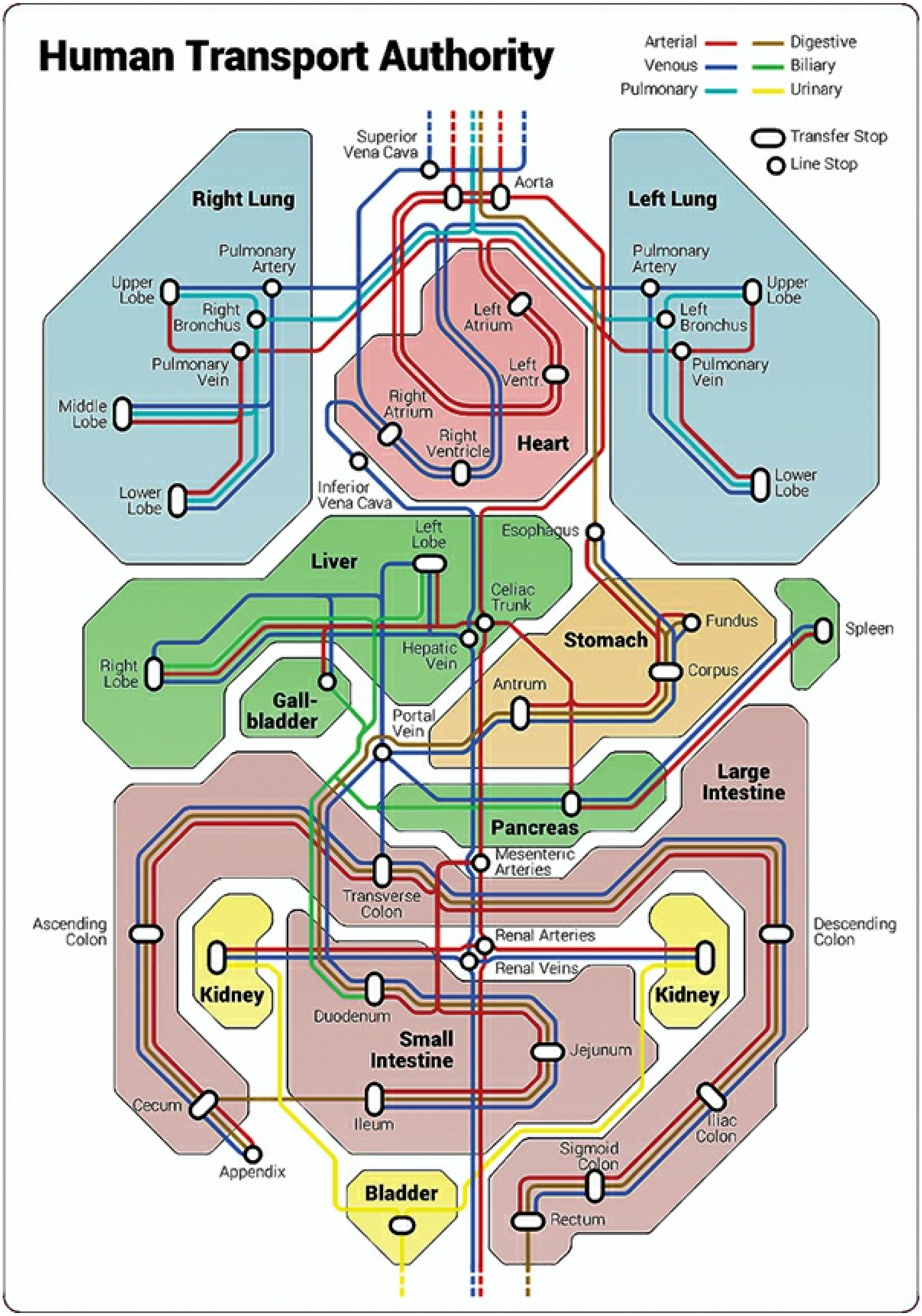
Cecum
Ileum
Iliac Colon
Appendix
Sigmoid Colon
Bladder
Rectum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Inferior Vena Cava
Esophagus
Liver
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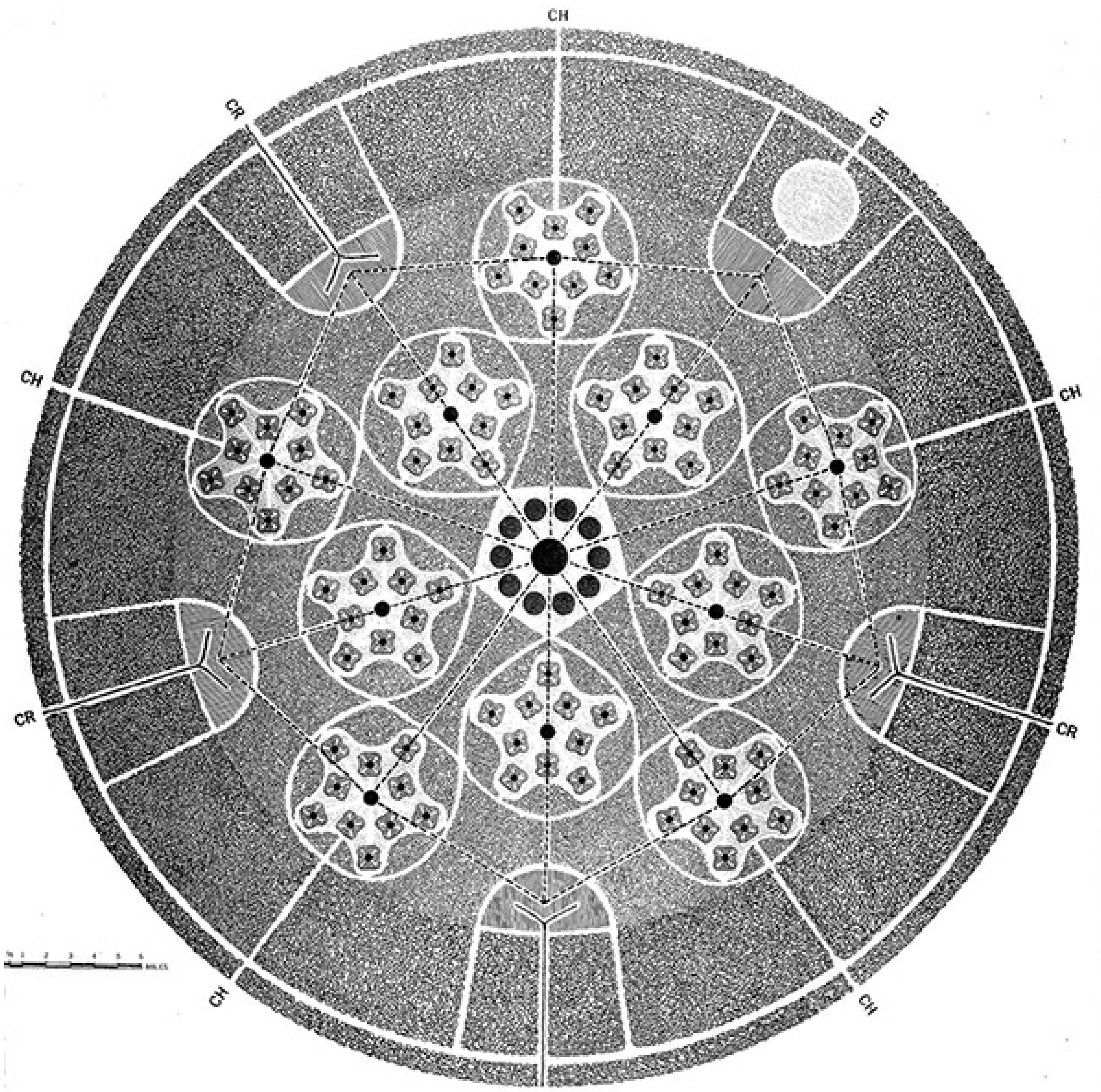
Celiac Trunk
Right Lobe
Hepatic Vein
Stomach
Fundus
Corpus
Spleen
Gall-bladder
Antrum
Portal Vein
Large Intestine
Pancreas
Mesenteric Arteries
Transverse Colon
Ascending Colon
Descending Colon
Kidney
Renal Arteries
Renal Veins
Kidney
Duodenum
Small Intestine
Jejunum
Cecum
Ileum
Iliac Colon
Sigmoid Colon
Appendix
Bladder
Rectum

40.6 Human cardiovascular system diagram.
(Jacob Larson)



40.7 Plan diagram for the perfect city.
(Victor Gruen)

Open spaces that separate neighborhoods can also serve important ecological functions, storing stormwater runoff, providing a habitat for wildlife, and maintaining patches of the original environment of the site.

They may be used for agriculture, growing fruits and vegetables for sale at farmers' markets or supermarkets, or for subscribers to a community-supported agriculture program. Creating small garden plots for residents will allow housing to be clustered more densely, creating a more walkable community. All of these functions may be seen at Prairie Crossing, and ecological community near Chicago.

At a totally different scale, on a site of 11.6 km2 (2,866 ac), the Sino-German Eco-Park near Qingdao, China is planned as a series of oval-shaped *pods* that accommodate dense clusters of housing with local services, industrial areas, a city center, and a university town. Green spaces separate the pods and contain the highways, arterial roads, and mass transit lines that connect one to another and link to the larger metropolitan region. While the individual pod plans are intended to be walkable, an important issue is whether they have enough of a critical mass to support the commercial and service uses desired by the residents. At Anting New Town outside of Shanghai, which was also arranged to emulate a small German town, it has proved difficult to attract major commercial tenants to the center of the largely residential gated area, leaving the shops in the town center empty and pedestrian spaces devoid of activity.

40.8

Original city plan of Reston, Virginia.
(Reston Development Corporation)

40.9

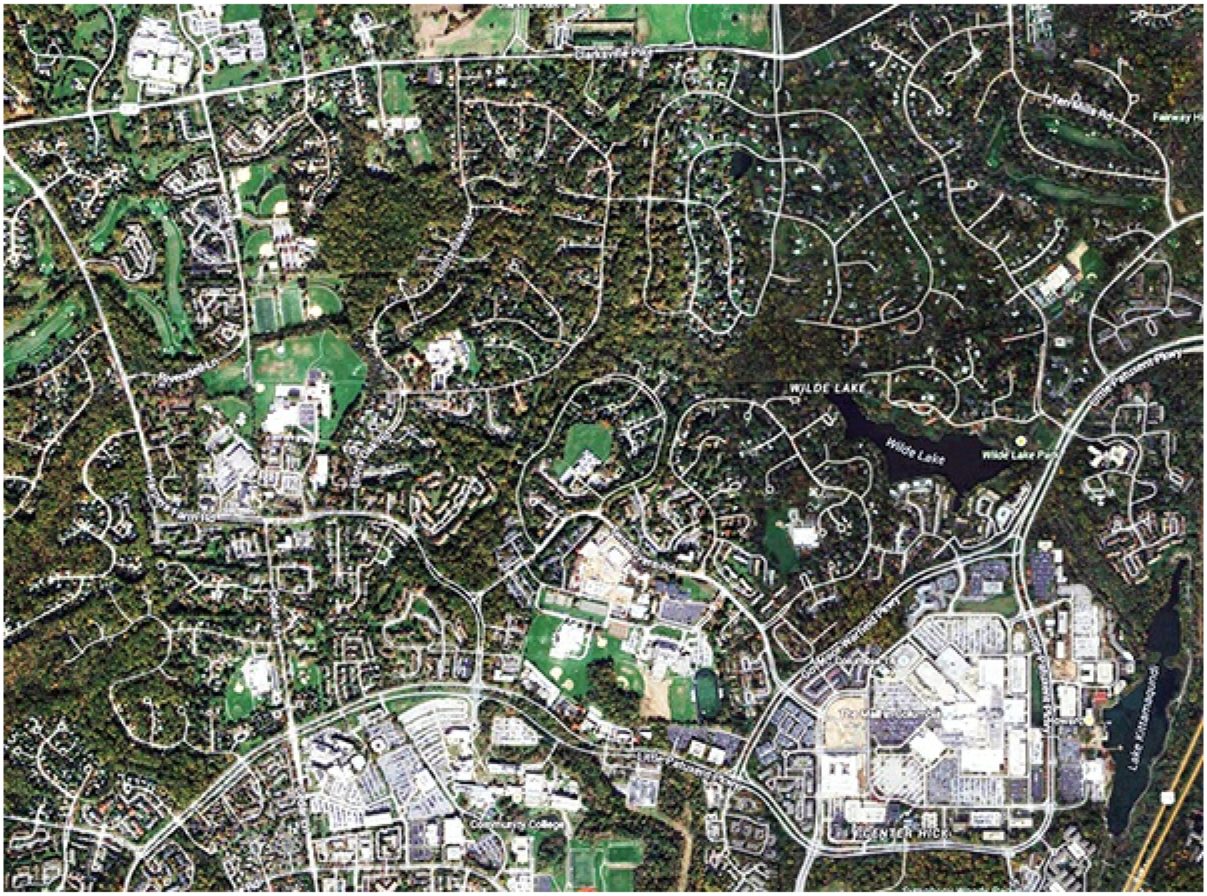
Lake Anne village center with housing over shops, Reston, Virginia.
(Gary Hack)

40.10

Residential area bordering on open space, Reston, Virginia.
(Gary Hack)

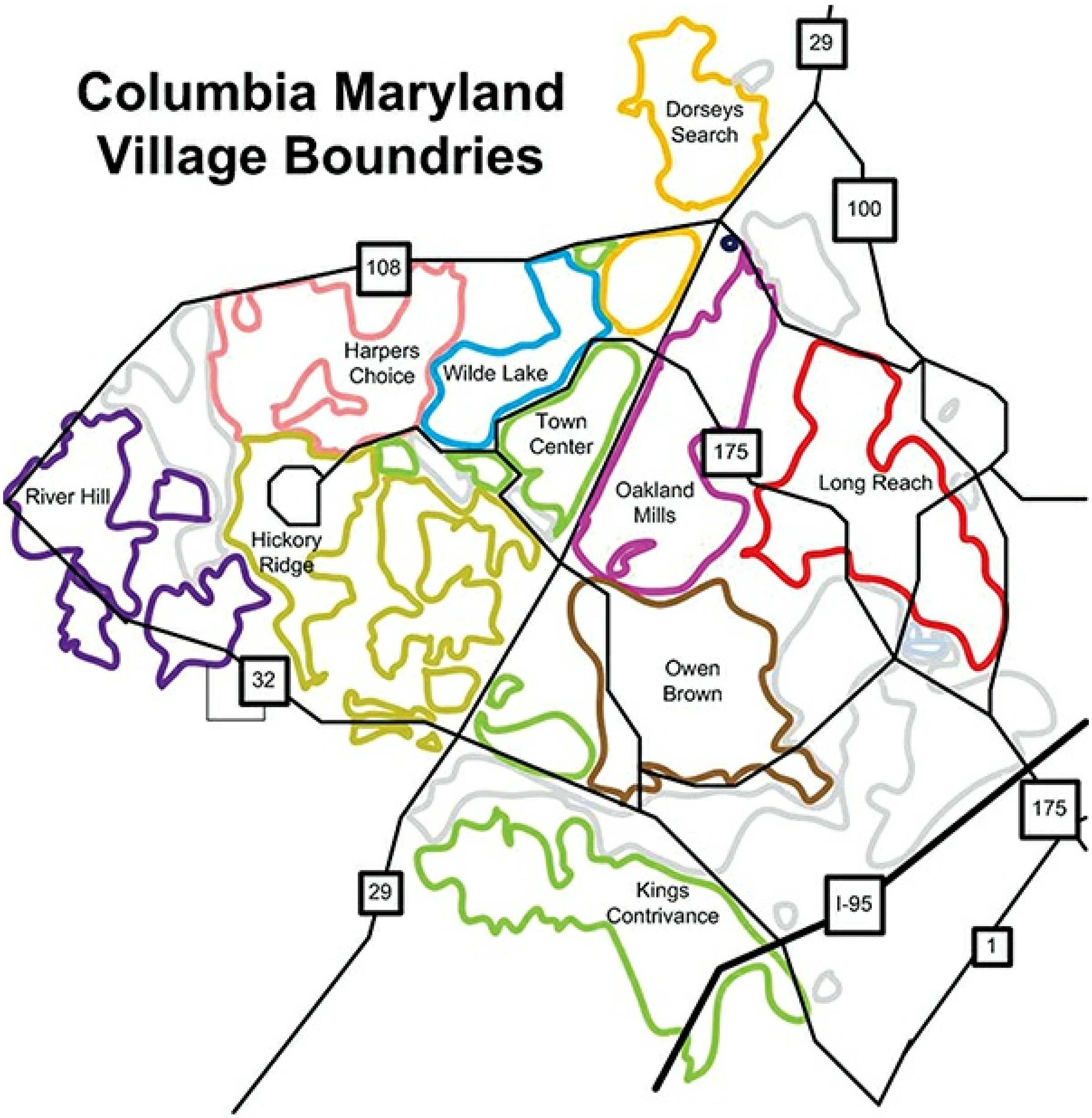
40.11

Reston city center street.
(Gary Hack)



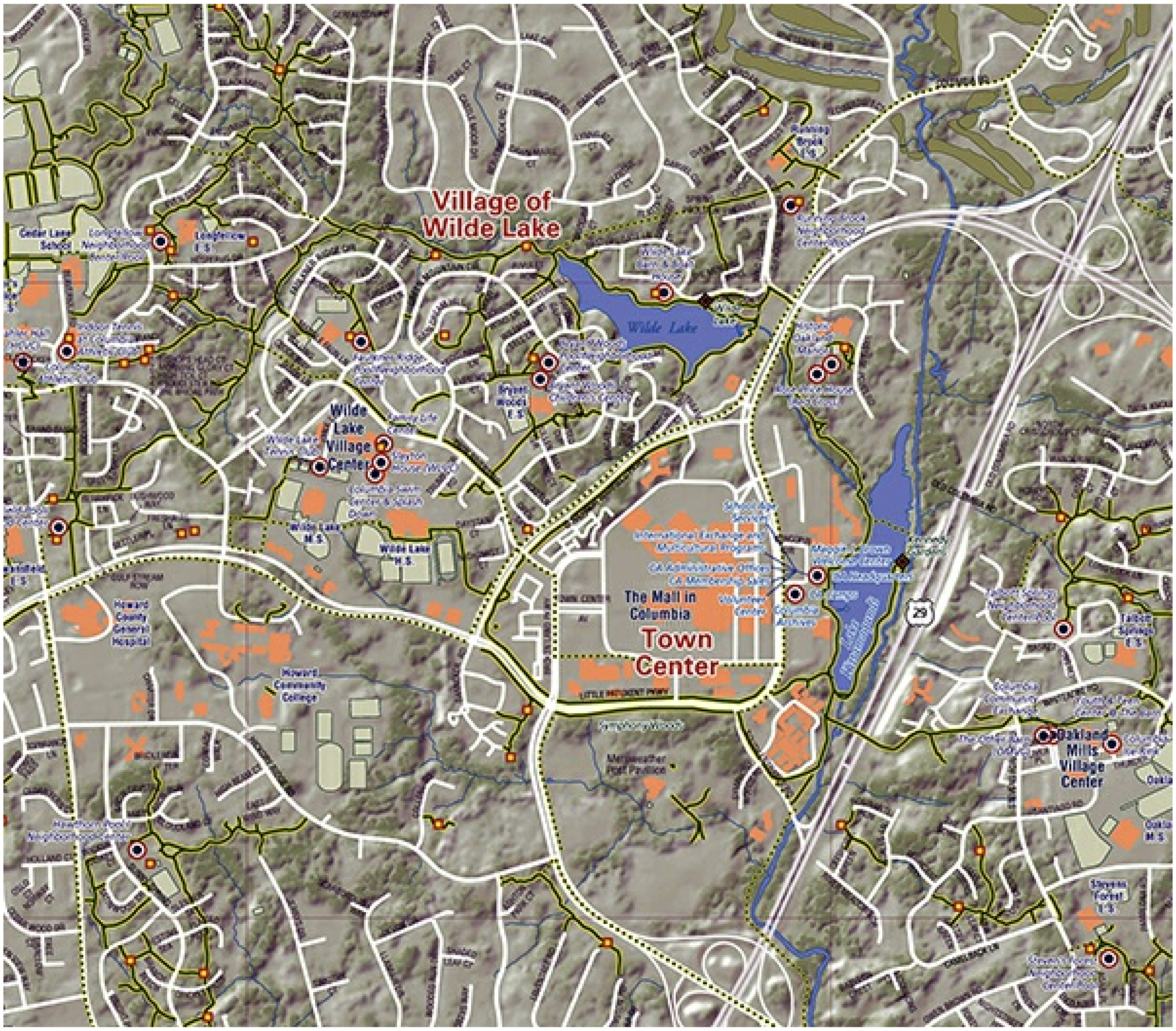
40.12

City Center and Wilde Lake Village, Columbia, Maryland.
(Google Earth)



Villages of Columbia

40.13 Neighborhood centers and key shared facilities, Columbia, Maryland.
(Courtesy of Columbia Association)



40.14

Map of Columbia Association facilities and bicycle paths, Columbia, Maryland.
(Courtesy of Columbia Association)

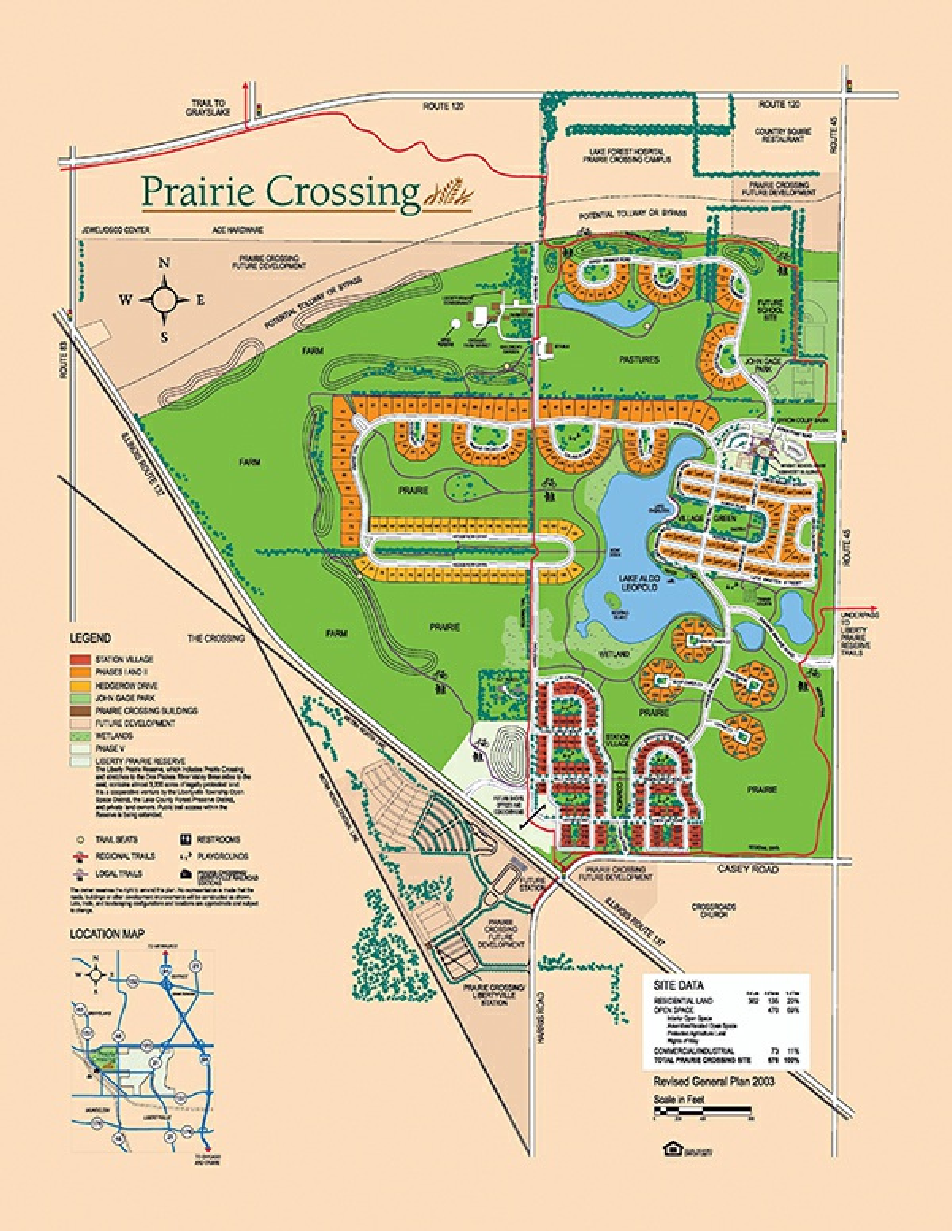
Sidebar 40.1

Prairie Crossing, Grayslake, Illinois

Located at the intersection of two major commuter rail lines, Prairie Crossing is an ecological community wonderfully endowed with open spaces and facilities. Over two-thirds of the site is dedicated to agriculture, recreation areas, and open prairie, reestablished on land that was farmed for generations. Osage orange hedgerows have been maintained and give structure to the site.

The open spaces integrate the site through their walking and cycling paths and varied activities. An organic farm, incubator farms, allotment gardens, educational farm programs, and rain gardens complement the lush natural prairie landscape.

Housing is grouped in a series of differentiated clusters ranging from 35 to 120 units, each with common internal open spaces. The design is Midwest US vernacular, and all houses are energy-efficient. Although lots are small, virtually every housing unit looks out on a large open space. A loop road connects the clusters and provides access to the surrounding arterial roads. Paved areas are minimized, and the site has zero net runoff.



40.15 Site plan, Prairie Crossing, Grayslake, Illinois.
(Courtesy of Prairie Holdings Corporation)

Commercial areas are grouped near the commuter rail station, which is walkable from many of the houses. Approximately 30% of residents currently commute to work by train, several times the local average. Future development in the area of the station will add local employment and region-serving retail uses.

A homeowners’ association is responsible for managing the open space, and several land trusts and nonprofit organizations are responsible for the farms and common facilities.

Location: Grayslake, Illinois, 65 km (40 mi) from Chicago

Site planners: William Johnson, Peter Calthorpe, Skidmore Owings and Merrill

Developer: Prairie Holdings Corporation, George Raney and Victoria Post Raney

Site area: 274 ha (678 ac)

Uses: 20% single-family housing (362 units); 11% mixed-use (113 units multifamily housing, commercial space, future employment areas); 69% open space (organic farms, meadows, lake, recreation areas, buffers)

Facilities: charter school, commuter rail stops (2), shops, medical clinic, fitness and recreation center, community facilities, garden plots, stables

40.16

Town Center viewed from Metra commuter rail station, Prairie Crossing.
(Gary Hack)

40.17
Lake Aldo Leopold and wetlands, Prairie Crossing.

(Gary Hack)

40.18
House bordering on prairie landscape, Prairie Crossing.

(Gary Hack)

40.19

Residential rain garden.
(Gary Hack)

40.20

Prairie Crossing Farm.

(Courtesy of Prairie Holdings Corporation)

40.21
Prairie Crossing community center.

(Gary Hack)

Despite its difficulties, the self-contained community has been widely used as an organizing idea for large-scale development. It need not be planned with curved streets and *organic forms*. Beginning in the 1970s, a prototypical 2 km (1.25 mi) square residential *superblock* was adopted as the basic unit of residential subdivision in Riyadh, and subsequently in much of Saudi Arabia. Organizing internal roadways in a pinwheel pattern minimizes the problems of through traffic. Larger blocks are included for open spaces and commercial uses near the center of each quadrant, and lot sizes are varied to allow for higher-density development along all 30 m (100 ft) rights-of-way. As in other locations, the prototype overestimated the amount of commercial space that could be supported locally by underestimating the growing popularity of large shopping centers, with the

result that many commercial sites have been left vacant. Some have been converted to playgrounds, and others remain as flex space for the future.

40.22 Sino-German Eco-Park, master plan, Qingdao, China.
(Courtesy of GMP Architekten)

40.23 Sino-German Eco-Park, first-phase development, Qingdao, China.
(Courtesy of GMP Architekten)

40.24 Anting New Town master plan, Shanghai, China.
(Albert Speer & Partner GmbH)

A hierarchical roadway pattern is an essential component of the organic model for organizing communities. At the neighborhood level, local streets are kept discontinuous, making through traffic difficult. Collector roads gather the traffic and channel it to arterial roads, which usually have green space buffers, as in Columbia, or sometimes have commercial uses accessible from them. Arterial roads or highways or expressways link the community to the larger city. Major roadways become the edges of

individual neighborhoods, often in tandem with a matrix of open spaces. Ironically, noisy roadways frequently occupy the quiet open spaces.

The organic-hierarchical model has largely dominated thought about how to organize large-scale communities since the invention of the garden city. The best older cities, however, are not structured so neatly. They evolve over time with layers of uses and facilities, changing as new groups inhabit a neighborhood, as shops arrive and leave and institutions are created and abandoned. As Christopher Alexander has famously asserted, “the city is not a tree” (Alexander 1965).

Consider the Glebe neighborhood in Ottawa, Canada, not far from downtown and Parliament Hill. Planned in the early twentieth century, the district is organized orthogonally, with green space around its perimeter and fingers of open space penetrating the neighborhood along historic creeks. A grid of residential streets and blocks runs in an east-west direction, each catering to a different housing type and price range. This allows residents to cluster along a street with others like themselves, but the full diversity of the neighborhood is evident when one walks across the grain of streets, from modest row houses to large single-family houses. Running north-south is Bank Street, the neighborhood’s shopping street and the location of public transit, within an easy 5–10-minute walk for all. And a chain of important local institutions—houses of worship, elementary schools, a tennis club, and small parks—are aligned on the quieter north-south streets in the middle of the neighborhood. The Glebe has been an attractive neighborhood for more than a century because it offers a matrix of opportunities to a diverse set of residents, and is organized in a legible way.

40.25 Typical neighborhood unit, Riyadh, Saudi Arabia.
(Google Earth)

If an organic metaphor isn't the best way to conceptualize a city, what else is? Alexander has suggested that a better model of the good city is that of a *semilattice*, in which there is a complex set of relationships between neighborhoods, subcenters, and centers in the larger city. Translated into spatial form, the city is conceived of as a network of opportunities, with a transportation system (for pedestrians, cyclists, vehicles, and mass transit) providing access to a diverse set of choices. The form of the neighborhood does not predetermine social groupings, but enables the social relationships that develop spontaneously.

40.26 Aerial view of the Glebe neighborhood, Ottawa, Canada.

(Google Earth)

40.27 Semidetached houses in the Glebe, Ottawa.
(Gary Hack)

40.28 Single detached houses in the Glebe, Ottawa.
(Gary Hack)

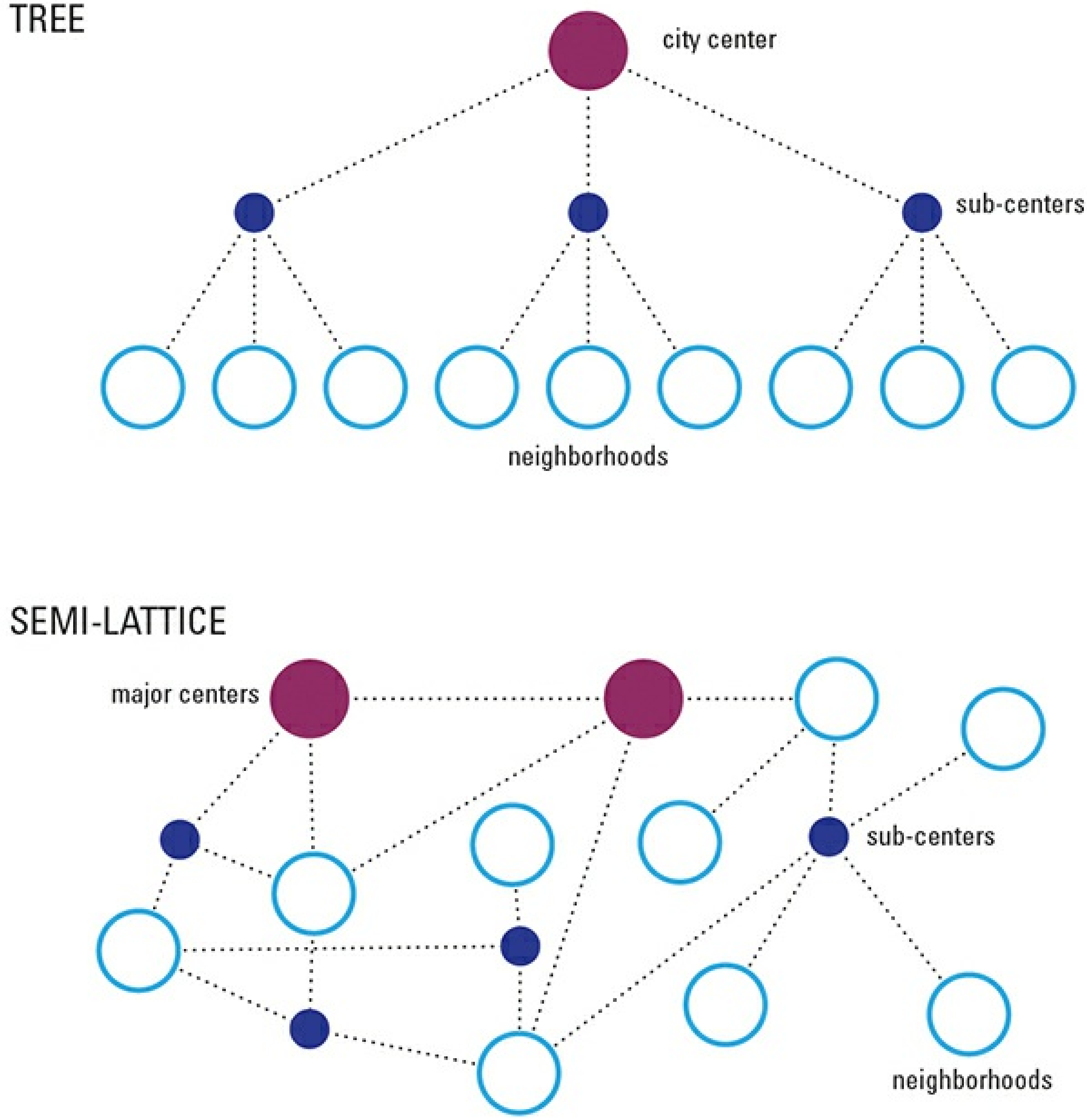
40.29 Bank Street shopping area, the Glebe, Ottawa.

(Gary Hack)

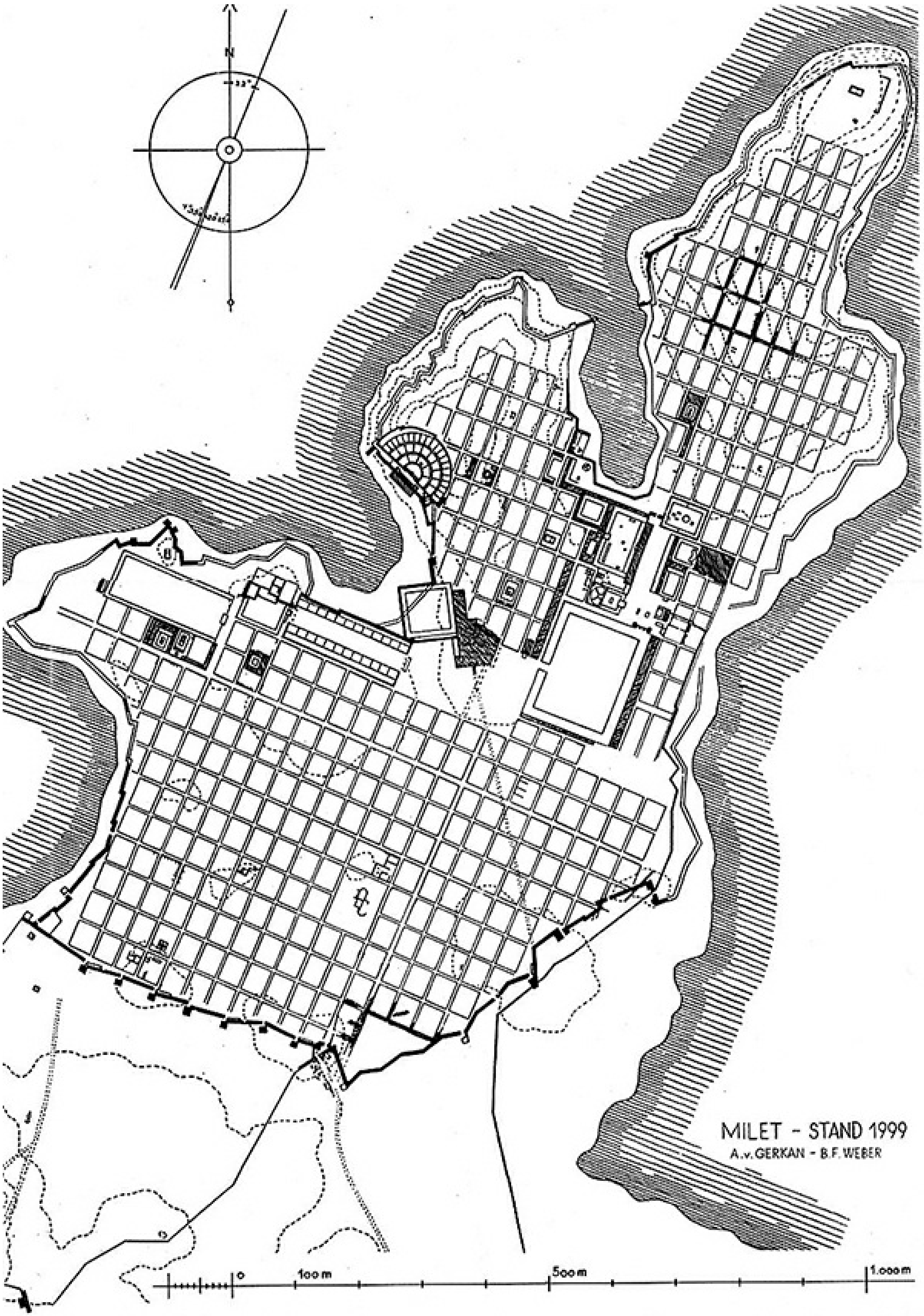
40.30 St James Tennis Club and Glebe Community Center in winter, Ottawa.
(Courtesy of the St James Tennis Club)

One time-proven form for this kind of city is the gridiron plan, as in the Glebe. Towns built in a grid pattern date to antiquity: Miletus in Anatolia, based on the grid invented by the architect Hippodamus in the fifth century BC, and Chang An (now Xi'an) in China, which reached its height of one million residents in 750 AD, were planned grid cities. French bastide towns of the twelfth century and Florentine new towns two centuries later used grids as their structuring devices. Savannah, Georgia, one of the finest colonial cities in the US, follows a regular grid pattern, although its charm is not a result of regularity but of how the pattern is broken by green squares introduced into the grid. Most Spanish towns in the Americas were laid out with a grid of square blocks, and these remain at the center of many contemporary cities.In the mid-nineteenth century, the new towns established along the expanding network of railroads in the US and Canada adopted a regular orthogonal pattern keyed to the Northwest Survey (US) and Dominion Land Survey (Canada). Surveyors laid out the entire land

area of the continent as a mile (1.6 km) square grid, dividing it into quadrants for easy distribution of the land. In Chicago and many other cities, the one-mile grid was further subdivided into 16 blocks in one direction and 8 blocks in the other (although in some areas the pattern of long and short blocks reverses each half mile). Allowing for rights-of-way of 50 ft (15 m) for streets, 25 ft (7.5 m) for rear alleys, and 80 ft (25 m) and 100 ft (30 m) on the half-mile and mile arterial roads, the resulting building blocks are 125 ft (38 m) deep by 600 ft (183 m) long. These dimensions have become the standard for many American gridiron cities. And the residential block with 8–12 houses (50–75 ft or 15–23 m lot widths) on each side of the street has become the typical social module for the traditional city. Shops and streetcars located on the mile or half-mile arterial streets are typically no more than a 10-minute walk from any home.



40.31 Tree versus semilattice organization.
(Adam Tecza)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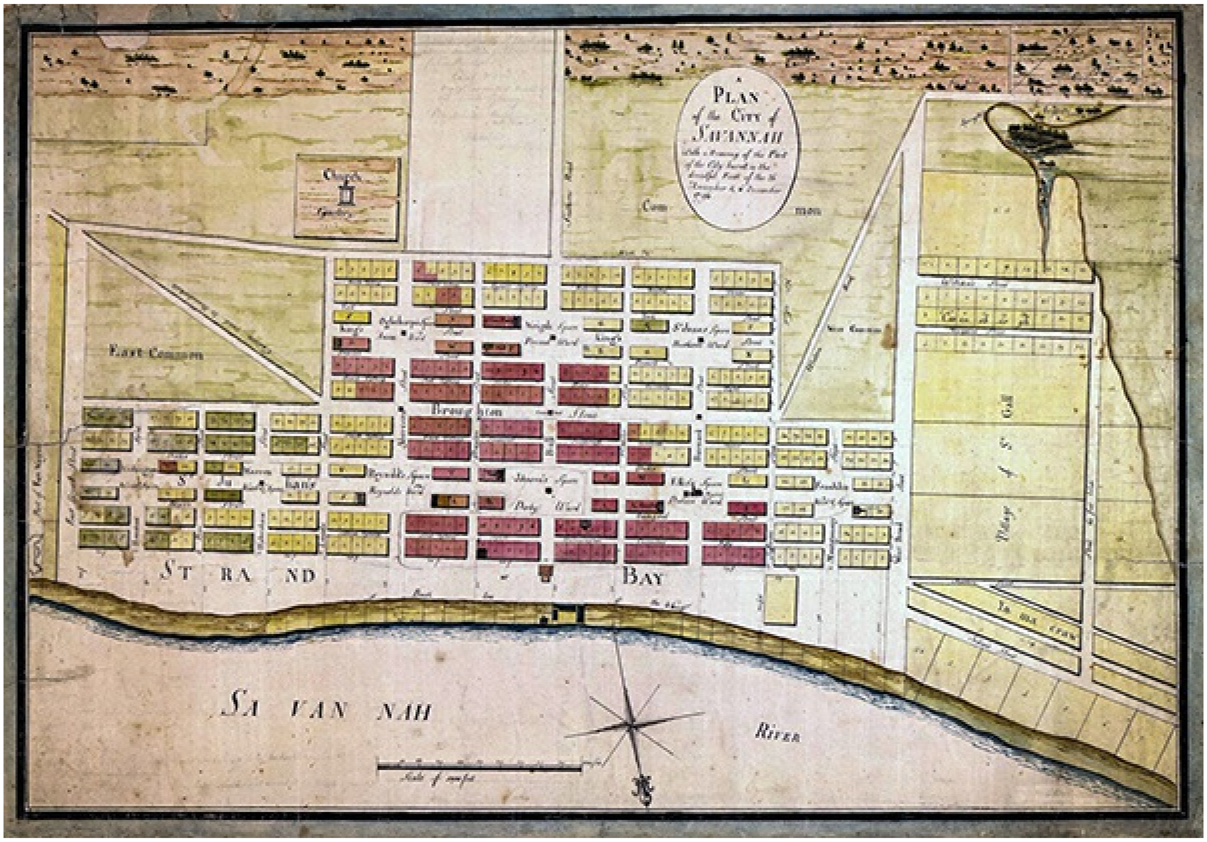
40.32 Miletus, Anatolia, planned in the fifth century BC.

(A. van Gerken/B. F. Weber)



40.33 Plan of Savannah, Georgia in 1796.
(City of Savannah)

Orthogonal block patterns have seen a revival in many of the recent new urbanist developments of the US. Streets are minimized in width, and lots for housing are narrower than the norm, taking advantage of alleyways that provide access to garages. In some instances, alleyways have become the main access routes, with fronts of houses facing on green pedestrian areas. With higher densities than typical suburban subdivisions, walking is encouraged, and communities are planned to ensure that there are shops, schools, and other destinations within easy range. A good example of this approach may be found in the new Robert Mueller Community being developed on the site of a former airport in Austin, Texas. A new medical

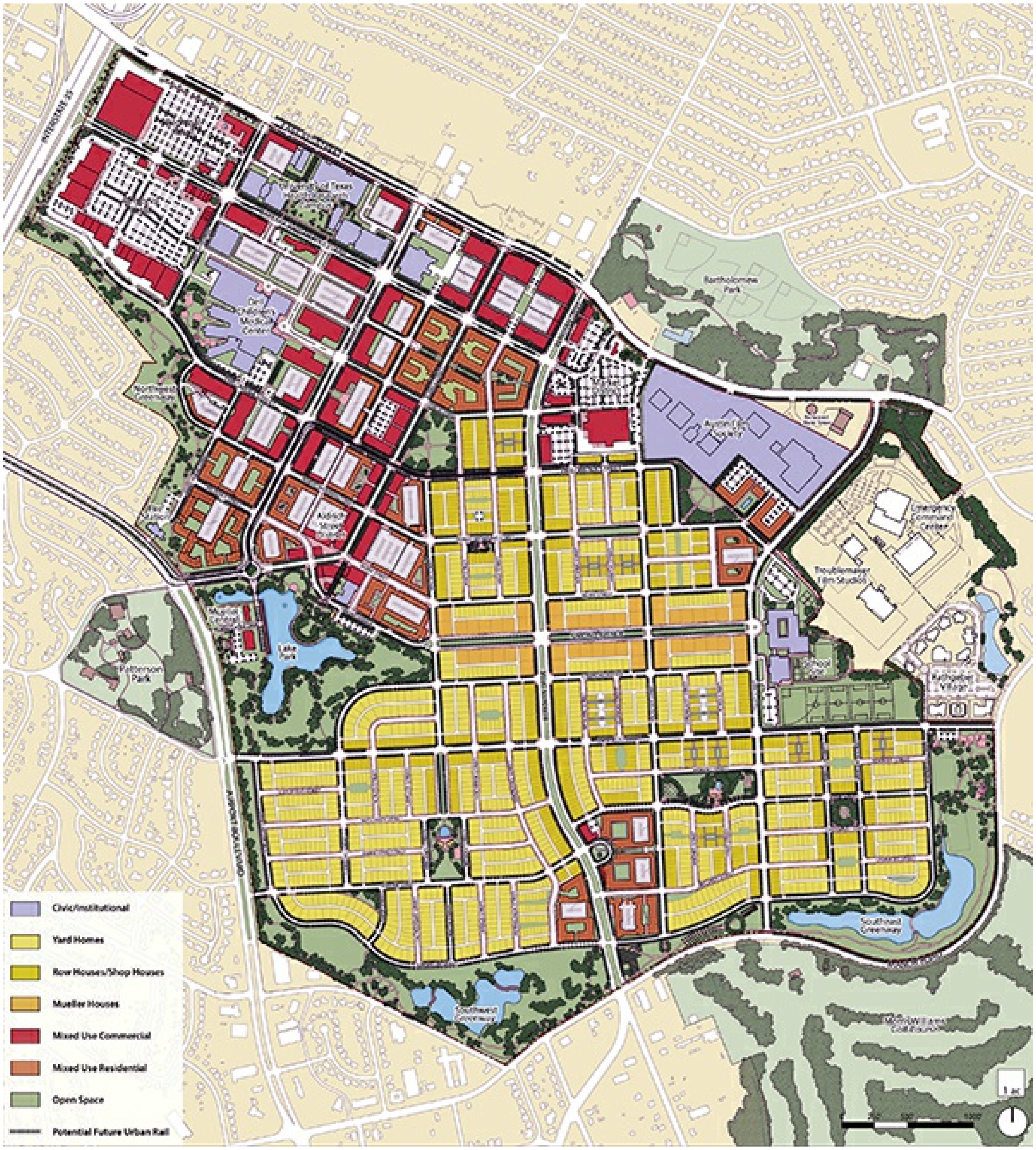
center anchors the area, along with offices, a range of commercial uses, schools, a variety of low-rise housing types, and active and passive recreation. It has become a new town, in town.

While land surveyors and real estate promoters were behind the grid cities of North America, in Europe engineers and architects searched for the ideal form of blocks and streets from a social and economic perspective. Ildefons Cerdà's 1859 plan for the expansion of Barcelona, l'Eixample, had broad influence on urban development plans in Europe and beyond. Designed to ensure light and air for all buildings, the grid is oriented at 45° from north-south, which means that all facades receive direct sunlight in the summer and winter. The blocks, or *manzanas* (illes in Catalan), are 113.3 m (372 ft) on a side, with corners chamfered (chaflanes) to assure smooth flow of traffic and provide enlarged public spaces at the intersections. Regular streets were 20 m (66 ft) wide, with the Gran Via at 50 m (165 ft) and Passeig de Gràcia as much as 60 m (197 ft). Development controls limited the heights of structures to 6–8 stories, and at least 800 m2 (8,600 sq ft) was reserved in the center of each block for gardens. While the street pattern is uniform, the development of l'Eixample has become a rich array of imaginative buildings, and continues to be renewed with innovative modern structures that continue to observe the development envelope. Some central spaces have been dedicated to parking, with larger green spaces on top. Through good and bad times, l'Eixample has remained Barcelona's prime residential area.

40.34 Square mile module of development, with four quadrants, Chicago.
(Google Earth)

It comes as no surprise that when Barcelona prepared for the 1992 Olympics, it chose to construct a modern version of l'Eixample for its Olympic Village. Replacing obsolete industrial areas and railway yards, 19 new blocks were created for housing, commercial uses, shops, and schools. The network of roadways continues the historical grid, and the block size is similar to the nineteenth-century plan, although adapted to account for remaining rail lines, major roadways, and other infrastructure. However, there are subtle differences in how the blocks are used, and a hierarchy of streets has been introduced. Major streets are lined with 6-story housing

with commerce on the ground level, with occasional offices and hotels interspersed. Since many of the northwest-southeast streets dead-end at the waterfront park, they are less critical as movement channels, and have been reduced in size and importance. Lower-density forms of housing, schools, and institutions have been located in the centers of blocks, along with open spaces and recreation areas. In several locations, structures span the minor streets, adding to the developable area and reinforcing the continuity of the main streets. All of these moves add richness to the texture and activities of the area and reflect the functions of a modern city.



40.35 Robert Mueller Community plan, Austin, Texas.
(Courtesy of McCann Adams Studio/Catellus Austin, LLC)

40.36 Mixed-use development in town center, Robert Mueller Community, Austin.
(City of Austin)

40.37 Single-family homes, Robert Mueller Community, Austin.
(Garreth Wilcock, David Weekley Solar Home/Creative Commons)

The Mueller community and Barcelona's Olympic Village provide networks of opportunities block by block for modest-sized developments. But it is also possible to apply this idea to larger-scaled developments. The UK's last planned new city, Milton Keynes, is such a network city, providing for a rich mixture of activities and uses in every corner of the settlement. Three elements form the main structure of the city: a roadway network based on a 1 km square grid that provides accessibility across the site; green space corridors that follow the two main rivers on the site and cut across the grid; and a central zone that has been reserved for commercial and service uses.

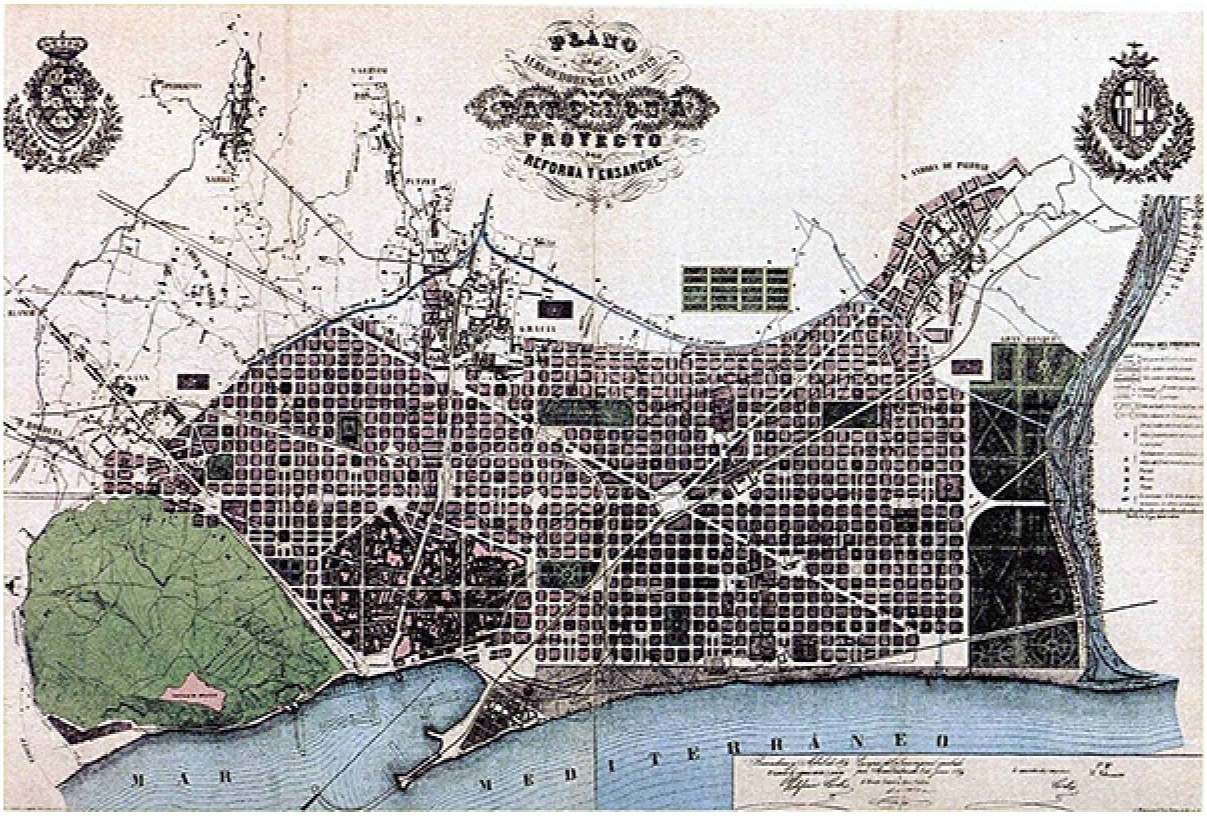
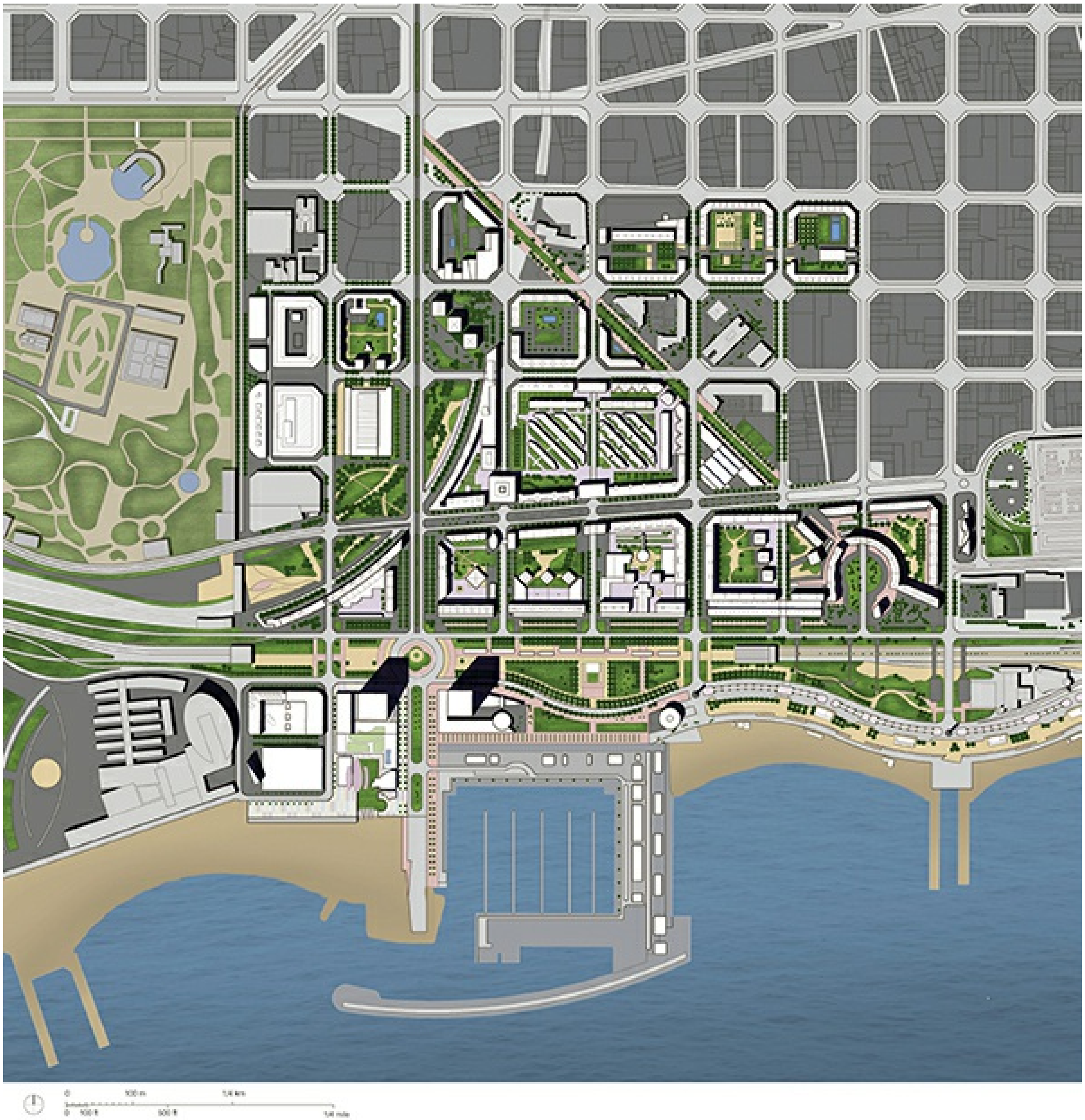


Figure 40.38
Plan for l’Eixample, Barcelona, Spain, by Ildefons Cerdà, 1869.

Figure 40.39
Aerial view, l’Eixample, Barcelona.

(© Iakov Filimonov/dreamstime.com)



40.40
Plan, Olympic Village community, Barcelona.

(Adam Tecza)

40.41
Paseo, Olympic Village community, Barcelona.

(Gary Hack)

40.42
Housing fronting on park, Olympic Village community, Barcelona.

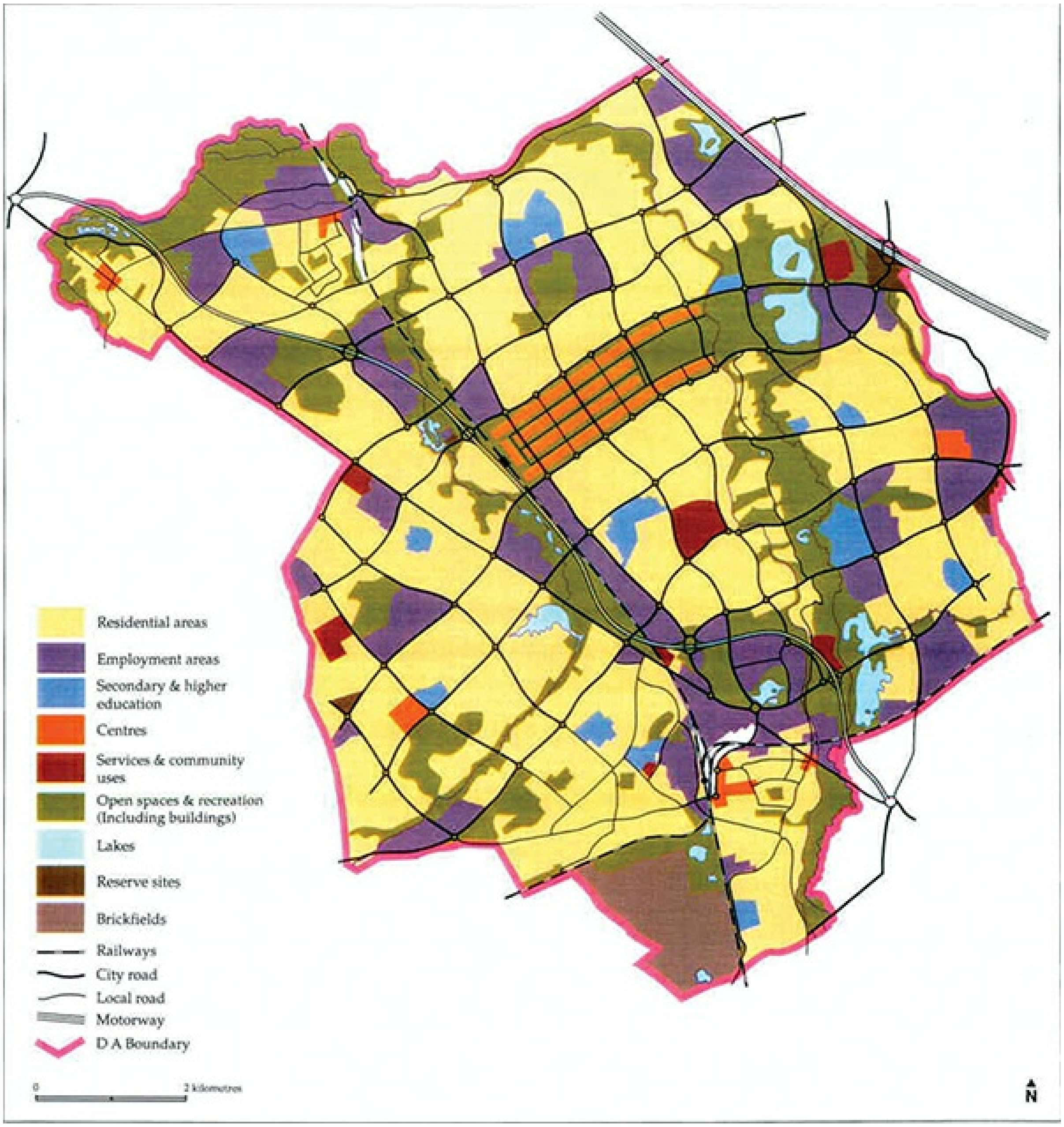
(Gary Hack)

40.43
Minor street, Olympic Village community, Barcelona.

(Gary Hack)

40.44
Internal space within block, Olympic Village community, Barcelona.

(Gary Hack)



40.45 Plan for Milton Keynes new town, UK, 1989.
(Lewellyn-Davies Associates)

The subtleties of the Milton Keynes plan are important. The roadway grid is deliberately distorted to account for changes in topography and natural form, and to avoid impacts on several small preexisting villages. Each development cell is developed as a unique response to its site, location, and market at the time of development. The plans for the cells

generally avoid crosscutting traffic, and pedestrians can get to each of the four adjacent areas via underpasses. The underpass locations are also the preferred sites for shops, schools, and other uses that serve larger areas than a single cell. Cells are joined in the city center to accommodate the large commercial complex, but blocks in the center are also subdivided to increase the frontages for commercial and office uses. Industry and office workplaces are distributed across the city rather than concentrated in one area, to allow traffic to also be distributed throughout the day. Most of the 1989 plan has been developed, with 250,000 residents and an almost equal number of employees today. There is a great deal of variation from cell to cell in pattern and amenities, just as intended. Milton Keynes is an icon of new community development, considered by many the greatest success of the UK's new town program.

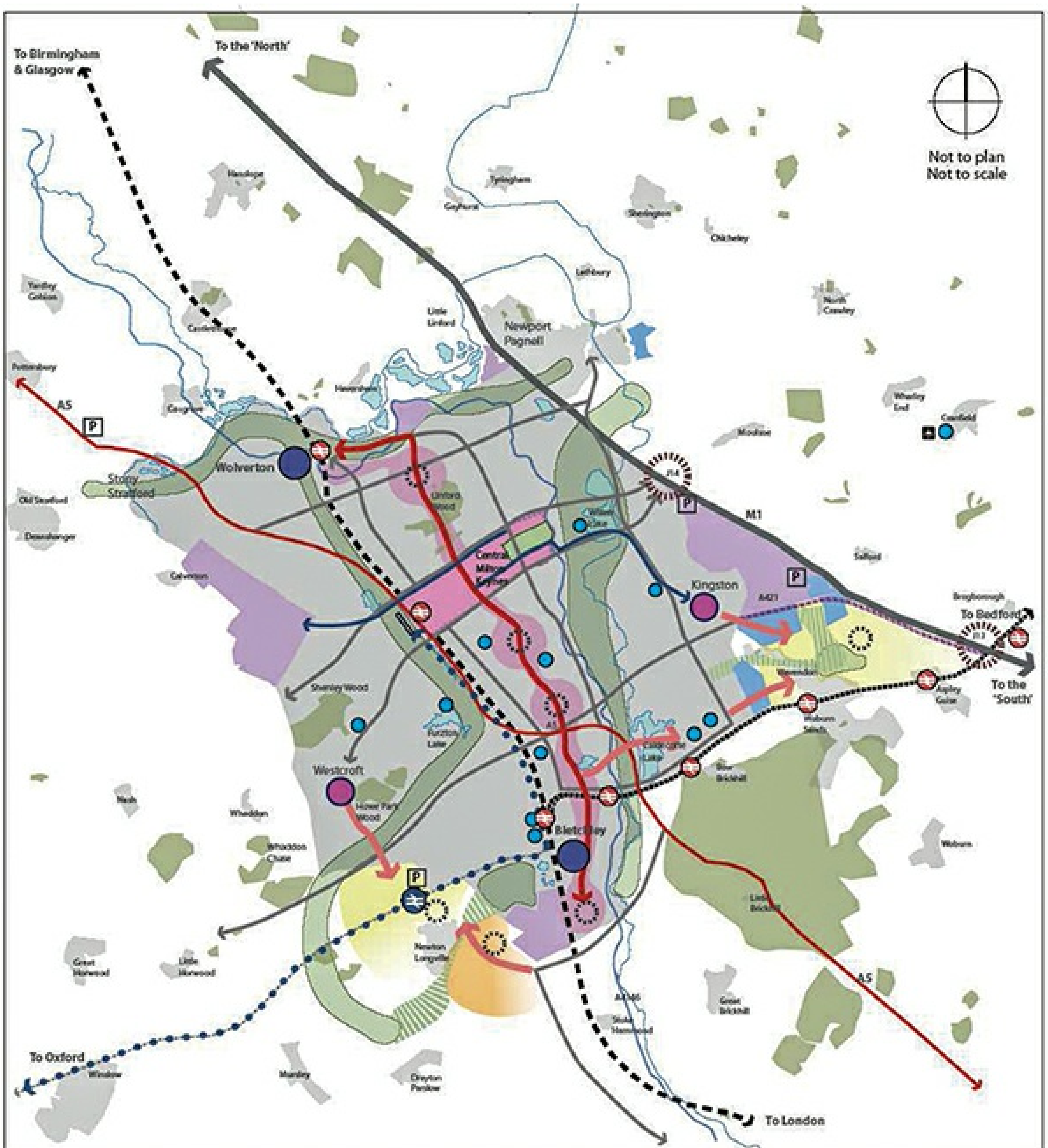
However, the city is not without its flaws. Notably, the grid does not make it easy to provide public transit because of the dispersed pattern of destinations and lack of separate transit rights-of-way. Bus service, operating on the grid roads, has been provided to the city center, railroad station, and some of the employment centers, but the many roundabouts and increasing congestion on some of the roadways compromise its efficiency. While there are many traffic-free pedestrian and cycle routes throughout the city, the underpasses below the main roads are dreary and often avoided by residents out of safety concerns. Densities are now considered too low in many of the cells, and both vacant and underdeveloped sites are being considered for a major expansion of the resident population. A new plan has been prepared for Milton Keynes, looking forward to 2031, which proposes higher-density sites for additional employment and residential construction, and the prospect of a fixed mass transit system. Plans are also afoot to introduce driverless vehicles on demand-responsive routes, which may take optimal advantage of the dispersed road system.

Rapid urbanization in Asian cities has led to a similar strategy of creating a network of arterial roads 0.5–1 km apart defining parcels for

development, areas to be reserved for schools and institutions, and lands devoted to parks and open spaces. Superficially, this resembles the Milton Keynes approach, or even the older North American land development strategy. The Qunli community in Harbin, China is an example of this strategy. While there are a number of exemplary projects in Qunli, including two wetlands parks that serve as a sponge for runoff, it also illustrates that not every grid plan is an effective network of opportunities. Wide arterial roads serve as separators rather than connective tissue, and there are few active uses along them to encourage walking. Shopping areas have been constructed as independent projects, surrounded by parking and wide roadways, discouraging pedestrians. Generally each residential parcel is designed as a freestanding project, usually gated to prevent outsiders from passing through. And public spaces—parks, boulevards, cultural institutions—while creatively designed, are independent destinations rather than spaces used during daily routines.

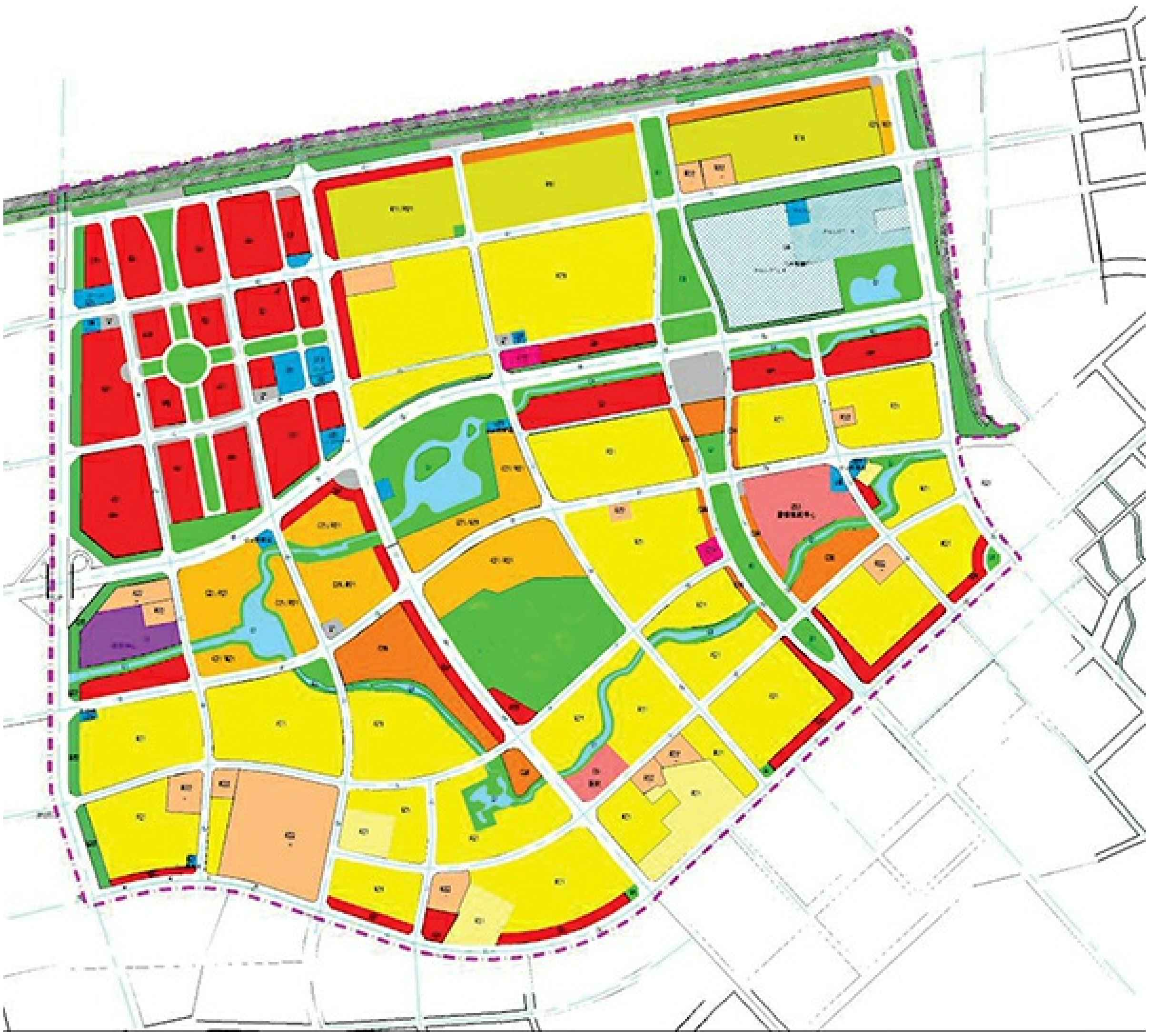
The lesson for site planners from Qunli is that planning for infrastructure and parcels is not enough to ensure that a development meets the aspiration of becoming a fine community. The scale of roadways, the bordering uses along sidewalks and parks, and the distinctions between public and private realms will ultimately determine how a community functions and the opportunities for human interaction. The site planner’s job does not end upon completion of the development plan.

40.46 Aerial view illustrating variation within the grid in 2012, Milton Keynes.
(Google Earth)



05. Making the connections

40.47 Plan for 2031, Milton Keynes.
(Milton Keynes Commission)



40.48 Plan for the Qunli community, Harbin, China.
(Courtesy of Turenscape)

40.49 Aerial view of development in 2012, Qunli community, Harbin.
(Google Earth)

40.50 View of Yuyang wetland park, Qunli community, Harbin.
(© loveharbin/dreamstime.com)

40.51 Shopping center along central spine, Qunli community, Harbin.
(Gary Hack)

40.52 Gated residential areas, Qunli community, Harbin.
(Gary Hack)

40.53 Central spine of Qunli community, Harbin.
(Gary Hack)

Sustainable Communities

The terms “sustainable” and “eco” have become the obligatory adjectives for current new communities. However, planning and building large-scale developments that are truly resilient, that reduce carbon emissions and diminish our dependence on nonrenewable resources, is a challenging assignment. It requires significant initial investment in technologies that

will be earned back over time, a market that is receptive to new ways of living, and changes in human attitudes and behavior. Only a few recently built communities have achieved these goals.

Start with the most important objectives:

Reducing carbon emissions directly attributable to the community—in its construction and operation, and as individuals live in the community. Among the large variables are fuels used for heating and electricity generation, the amount of energy used for mobility, the operation of public water and sewer systems, and maintenance of the public realm.

Lowering energy consumption by reducing the dependence on private automobiles, by encouraging walking, cycling, use of mass transit and shared vehicles. Movement is an *induced demand* that can be reduced by locating housing, shopping, and workplaces in closer proximity, and by increasing densities.

Creating energy from renewable and low-carbon sources on the site, such as solar, wind, and waste energy from industrial and building sources.

Reducing, reusing, and recycling disposable materials, both inorganic and organic. Creating closed loops of energy and materials on the site is one strategy.

Retaining, treating, and reusing rainwater and wastewater on the site. Water is too valuable to be used only once, and can be too destructive when discharged into streams after major storm events. Exporting runoff simply shifts the problems to others.

Protecting the community from severe weather events, sea level rise, and extreme droughts, landslide hazards, forest fires, and flooding. Mitigating the expected 2.5°C (5°F) temperature rise and heat island effects.

Maintaining and extending the capacity of natural systems to absorb water, filter it, recharge the groundwater, and support terrestrial and marine life, even in the face of greater climate extremes.

Other objectives, which may not seem directly relevant, can have important impacts on the sustainability of a community. An example is providing a diverse supply of housing for a broad band of incomes and ages. Segregating communities can increase the need for travel and make walking destinations less desirable.

A meaningful set of objectives must be accompanied by *metrics*—as the saying goes, if you can't measure, you can't manage things. Some metrics are obvious: the amount of energy consumed per capita, the amount of energy produced on the site, the vehicle miles traveled in private automobiles per capita, water use per capita, the rate of recycling, the amount of food produced locally, and so on (see chapter 18). But other metrics are more qualitative and can only be scored in relative terms. A community's participation in the maintenance of its public realm is an example, as is local membership in social organizations, both of which are important to the social capital that will be required in times of emergency.

The Tianjin Eco-City (formerly the Sino-Singapore Eco-City) set down 26 quantitative and qualitative indicators to guide its development efforts and to be used as measures of progress. The new community will ultimately house 350,000 residents on its 30 km2 (11.6 sq mi) site and provide an environment for technologically sophisticated industries. It is being built on land that is largely reclaimed from the sea, having been used as salt evaporation ponds for many years. The plan includes extensive restoration of wetlands and the construction of a new natural environment that will buffer the city. While one of the project's objectives is to have no net loss of wetlands, in reality the issue is constructing wetlands that are sustainable in the future in a densely packed environment. A mass transit system will connect a series of five new centers with a high-density mix of employment uses and housing. The roadway network is largely a grid pattern, with individual blocks housing gated compounds, much as in the Qinli community discussed earlier. Massive solar arrays have been installed along the edges of major roadways, a solution that provides a noise barrier while generating a significant amount of energy.

A close look at the indicators for Tianjin Eco-City suggests that they are extremely ambitious—90% of the trips are to be green trips; water consumption levels are to be well below those of typical new developments, and the proposed waste generation and recycling rates are also a stretch, as examples. Unfortunately, the infrastructure and first-phase development patterns for the city do not match these expectations. Wide arterial roadways, which conform to national norms, encourage private auto use, and gated communities with no street presence discourage walking. There is little evidence that people moving to the eco-city are willing to part with their vehicles, and the delay in creating mass transit systems has made private automobiles obligatory. Generous landscaped areas require large quantities of water for irrigation, and few of the landscape patterns rely on natural runoff. These contradictions highlight the importance of implementation if sustainability targets are to be met. An ecological community requires residents to adopt habits that are conservation-minded.

An older eco-community in the Netherlands demonstrates how important it is for residents to share a commitment to an ecologically attuned lifestyle. At the Lanxmeer community in Culemborg, near Utrecht, a core of prospective residents participated in the design of their community, gaining a consensus on the life patterns they would accept to live a sustainable lifestyle. On a site that once was kept undeveloped to protect water quality for the city's wells, the residents and planners agreed that the essential natural systems should remain undisturbed. All rainwater would be maintained on the site and purified by natural processes so that its quality was high enough for recreation use. An orchard would be preserved to provide fruits for the community, and areas would be set aside for residents to keep chickens and domesticated animals.

Sidebar 40.2

Key Performance Indicators (KPIs) for Sino-Singapore Tianjin Eco-City, Tianjin, China

Quantitative KPIs

(1) Good natural environment

KPI 1: Ambient air quality

The air quality in the Eco-city should meet at least China's National Ambient Air Quality Grade II Standard for at least 310 days. The SO2 and NOX content in the ambient air should not exceed the limits stipulated for China's National Ambient Air Quality Grade 1 standard for at least 155 days.

KPI 2: Quality of water bodies within the Eco-city

Water bodies in the Eco-city should meet Grade IV of China's latest national standards by 2020.

KPI 3: Quality of water from taps

Water from all taps should be potable.

KPI 4: Noise pollution levels

Noise levels must fully comply with China's standards for environmental noise in urban areas.

KPI 5: Carbon emission per unit GDP

The carbon emission per unit GDP in the Eco-city should not exceed 150 tonnes C per US$1 million.

KPI 6: Net loss of natural wetlands

There should be no net loss of natural wetlands in the Eco-city.

(2) Healthy balance in the man-made environment

KPI 7: Proportion of green buildings

All buildings in the Eco-city should meet green building standards.

KPI 8: Native vegetation index

At least 70% of the plant varieties in the Eco-city should be native

plants/vegetation.

KPI 9: Per capita public green space

The public green space should be at least 12 square meters per person by 2013.

(3) Good lifestyle habits

KPI 10: Per capita daily water consumption

The daily water consumption per day each person should not exceed 120 liters by 2013.

KPI 11: Per capita daily domestic waste generation

The amount of domestic waste generated by each person should not exceed 0.8 kg by 2013.

KPI 12: Proportion of green trips

At least 90% of trips within the Eco-city should be in the form of green trips by 2020. Green trips refer to nonmotorized transport, i.e., cycling and walking, as well as trips on public transport.

KPI 13: Overall recycling rate

At least 60% of total waste should be recycled by 2013.

KPI 14: Access to free recreational and sports amenities

All residential areas in the Eco-city should have access to free recreational and sports amenities within a walking distance of 500 m by 2013.

KPI 15: Waste treatment

All hazardous and domestic waste in the Eco-city should be rendered nontoxic through treatment.

KPI 16: Barrier-free accessibility

The Eco-city should have 100% barrier-free access.

KPI 17: Services network coverage

The entire Eco-city will have access to key infrastructure services, such as recycled water, gas, broadband, electricity, and heating, by 2013.

KPI 18: Proportion of affordable public housing

At least 20% of housing in the Eco-city will be in the form of subsidized public housing by 2013.

(4) Developing a dynamic and efficient economy

KPI 19: Use of renewable energy

The proportion of energy utilized in the Eco-city in the form of renewable energy, such as solar and geothermal energy, should be at least 20% by 2020.

KPI 20: Use of water from nontraditional sources

At least 50% of the Eco-city's water supply will be from nontraditional sources such as desalination and recycled water by 2020.

KPI 21: Proportion of R&D scientists and engineers in the Eco-city workforce

There should be at least 50 R&D scientists and engineers per 10,000 workforce in the Eco-city by 2020.

KPI 22: Employment-housing equilibrium index

At least 50% of the employable residents in the Eco-city should be employed in the Eco-city by 2013.

Qualitative KPIs

KPI 23: Maintain a safe and healthy ecology through green consumption and low-carbon operations.

KPI 24: Adopt innovative policies that will promote regional collaboration and improve the environment of the surrounding regions.

KPI 25: Give prominence to the river estuarine culture to preserve history and cultural heritage and manifest its uniqueness.

KPI 26: Complement the development of recycling industries and promote the orderly development of the surrounding regions.

Source: Tianjin Eco-City, http://tianjinecocity.gov.sg/KPI.htm#2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40.54 Plan of Tianjin Eco-City, Tianjin, China.
(Sino-Singapore Tianjin Eco-City)

40.55 Aerial rendering of future development, Tianjin Eco-City, Tianjin.
(Keppel Corporation)

40.56 Reconstructed wetlands, Tianjin Eco-City, Tianjin.
(Courtesy of Richard Register/EcoCity Builders)

40.57 Solar array, Tianjin Eco-City, Tianjin.
(Sino-Singapore Tianjin Eco-City)

Housing in Lanxmeer was planned as a series of clusters, with common space for each, used as the residents of the cluster decide. A variety of accommodations are available, and each complex incorporates passive design or active solar panels providing up to 25% of the energy needs of their complex each year. In addition to schools and common facilities, the community also provides sites for employment—live-work accommodations, small offices, and larger sites for established firms.

Most of Lanxmeer is car-free. Residents park their cars at the edge of the complex, where individual storage areas are also located, and walk to their homes five minutes or less away. Those who commute to work elsewhere by train walk or cycle to the station, on the opposite side of the site. If large items need to be delivered, cars or small trucks are allowed to use the pedestrian pathways, traveling at pedestrian speeds.

Maintaining the collective lands, worrying about recycling and disposal, and overseeing the operations of the heating and energy systems require a significant commitment on the part of all residents. The buy-in to this participatory lifestyle began with the initial planning of the complex, and has been passed along to new residents as they arrive. In exchange for occasional hard work maintaining the public spaces and deciding upon the finances of the group, there is the satisfaction of being part of a caring community with an abiding commitment to their living environment.

Lanxmeer has demonstrated the virtue of an ecological community, but with fewer than 1,000 residents it is small enough that many residents know or recognize others when they meet them. Can this kind of commitment to ecological living be sustained at a much larger scale? Hammarby Sjöstad, Stockholm’s new ecological community, offers some clues.

The site for Hammarby Sjöstad, 6 km (3.5 mi) from the center of the city, was a derelict industrial and waste disposal site when the city government acquired the lands and began its plans to create a model community. The aspiration was to create a highly livable, walkable, and sustainable community served by the most advanced technologies for infrastructure and movement. While the infrastructure would become the responsibility of the city government and local public utilities, Hammarby Sjöstad would be built by private developers, working within a parcel plan and design guidelines planned by the city. Competition and choice became the watchwords for developers and their architects, each trying to best their neighbors in terms of quality and price of the housing they offered. Densities are high, but are offset by the generous amount of open space in the form of semipublic courtyards and public parks and green spaces. The extraordinary waterfront site offers much more openness than the simple area of green.

Infrastructure systems at Hammarby Sjöstad were guided by the concept of creating closed systems—waste turned into supply. Wastewater is separated, with gray water recycled or used for irrigation and organic

matter converted to fertilizer or feedstock for energy production. Garbage is separated at the source and transported via underground vacuum tubes to the energy center, where organic matter is burned for electricity or district heating and recyclables are packaged for transport to manufacturers. Rainwater that falls onto the site is channeled through natural filters until it is usable for irrigation. Natural vegetation on water's edges helps improve water quality while serving as a buffer for flood surges. Each system has been thought through, and is closely monitored to judge whether it meets expectations.

Before housing was constructed, a light rail system was put in place along the main boulevard of Hammarby Sjöstad. Buses also use the same right-of-way, radiating out beyond the transit routes. Residents have other choices for mobility as well: schools, local offices, and most shops they need are within a short walk; there are bicycle and car share services distributed through the community; and ferry services connect to central Stockholm and other areas. The high quality of these options means that only about 21% of the trips are by private automobile and only 45% of households own a vehicle (Foletta and Field 2011). Automobile CO2 emissions are about half those of comparable areas in Stockholm, which as a city has one of the lowest emissions rates in the world.

Hammarby Sjöstad probably attracts those who wish to live a more sustainable lifestyle, but it also makes this possible through its physical plan, housing design, technological investments, and infrastructure. Conversations with residents suggest that they take great pride in both the quality of life and the commitment they have made to live responsibly in the environment.

Sidebar 40.3

Lanxmeer, Culemborg, Netherlands

The community of Lanxmeer has its origins in a participatory design process among prospective residents seeking to design a community that encouraged social interaction, minimized the demands on the land, reduced energy use

and the disposal of water and wastes, and produced as much energy, food, and water locally as possible. The happy result is a unique environment, largely free of cars, with clusters of housing each fitting the preferences of its residents. There are apartment units, special units for the elderly, row houses and stacked row houses, individual houses, and specially designed live-work units. Residents of each cluster share common outdoor spaces and have more private spaces in the form of balconies and gardens. Each housing cluster incorporates passive and active solar energy providing up to 25% of its energy needs, and units are heated by a district heating system that employs geothermal energy. Recycling of solid wastes is mandated.

The site plan conserves an orchard and other gardening spaces, and provides wetlands to absorb storm runoff and treat gray water from units. The area is lushly planted and carefully tended, largely through volunteer efforts. Parking is largely confined to the outer edges of the community, where storage areas for residents are also located. The area nearest the rail station is also the site of substantial offices and institutional uses, which balances the flow of commuters.

Residents of Lanxmeer remain deeply engaged in the management and operations of their community. They own and manage the district heating facility and assume responsibility for all site maintenance and collection of wastes. They have an active array of arts and social activities extending throughout the year. The community is remarkably diverse, but individuals share a common commitment to ecological living.

Location: Culemborg, The Netherlands, 18 km (10 mi) from Utrecht

Site planners: Marleen Kaptein, Jean Eigeman, Joachim Eble, Bugel Hajema

Developer: Stichting EVA, Marleen Kaptein

Site area: 24 ha (59 ac)

Uses: diverse housing types (400 units), including live-work units; mixed-use (institutional housing, 50,000 m2 [538,000 sq ft], offices, modest

commercial space); open space (farm, orchards, recreation areas, allotment gardens, buffers)

Facilities: elementary school, creche, art schools, commuter rail stop adjacent, convenience shops and services, district heating facility, local solar energy utility, common storage areas, car share

40.58

Site plan for Lanxmeer, Culemborg, Netherlands.
(Hyco Verhaagen/Courtesy of Stichting EVA)

40.59

Entrance to auto-free zone, with school on right.
(Gary Hack)

40.60

Housing cluster, created and maintained by surrounding residents.
(Gary Hack)

40.61

Seniors housing cluster.
(Gary Hack)

40.62
Office area.

(Gary Hack)

40.63
Wetlands area with community orchard.

(Gary Hack)

40.64
Montessori School and individually owned houses.

(Gary Hack)

40.65
Live-work housing with space for residents’ offices.

(Gary Hack)

40.66
Recreation pond fed by filtered runoff.

(Gary Hack)

40.67
Environmental education boards.

(Gary Hack)

Sidebar 40.4

Hammarby Sjöstad, Stockholm Sweden

Hammarby Sjöstad is a stellar example of an integrated, environmentally sustainable development on a brownfield site. Planned by Stockholm's City Planning Bureau, it anticipates having 24,000 residents of all ages and incomes, with residential areas averaging 130 persons/ha (320 persons per ac). Over 30% of the site is devoted to industry and commercial uses, employing over 5,000. It has the full range of educational and cultural facilities for a community of its size. Over 40 developers, with 30 architects, have constructed housing on the site, competing to provide the most attractive and energy-efficient units for sale (55%) and rent (45%). Mixed-

use development lines the 37.5 m (123 ft) boulevard that is the spine of the community, with shops, schools, offices, and housing above, all within a few steps of public transit.

Hammarby set high targets in terms of energy efficiency, reuse of rainwater and wastewater, recycling of materials, and reduction of private automobile use. Its mantra is to create closed systems where materials are used to their maximum advantage: 50% of electricity and district heating is derived from recycled organic and combustible waste; solar energy panels on buildings provide half of the energy needed for hot water and contribute to electrical supply; 52% of residents use public transport and 27% commute by bicycle or walking; rainwater and gray water are filtered naturally and used for nonpotable water and irrigation; and biogas harvested from the former brownfields contributes to the supply of energy for heating. The green and technologically advanced infrastructure systems were installed from the beginning. Notably, the light rail system serving Hammarby and connecting it to the Stockholm Metro was in place before the first residents arrived, obviating the need for purchasing cars. Car sharing and bicycle sharing further reduce the need for private automobiles.

Recreation opportunities are an important attraction of Hammarby. Located on an inlet of the city’s archipelago, it offers opportunities for recreational boating, and no resident is more than 5 minutes’ walk from the water. The water’s edge is lined by promenades, cafés, and places to relax. The development goal is to provide 25 m2 of public open space per apartment, and 15 m2 additional open space in private courtyards. This is an equivalent of 18 m2 per person, or 4.5 ac per 1,000 population in green space.

Location: Stockholm, Sweden

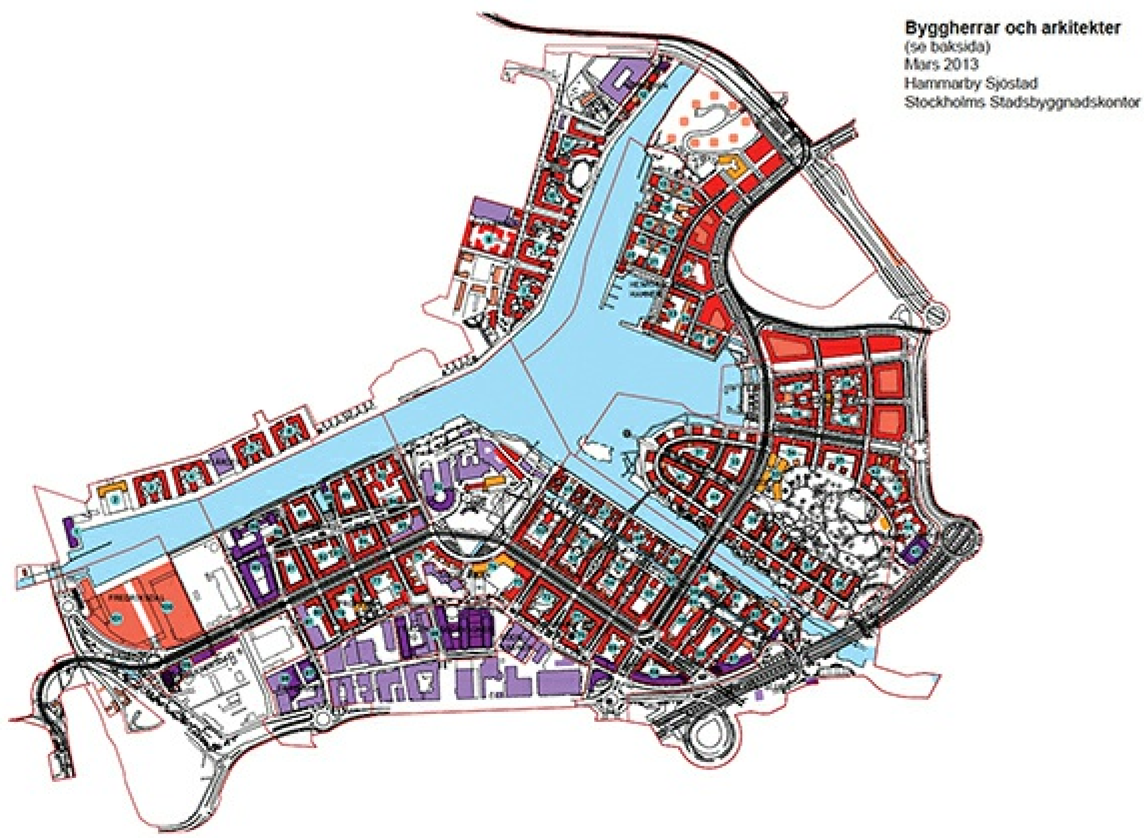
Site planner: Jan Inghe-Hagström, Stockholm City Planning Bureau

Developer: Hammarby Sjöstad Project Team, City Department of Streets and Real Estate Administration, with other city departments and public utility companies; housing and commercial uses by private or nonprofit developers

Site area (land): 160 ha (395 ac)

Uses: 10,800 apartments, 23% social housing, 29% privately owned, 37% cooperative; 290,000 m2 (3,121,500 sq ft) office, light industry, and commerce; 30 ha (74 ac) green space

Facilities: preschools (10), schools (3), cultural institutions, health care centers, district energy facility, vacuum garbage collection system, car share and bicycle share systems



40.68 Plan of Hammarby Sjöstad, Stockholm, Sweden.
(Stockholm City Planning Department)

40.69 Aerial view of Hammarby Sjöstad.
(Hammarby Sjöstad Ekonomisk Foerening)

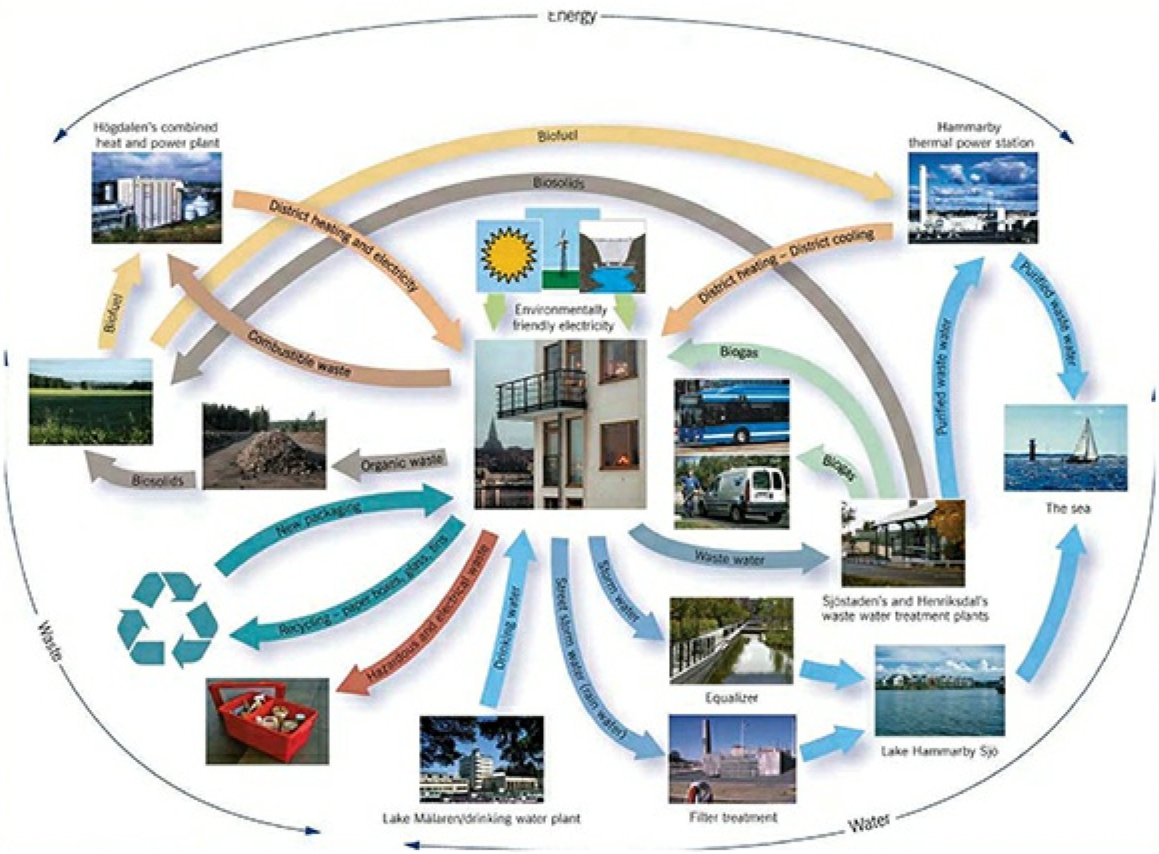
Hammarby Sjöstad, Stockholm Sweden

40.70 Main boulevard with transit stop.

(Gary Hack)

40.71 Housing courtyard with vacuum refuse ports.
(Courtesy of EnVac)

40.72 Waterfront view of Hammarby Sjöstad.
(Arild Vagen/Wikimedia Commons)



40.73

Closed-loop system diagram, Hammarby Sjöstad.
(Stockholm City Planning Department)

40.74

Sustainability strategies, Hammarby Sjöstad.
(Courtesy of V. S. Gullapalli, K. Keyimu, Roel M. Martinez, R. Mittai, Mohd A. Naqvi, C. Sichel, and M. A. Wanis Walaa, Politecnico di Milano)

40.75

Rainwater detention park.
(Gary Hack)

40.76

District energy plant.
(Courtesy of Urbed)

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Academical village: Thomas Jefferson's plan for living and learning at the University of Virginia, which has become the prototype for the American college campus 591–592, 604
Academies (or institutes or *grandes écoles*): specialized institutions of higher learning and research devoted to particular fields 592–593
Accessory units: additional units built on a residential site, such as garages, granny flats, or home workspaces 488
Acidification: changes to the chemical composition of water bodies resulting from the absorption of CO2 from the atmosphere or other sources 71
Activity programming: organizing and producing events, festivals, performances, and other activities in public spaces 634
Adaptability: the ability to accommodate changes to the form of the built environment over time 1, 10–11, 487, 497, 503, 600, 601, 672
Adaptation to climate change: adjustment in natural systems or the built environment to actual or expected changes to temperature, sea level, or weather conditions 231, 236
Adventure playground: a play area constructed by children, sometimes with adult assistance, that develops skills while satisfying the desire for recreation activities 485, 578
Adverse possession: the right to continued use of land established by occupying it for a long period of time, without actions by the rightful owner to prohibit such use 94
Aerial tramway (or *cable car*, *ropeway*, or aerial tram): a passenger compartment used for transportation, suspended from one or two stationary cables, propelled by a moving cable 320, 330–331
Aerobic biological processes: treatment of wastewater or solids through contact with oxygen from the atmosphere or through injection into or contact with soils, such as in composting, wetlands, or mechanical treatment basins 396, 462
Air rights: the right conferred by regulations to extend construction vertically, a right often transferrable from one site to another 325
Albedo: the proportion of light falling on a surface that is reflected 55–56
Alternating current: electric current that changes direction many times each second, typically used to supply power to sites 417
Anchor stores: large retail outlets that draw customers to a shopping center, providing patrons for smaller stores 508, 514, 527, 531, 533, 656
Ancient lights: English common law principle that an owner or occupier of an adjoining structure cannot block light to a building that has enjoyed it continuously for at least 20 years 57
Angle of repose: the steepest angle at which a specific loose material is stable 39, 466
Animateur: a person who enlivens and orchestrates a dialogue 122
Annual plants: plants with a life cycle of a single year that must be replaced each year 474, 478
Appraisal: an estimate of the value of a site or structure, generally based on sales of comparable properties, their revenue potential, and replacement costs 204, 207
Aquifer: a geological formation that contains or conducts groundwater 42–43, 191, 385
  confined aquifer: an area saturated by water that has impermeable materials above and below, and is generally under pressure so that water will rise to the top of the aquifer if the strata are penetrated by a well 43
  unconfined aquifer: an area saturated by water where the upper surface (water table) is open to the

Behavior setting: physical settings that mediate between the dynamic behavior of individuals and more stable social structures 133–134

Bicycle garage: a protected space for storage of bicycles 342–343

Bicycle path: a designated or dedicated pathway aimed at promoting safe use of bicycles for travel or recreation 337, 340, 674

Bicycle sharing system: a system in which bicycles are made available for use by subscribers for short-term use 343–344

- call-a-bike system: a bicycle share system coordinated with Intercity Express rail transportation, employing a system of authentication codes to automatically lock and unlock bikes 344
- commercial bicycle sharing: a privately operated bicycle sharing system charging fees for use, with either fixed rental/return locations or GPS devices mounted on bicycles that allow tracking of locations 343
- community bicycle sharing: a community-owned and operated bicycle sharing system, often restricting locations for rental and return to the area 343
- OV-fiets bicycle rentals: prepaid bicycle and scooter rental systems in the Netherlands that allow bicycles to be rented in over 300 locations and used in concert with public transit 344

Big box retailers: large branded retail stores specializing in specific lines of products (furniture, clothing, building supplies, toys, etc.), generally preferring freestanding locations or clustering with other large outlets 361, 533, 535

Biogeoclimatic zones: large geographic areas with relatively uniform macroclimate, soils, vegetation, and animal life 65–66

Biomass: organic matter such as wood, agricultural crops, or wastes capable of being burned 401, 422, 432, 439–441

Biomass conversion to energy: technology for conversion of biomass materials into heat or other forms of energy 422, 439–441

- combustion: burning biomass in a chamber and converting the heat into steam used to produce electricity, mechanical energy, heating, or cooling 439
- gasification: converting solid biomass fuel into gaseous combustible gas (producer gas) through a sequence of thermochemical reactions 406, 439
- pyrolysis: decomposition of biomass in the absence of oxygen, producing biochar, bio-oil, and gases including methane, hydrogen, carbon monoxide, and carbon dioxide 406, 439

Biosolids: organic matter recycled from sewage, generally used as a soil conditioner for agricultural uses 397

Biotic community: a group of independent organisms inhabiting the same region and interacting with each other 64–66

Blackwater tank: holding tank for wastewater from toilets, often used for settling of solids before disposal 392–393, 395–396

Borrowed landscape (or scenery): the principle of incorporating background landscape or distant scenic elements into the composition of a garden or park (Japanese: *shakkei*) 79

Branching layouts of roadways: treelike layout of streets with many local streets originating from higher-capacity roadways 292–293

Branded retailers: shops specializing in a single brand of merchandise, sometimes referred to as boutiques 506, 533, 535

Broadband communication: cable communication lines including coaxial cable, optical fiber, radio, or twisted-pair lines, allowing wide-bandwidth data transmission, supporting multiple signals and traffic types 446–447, 691

Brownfields: sites that are affected by real or perceived environmental contamination, often the result of prior industrial or commercial uses 48, 100, 188, 207, 458, 460–465, 696

indefeasible title to those included on the register, and landownership is transferred through registration of title rather than deeds 96
Capacitance: the ability of a system to collect and store an electrical charge, such as in a battery 420
Capital costs or expenditures: financial resources dedicated to the creation of fixed assets, such as buildings, infrastructure, and landscape 228, 254, 403, 421, 444, 508
Capitalize: to record the amount of an item in a balance sheet account as a long-term asset, rather than as an expense 207
Carbon emission: the release of carbon into the atmosphere, generally in the form of CO2, as a result of burning oil, coal, and gas for energy use, or through decay of natural products 4–5, 233–234, 236, 262, 314, 441–443, 601, 689
Carbon footprint: the quantity of carbon emitted by an individual, event, product, organization, or community, the geographic area over which these impacts are felt, or the area required to serve an urban settlement 5, 440, 601
Car-free zone: an area of settlement where automobiles are generally banned, either throughout the day or during specific hours 359, 362, 693–694
Catenaries: wires or ropes hanging freely between two points, conveying electricity (for use by trams or trains) or power (for ropeways or cable cars) 316–317, 320, 322–324, 360
Cell tower: a vertical structure for antennas and electronic communications equipment to create a cellular network 448–450
Centralized electrical generation: large facilities for electric power generation that serve entire communities or wider areas 417
Cesspool or *blackwater tank*: a tank for holding toilet wastes or other contaminated substances until they are removed for disposal 393
Chaflanes: chamfered corners on streets designed to improve the visibility and turning flows at intersections 682
Charrette: a brief, intense set of meetings in which professionals, stakeholders, and citizens collaborate on agreeing on objectives, sketching out a plan for an area, and reaching a consensus on its desirability 122–126
Chartered real estate investment companies or trusts (REICOs): real estate companies chartered by the state that have the capacity to aggregate property, often by offering shares to owners, installing infrastructure, redeveloping sites, and operating revenue-producing properties 206
Cistern: a structure used to collect rainwater, often belowground, to be used as needed 17, 236, 366, 377, 382–385, 387–388
Citizens' jury: a meeting involving a cross section of residents that debates goals or reviews plans 123
Civic spaces: public areas that belong to all in a city, which go by several names: *civic square*, *city or town square*, *people's (renmin) square*, *piazza*, *plaza mayor*, *campo*, and *zócalo*, among others 165, 635–639
Civil law traditions or *Napoleonic law*: a comprehensive system of law that is codified (in contrast to common law) covering substantive law, procedural law, and punishments, that has its origins in Europe, has spread to many of the colonies of France, Holland, Spain, and other countries, and is the underpinning of legal systems in Russia, China, and other countries 89–91
Clay: a natural very fine-grained material that is plastic when wet, consisting mainly of hydrated silicates of aluminum 36–39, 42–43, 48–49, 69, 72, 377, 379, 467, 580
Clients: individuals or organizations that commission and pay for professional work 10, 112, 114, 115, 119–121, 126–128, 137, 141, 145, 157, 160, 164, 174, 175, 237, 240, 574
Climate impact assessment: any of several methods for estimating the likely impacts of site plans and developments on the climate, both locally and in terms of global concerns 224, 231–236

aerobic bacteria, fungi, and other organisms, producing materials that can be used as fertilizer 4, 261, 404, 406, 411, 413–415, 463

Comprehensive plan: a long-range municipal plan that synchronizes land use, infrastructure, transportation, public facilities, housing, and other elements essential to creating a beautiful, healthy, and economically successful community 81

Concurrency requirement: a requirement that the timing of any development approved conform to the schedule for extending infrastructure to the site 81

Condominium, *strata title*, *commonhold*, *syndicate of co-ownership*, or co-propriété: a form of ownership in which portions of a building or complex of buildings are owned by separate individuals or companies while the site is held in undivided ownership of the collectivity 79, 93, 198–201, 222, 422, 494, 647, 655, 667–668

condominium corporation, *strata council*, *commonhold association*, *body corporate*, *owners' corporation*, or *syndic*: the entity selected by owners to manage the combined assets of the site, with responsibility for proposing or deciding upon charges to pay for operations and improvements 199

Connected node ratio (CNR): an index of the connectivity of a roadway pattern, computed by dividing the number of real intersections by the number of dead-end roadway points 294

Connectivity: the ease of making connections between blocks in a district or neighborhood, without taking circuitous routes 294–296

Conservation easement: a restriction on a property that prohibits building or development in perpetuity 94

Consistency requirements: requirements that development regulations and any projects approved conform to an adopted community plan 81

Constructed wetland: an artificial wetland constructed for the purpose of detaining or treating municipal and industrial wastewater, graywater, or stormwater runoff 70–71, 397–399, 682

Contour map: a map that locates equal elevation lines on a site 45–47, 64, 149, 156, 368–369, 396, 466, 468–470, 612

Controlled intersection: an intersection with traffic control devices that determine flows of vehicles and pedestrians 81, 273

Cooperative corporation, *co-op*, or *coop*: an association created to collectively own property, typically housing, in which individuals holding shares have proprietary leases for portions of the property they occupy, and the board of the entity has the right to approve all transfers of shares 93, 198, 200, 343, 503, 697

asunto-osakeyhtio (Finland): a form of cooperative ownership for approximately one quarter of the apartments in the country, regulated by the Housing Companies Act, aimed at ensuring that housing is well maintained and retains its value 200

borettslag (Norway): a housing association that is the common form of housing cooperative in the country, organized in similar ways to other countries in Scandinavia 200

bostadsrattsförening (Sweden): a housing association with cooperative ownership, mandated by the National Board of Housing to balance the maintenance and improvements of a property with the ability of shareholders to pay the annual costs, in which appreciation upon resale is taxed as capital gain 200

cooperative housing societies (India): associations promoting housing ownership in India 200

limited equity or limited dividend cooperative (Canada): a cooperative in which the price of purchasing shares is low and owners must sell their shares back to the cooperative when leaving, realizing appreciation that is proportional to the amount they invested 200

mutual housing associations (UK): self-managed cooperative entities that date to the nineteenth century, in which shareholders pay a modest deposit upon entry, have perpetual leases while

idea competition: here the purpose is to enlarge the pool of ideas, not necessarily to select a plan or planner 122, 127

invited competition: here the sponsor selects a number of professionals or teams to submit proposals, and may provide stipends for preparation of proposals 126

mediated competition: here representatives of the sponsor work with a short list of competitors to ensure that proposals are as responsive as possible to the client's aspirations 127

open competition: here the contest is open to all who register, and the results are typically assessed by a jury 126

team selection competition: a process in which competitors are asked to submit ideas and qualifications to assist the sponsor in selecting a team to work with in preparing site plans 127–128

Design guidelines: statements of intent, quantitative rules, or *graphic suggestions* intended to guide the design or planning of a site, which may be suggestive or mandatory 25, 30–31, 81, 116, 175–185, 217, 597, 664, 693

Design review: the process of reviewing plans and architectural designs in terms of their suitability, which may be conducted by a *panel of experts* or through a *public inquiry* (UK) 178–179, 184–185

Design review commission or *architectural review commission*: a formal body created by a government to review projects in terms of their appropriateness; it may be *advisory* or have *decision authority* 184–185

Design speed: the selected speed used to determine the geometric and dimensional features of a roadway, generally set 10–15% higher than the posted speed limit, or by adding 8–16 kph (5–10 mph) to the posted speed limit 274–277, 289, 319, 321, 341, 467

Design vehicle: a frequently used vehicle that is used as the basis for computing turning radii and other requirements in the design of streets 272

Development agreement: an agreement between a local government or entity and a developer spelling out what may be built on a site, its form, any contributions to mitigate impacts, and the timing of development 102, 117, 197

Development concept plan or *master site plan*: a conceptual plan for a large site that will be developed in phases, serving as a reference as individual segments are approved 18–19, 102, 194, 197, 205, 217, 241, 558–559, 561, 587, 594–597, 637, 678

Development control plan (Australia): a plan that provides detailed planning and design guidelines to support the planning controls in the local environmental plan 97

Development or project impact report: a report prepared by the developer of a site that outlines the positive and negative impacts of the proposed site development 224–225

Development permit: a permit authorizing development (in locations where there is *discretionary review*), usually with a list of conditions that must be met 102–103, 118

Development regulations: public controls on the uses, density, form, massing, and other characteristics of permitted development 81, 92, 97–103, 117, 174, 220, 385, 644–645

Development rights or entitlements: the amount of development permitted by zoning or other development controls, or by special exceptions or development agreements 18, 20, 93–94, 101–102, 117, 217–219, 221–222

Direct current (DC): electric current flows in one direction, such as in photovoltaic instillations or locally generated electricity, now used in some large data centers 417

Direct observation: the technique of studying human behavior by observing and recording activities in spaces 133

Disaggregated per capita costs: cost accounting broken down to demonstrate the incidence of individuals and groups in the relevant population 228

Discharge locations: locations where overland runoff is released into streams, detention areas, lakes, or other water bodies 5, 42–43, 89, 262, 366–367, 373, 397–398, 401, 690

they will find useful 415
Expropriation: involuntary taking of property from its owner for public use or benefit, generally with compensation. Similar terms include *compulsory taking*, *compulsory purchase*, *eminent* domain, *condemnation* 88, 204–206
Ex-situ treatment of hazardous wastes: extracting and treatment of contaminants through chemical processes, then returning treated materials to their previous location 461–462
Extended aeration process: a method of sewage treatment using modified activated sludge procedures, in which suspended-growth microorganisms are applied to break down wastes 399
Extra high voltage lines: cables transmitting electricity at voltages above 765 kV, carrying bulk power over long distances 417

Fair market value: the amount that a motivated seller and buyer would agree upon for a property in an open exchange 207
Farmers' market: a zone or structure where local farmers offer produce, foods, or goods for sale on a seasonal or year-round basis 515, 626, 628, 634, 639, 658, 673
FAR value: the amount that would be paid by a buyer of a site per FAR of development rights (see also *Floor area ratio*) 214–215
Feng Shui: a Chinese philosophical system of harmonizing people with their environment, focusing on orientation, forms, and relationships of buildings to natural landmarks 169–170, 172
Ferry system: a water-based transportation system connecting fixed terminals 331–332, 693
Fiber optic communication lines: a method of transmitting information from one place to another by sending pulses of light through an optical fiber 260, 446–448
  fiber to the curb (FTTC): providing service to the curb, with responsibility for further distribution falling to the owner of the site 447
  fiber to the home or premises (FTTH): providing fiber cables from a central point directly to the home or building 447
  fiber to the network or node (FTTN): providing service to central points, from which wireless service or distribution via cables is provided 447
Filter drain or *French drain*: a trench filled with gravel or rock or containing perforated pipe that redirects surface water and groundwater 378
Financial plan: a multiyear plan that identifies costs and revenues for development of a site, including both hard costs (construction) and soft costs (services, interest on construction, etc.) 112, 117, 202, 214–215, 217
Financial pro forma: an accounting of projected costs and revenues of a project by year that allows an analysis to be made of its value as an investment 114–115, 141–142, 144, 209–216
Fines: fine-grained crushed rock, often used as a surface for walkways 352, 565
Fiscal impact assessment: an analysis of the impacts of site development on the costs and revenues of government units, and the distribution of these to specific operating entities 116, 224, 227–229
Flag lots: building lots generally set behind others that are connected to the street by a narrow driveway 489
Flat: an apartment in a building with a common entrance to several units 480, 497–501
Floor area ratio (FAR) or floor space index: the occupied space on a site divided by the site area (see also *FAR value*) 98–101, 193, 214, 218–219, 482, 598–599
Focus group: a group of representative users assembled to preview or offer comments on a proposal 137
Food court: an area, typically in a shopping center, with food outlets and a common eating area 507, 516, 531, 535
Form-based zoning: land development regulation that prescribes the physical form of structures,

rather than their use 100
Fractional ownership: a method by which several unrelated parties can each own and occupy a site or building for specific periods of time over the year 93, 200
Freelancers: self-employed independent workers who work on contract for organizations either in their own spaces or embedded within others' spaces 544
Freeze-thaw cycles: 24-hour periods with temperatures both below and above freezing 38, 351, 368, 379, 478
Frost line: the depth below the surface that typically freezes during winter 43, 394
Funicular, *cliff railway*, or cog railway: cars that ascend steep slopes guided by rails and propelled by either ropes or moving cogs between the rails 328–329

Galleria: a covered passageway, usually with a glass roof, lined by shops along its length 506, 524–526, 531
Gasification: a process that converts organic or fossil-fuel-based biomass materials into syngas and CO2, accomplished by subjecting the material to high temperatures (>700°C) without combustion. The process combined with use of the syngas can be a source of energy 416, 439
Gated community: an area protected by a perimeter fence or wall, where all entering the enclosure must use a pass or be interviewed by guards 669
General plan. See *Comprehensive plan*
Geographic information system (GIS): computer software designed to capture, store, manipulate, analyze, manage, map, and present spatial or geographic data 35, 40, 45, 80, 108–110, 153–154, 163, 368
Geomancy: the art of placing or arranging buildings on a site to take account of natural forces or signs from the earth (see also *Feng Shui*; *Vastu Shastra*) 169
Geomorphology: the geological science that deals with the structure, origin, and processes of creating topography and other earth features 33, 34
Geothermal energy: the use of relatively constant subsurface temperatures to heat or cool building spaces, typically by pumping water from belowground or by tapping the releases of steam from the magma 4, 16–17, 43, 177, 417, 437–439, 444, 691, 694
  closed-loop system: water in enclosed tubes is circulated from belowground, exchanged in heating or cooling devices within the structure, and returned 438
  open-loop system: groundwater is pumped to an exchanger, then returned to the groundwater or wasted 438
Gradient: a measure of the slope of a site or roadway, typically expressed as a ratio of height to distance, or as a percentage 47–48, 73, 274, 319, 321, 328, 341, 348, 380–381, 395, 456, 466
Gravel: a loose aggregation of small water-worn stones or crushed rock, typically between ¼ in (6 mm) and ¾ in (19 mm) in diameter 38, 42, 47, 49–50, 297, 303–304, 352, 375, 378, 381, 392, 397, 444, 460, 467
Gravity model: a model that can predict the flow or attraction of people, goods, or communication based on Newton's Law of Gravitation, accounting for mass and distance 507
Gravity sewer system: a system that depends on downhill flow to move effluents to a disposal site 379–381, 393–397, 402
  collector lines aggregating discharges from many sources 380, 394
  lateral lines from occupied buildings to the public sewer lines 379, 380, 389
  manholes at critical junction points to allow for cleanout of the system 380–381, 394, 395
  sewage treatment plants that remove impurities before discharging or recycling water 393, 394, 396–397
  trunk lines transporting the waste to the sewage treatment plan 379, 381, 392, 394, 396

Gray water: relatively clean wastewater without fecal contamination, from baths, sinks, washing machines, and kitchen appliances 261, 368, 390–391, 392, 693–694, 696
Greenhouse gas (GHG) emissions: discharge of gases that contribute to the greenhouse effect by absorbing infrared radiation produced by solar warming of the Earth's surface, including carbon dioxide (CO2), methane (CH4), nitrous oxide (NO2), and water vapor 4–5, 233–236, 308, 441, 443, 601
Green infrastructure: use of natural systems to collect, filter, detain, and transport water, improve air quality, recycle wastes, and perform other essential functions 16, 114, 116, 178, 188, 260–262, 379
Green roof (also living roof): a roof covered by a waterproofing membrane, growing medium, and plants designed to absorb rainfall and cool the temperature of the roof 367, 371, 375–376, 553, 564–565
  extensive green roof: a roof in which the building is partially or fully covered by planting 376
  intensive green roof: a roof in which portions of the building are planted more extensively and used for outdoor living or recreation 376
Gridiron plan: a rectilinear pattern of streets and blocks in a settlement 76, 168, 290–292, 303, 561, 680, 682
Grid parity: a situation in which an alternative energy source such as solar panels or wind turbines can generate power that is less than or equal to the price of purchasing power generated from conventional sources 422
Ground cover: horizontally spreading planting that protects a surface from erosion and inhibits weeds 2, 69, 71–72, 226, 368, 370, 381, 457, 463, 466, 477–478
Groundwater: water that is found below the surface in the cracks and spaces in soil, sand, and rocks, the source of 20% of the freshwater on the earth 3, 34, 36, 42–43, 51, 69–71, 108, 226, 303, 305, 367–368, 374–375, 377, 379, 383–384, 386, 392, 402, 414, 437–438, 444, 460–462, 690

Habitat corridor. See *Ecological corridor*
Halophyte species: plants that grow in waters of high salinity or in areas of salt spray, including mangrove swamps, saline semideserts, coastal marshes, and seashores 68
Hazards: situations or conditions that increase risk or danger 4, 7, 43, 50, 63, 68, 72, 231, 260, 278, 296, 368, 373, 427, 443, 461, 478, 513, 582, 690
Headhouse: areas of a transportation system designed to accommodate persons waiting for boarding, such as ferry terminals, waiting rooms, loading areas 325, 381
Headways: the average interval between vehicles or trains moving in the same direction on a route 311, 314–315, 318
Health: the condition of being sound in body, mind, or spirit, the relative absence of diseases or maladies 85, 116, 191–192, 224, 230–232, 259, 335, 397, 416–418, 427, 449, 460, 552, 567, 691
Health impact assessment: an analysis of the health effects and distribution of the effects of a project or development, such as hazards created, effects on air and water quality, and displacements 116, 224, 230–231
Health indicators: quantifiable characteristics of a population used to measure or predict likely impacts of a development 231
Heat exchanger: a device for transferring heat from one medium to another, such as between piped steam and circulating air 425, 438–439, 441–442
Heat island effect: a situation in which the densely built-up portions of an urban area are significantly warmer than the surrounding countryside, because of the absorption and retention of heat by hard-surfaced materials 55–57, 188, 193, 226, 231, 236, 303, 375, 475, 530, 639, 690
Height limits: regulations setting maximum heights for buildings 98, 102, 498, 501
Height planes: sloped planes that limit building heights, typically requiring buildings to step back

from the street to allow the penetration of sunlight 99, 179
Heliostat array and collector: mirrored surfaces that reflect sunlight onto a single collector containing a medium such as water or molten salt that drives turbines to generate electricity 425–426
High-capacity information networks: trunk circuits with high capacity (backbones) that can carry all forms of data, typically dedicated to Internet traffic 543
Highest and best use: a legally permitted use of land or property that is likely to yield the highest economic return 207
Historic commission, *landmark commission*, or heritage commission: a committee or commission created to serve as a steward of historic properties or districts, reviewing any proposals for change 102
Historic preservation: the process of cataloging, researching, and designating structures, places, and districts for special protection, and encouraging wise use of them 25, 102
Historic tax credits: a credit against income for expenditures for rehabilitating or improving historic income-producing properties (the credit may be sold to others to obtain capital for improvements) 84
Homeowners' association, *property owners' association*, *property board*, *property committee*, *property trust*, *owners' corporation*, or *common interest realty association*: an entity created to manage commonly owned aspects of a site, with power to charge owners a pro-rata share of the expenses 95–96, 185, 198, 422, 677
Horizontal mixed uses: different uses, such as housing, offices, or a hotel, organized side by side within a single building 662–664
Housing density: the number of housing units per unit of land area (gross density if the denominator is the entire site, *net density* if only residential sites are included) 97, 332, 480–482, 487–488, 669
Housing types: prototypical housing forms based on whether units have their own site or share land with other units, have independent or shared entrances, or are in a shared structure 480–482, 487–502

- apartments (or flats): units with common entrances and access ways, including *walkup apartments*, *garden apartments*, high-rise apartments, *street bar housing*, and tall thin towers 480, 497–501
- attached housing: individual housing units with separate entrances joined up with other units through party walls, usually on both sides, including *semidetached houses*, *duplexes*, *quads*, *row houses*, *town houses*, *terrace houses*, *court garden houses*, *stacked row houses*, *back-to-back stacked row houses*, and maisonettes 198, 211, 480, 492–497, 680
- cohousing or *congregate housing*: structures that combine individual living units with shared kitchens and social spaces 503–504
- detached housing: freestanding single-household units on their own sites, including *bungalows*, *villas*, *small lot housing*, and zero lot line houses 198, 211, 480, 487–492, 673
- extended-care housing: buildings or complexes that provide living opportunities at varying levels of care from independent living to assisted care to full nursing care 12–18, 503
- mixed housing forms: units that combine two or more housing types or housing with other uses such as shopping, working, or social service spaces with living (one example being *loft housing*) 480, 501–503

Human contact: meeting or greeting others, participating in shared activities, or simply observing strangers in public spaces 7, 133, 482, 484, 599, 601, 618, 622, 672
Human development stages: the stages of cognitive and motor skill development from first steps to independent teenage years, distinctions useful in planning play facilities, typically differentiated as *early childhood*, *exploration years*, *imaginative play years*, *collaborative years*, and *teamwork years* 574–578
Humus: the organic component of soil, formed by decomposition of leaves and other plant material by soil microorganisms 37, 65, 413

Leasehold: a contract between an owner (lessor) and a tenant (lessee) that conveys certain rights to use a property for a defined period. Interest in property held under such a contract may be paid for by *periodic payments* or through a *prepaid leasehold* 18, 21, 25, 30, 32, 89–96, 185, 195, 198, 200–201, 206, 214, 550, 664, 672
Ledge: a narrow horizontal surface projecting from a wall or cliff 14, 34, 383, 395, 402
LEED: Leadership in Energy and Environmental Design, a sustainability-oriented building certification run under the auspices of the US Green Building Council (USGBC); includes *LEED-ND* designed to assess sustainability in site development 22, 185–190, 192–194, 565
Legacy structures: sites or buildings, generally over 50 years in age, that have special meaning because of their distinctive design, persons or institutions that have inhabited them, or events that have occurred there; also referred to as *historic structures*, *landmarks*, *cultural monuments*, and *heritage structures and sites* 83–85
Level of service (LOS): a qualitative measure used to predict the quality of movement based on traffic flow, speed, and delays; common usage includes *vehicular LOS*, *bicycle LOS*, and *pedestrian LOS* 272–274, 318, 332, 349, 569, 636, 693
LIDAR survey: light detection and ranging, a remote sensing method that uses light in the form of a pulsed radar to measure distances and construct topographic maps 46, 466
Life cycle costs: total costs incurred over the lifetime of use of a facility, often expressed as the sum of annual costs discounted at an appropriate interest rate reflecting the value of money 6, 254, 265, 435
Lifestyle: way of life or style of living that reflects the attitudes and values of a person or group 116, 130–133, 235, 382, 404, 480, 482, 484, 535, 540, 690–691
Lighting fixtures: lighting units generally mounted on poles in streets, with light technologies including light-emitting diode (LED), *high-pressure sodium (HPS)*, and *compact ceramic metal halide (CCMH)* 139, 258, 287, 352, 430–434
Light rail transit (LRT) systems: multiple-unit self-powered vehicles that travel on rails within street rights-of-way or on dedicated corridors, offering an intermediate level of transit between high-capacity rail and individual streetcars; also referred to as *trolleys*, *trams*, *munis*, *subway-surface lines*, or *interurbans* 320–323
Liminal pond: a space occupied by seasonal water, dry in other parts of the year 71
Limited mobility: diminished capacity to walk or move unaided by others, which may be the result of disease, congenital disorder, accident, or neuromuscular and orthopedic impairments 8, 47, 301, 303, 312
Linear systems: patterns of streets following a single alignment for movement, with all secondary streets accessible from it 168, 241, 290, 293–294, 324
Liquefaction: a phenomenon whereby a saturated or partially saturated soil substantially loses strength in response to external stress, such as an earthquake, causing it to behave like a liquid 51
Live-work buildings: structures accommodating residential units as well as work spaces such as home offices, independent office space, or maker spaces 234, 293, 480–481, 499, 502–503, 646–647, 651, 656, 671, 693–695
Loading dock: a dedicated area for loading or unloading trucks, generally with a platform that is elevated to the height of the truck floor 6, 407, 512–513, 655
Loam: soil with roughly equal proportions of sand, silt, and clay, typically also containing humus 38–42, 391
Logistics warehouses: large usually automated warehouses that inventory goods or components and transfer them to shipping lines or end users as needed 544
Loss leader: a site or building space sold or leased at less than the cost of producing it, intended to serve as an attraction to other buyers or lessors 10

Low-carbon energy sources: sustainable sources of energy production, including solar, wind, tidal, and nuclear, although each needs to account for energy consumed in constructing and assembling the infrastructure and devices used in production 689, 691
Low-frequency infrasound: sounds below 20 Hz, lower than the threshold of human hearing, which may affect the feelings and health of humans and animals 428
Low-head hydropower: the use of stream flow or tidal flows with a head of 20 m (66 ft) or less to produce energy, also referred to as *micro hydropower* 422, 430–431

Mandala: a geometric figure representing the universe in Hindu and Buddhist symbolism, often circular with nested squares 169–170
Mandatory homes association: an organization of homeowners in which membership is automatic upon purchasing a home, which has responsibility for managing shared spaces, may have approval powers over changes to the exteriors of homes, and may levy charges to pay for common expenses 199
Mangrove: coastal swamps with trees or shrubs that are partly flooded at high tide and serve as a barrier to flood surges, the vegetation having tangled roots aboveground forming dense thickets 67–68
Manhole: a small covered opening in a walkway or roadway leading to a sewer or vault that allows a person to enter 380–381, 384, 395, 403
Manufactured homes: housing units prefabricated in a factory and moved to a site in components or complete units, sometimes referred to as *mobile homes* 490
Manzanas or *illes*: square blocks in l'Eixample, Barcelona, with chamfered corners (chaflanes) to assure smooth flow of traffic at intersections 682
Mass transit systems: generically, public transit systems of all modes, but also referring more specifically to heavy rail-based systems on separate rights-of-way above or belowground, variously designated Metro, rapid transit, Metropolitaine, subway, subterraneo, U-Bahn, S-Train, underground, rapid railway, T, MTA, CTA, SkyTrain, MRT, MetroTrain, MetroRail, MARTA, WMATA, the El 47, 82, 85, 87, 226, 234, 257, 293, 298, 309, 318, 323–327, 344, 360, 364, 527, 537, 637, 678–679, 687–690
Master control plan: a comprehensive set of regulations affecting development that derive from an areawide or citywide plan 81
Master plan: an overall spatial plan for an area that serves as a guide for development 18–19, 81, 102–103, 197, 206, 217, 558–559, 561–562, 587, 594–596, 637–638, 678
Material recovery station: a location for separation and recycling of solid wastes that have potential for reuse, also referred to as *recycling station* or *transfer station* 412
Membrane bioreactor (MBR): the combination of a membrane process like microfiltration or ultrafiltration with a suspended-growth bioreactor, widely used for municipal and industrial wastewater treatment 396, 399
Mental map: the spatial understanding of an area used for orientation and navigation 75–76
Metrics: measures of performance that allow objectives to be monitored and managed 4, 115, 122, 212, 680
Micro hydropower. See *Low-head hydropower*
Mitigation of climate change: efforts to reduce the emission of greenhouse gases (GHG) 231
Mitigation measures: steps a site developer is required to take to offset negative environmental impacts of developing a site 191, 196, 224–225, 227, 296, 461
Mixed-use structure: a structure containing two or more uses within a single envelope 479, 481, 530, 644–668
Mobile information devices: handheld personal communication devices with the capability of linking

to Internet resources, such as smartphones 454
Monorail system: typically an elevated system of transit guided and powered from a single rail 309, 326
Morphological analysis: the study of the overall form of an area, from which generalizations are derived; as a design method, exploring exhaustively all the possible forms that respond to a multiobjective program 163
Moving eyeballs: the number of people passing a storefront or attraction 509
Moving sidewalks: automated belts or links carrying pedestrians along a route 327, 329–330
Multilevel retail center: a shopping area with stores on two or more levels 325, 365, 507, 510
Multiplier effects: second-order and further expenditures that flow from an initial investment, such as expenditures by new employees of a business that moves to an area 228
Multiuse infrastructure: infrastructure that serves purposes beyond the utilitarian, such as a drainage way that is also a recreation corridor or a detention area that is used as a playfield when dry 6

Natural experiment: findings that may be derived by analyzing a normal change to the environment, such as changes in automobile volumes on streets in an area when bus service is extended to it 139
Neighborhood: a defined area where individuals share social ties, use of facilities, or values 7, 9, 14, 25, 30–31, 75, 125, 130–132, 135, 138, 185, 187–188, 215–217, 222, 268, 283, 290–298, 333, 381, 420, 454, 475, 484, 492, 500–501, 527–529, 569, 571–572, 579–582, 587–588, 614, 618–620, 630, 632, 644–645, 655–656, 662–664, 668, 669–674, 679–680
Neighborhood plan: a plan for improvements to a defined area as well as regulations for future development, also known as a *subarea* or secondary plan 81, 100
Neighborhood unit: the proposed form for a residential area guided by the number of households needed to support an elementary school and recreation facilities at its center, and restricting heavy and high-speed traffic to the perimeter of the area 669, 679
New city: a planned new settlement large enough to support a range of commercial and employment facilities and provide diverse housing, recreation, and cultural activities, also referred to as *new town* and *new community* 314, 425, 637, 669, 672–673, 684
New urbanism: an urban design movement that promotes mixed-use walkable neighborhoods and diverse communities, containing a wide range of uses and jobs, and built with coherent character 163, 165, 222–223, 294, 298, 488, 491, 682
New urbanist town centers: areas with street-oriented commerce and housing or office uses above, on-street parking with larger lots behind shops, and generous sidewalks and public space 645
New village or neighborhood: a smaller-scale new development often centered on a school or local shopping area, planned to encourage local interaction 30, 475, 669
NIMBY: “not in my back yard,” the rallying cry of groups that resist what they consider undesirable development (too large, too much traffic, too many outsiders, etc.) near where they live 9
No-build alternative: the option of not changing the status quo, which forms a benchmark for comparing the impacts of changes to the environment 116, 225
Noise impact area: the area, defined by type of noise source, within which incompatible land uses such as residences, schools, hospitals, or places of worship should not be located; for airports in most jurisdictions, this is the 65 dB community noise equivalent level (CNEL) 86

Occupation classifications: a typology of occupations, ranging from precise (International Labor Organization [ILO] three-digit classifications) to generalized (white-collar, blue-collar, no-collar, creative, freelancer, etc.) 543
Offices: areas for administrative, professional, and clerical work, such as occurs in *office parks*, business parks, high-tech office parks, and headquarters campuses 22–23, 26, 200, 220, 301, 359,

463–464
phytoaccumulation (or phytoextraction): extraction and storage of contaminants in plants, which are then removed 462
phytodegradation (or *phytotransformation*): the process by which substances taken by a plant are broken down 462–464
phytovolatilization: release into the air of harmful substances from the soil, sometimes after they have been broken down into volatile components 462, 464
rhizodegradation (or phytostimulation): the degradation of contaminants in the rhizosphere (area of soil surrounding the roots of plants) by microbial activity which is enhanced by the roots 462–464

Pilot project: a project undertaken as a test of concept for the purpose of improving future projects 139, 189, 452

Place: a specific location on a site, often filled with activities, where the occupant has a sense of being somewhere 1, 3, 8, 11, 21, 57, 75–76, 78–80, 83–85, 133–135, 164, 176–177, 241, 298, 357–364, 400, 432–434, 454, 456, 478, 484–485, 506, 516, 540, 544, 549, 567–569, 578, 587, 594, 600, 604, 616, 618, 622–643, 658, 672

Planned unit development (PUD) or planned development (PD) area: a multiphase development project in which densities have been modified from as-of-right development rules in favor of a contract that specifies site-specific requirements for facilities, open spaces, site arrangements, and timing of development, and optimizes the use of the site 102, 197, 266

Planning cell (Planungszelle): a process that engages approximately 25 randomly selected people who work as public consultants for a limited time (such as a week) on a planning or policy problem, moderated by two process guides, and then summarize their proposals in a citizen report; a process devised by Peter Dienel 123

Planning conditions and obligations: development approval granted subject to the applicant meeting specific conditions and making good on obligations 103

Planning permission (England and Wales): permission granted by a local authority for building or development, based on an application that may trigger a planning inquiry (pubic review process); also known as *planning obligation* 103, 179

Planning values: aspirations or objectives that underlie public plans 1–11

Plant classification: the formal naming of plants, based on genus, species, variety, and cultivar, such as *Ulmus americana* ‘Princeton’ 475

Plant hardiness zones: zones that help determine which plants are most likely to thrive at a location, based on average minimum winter temperature divided into 10°F intervals 472

Plot ratio. See *Floor area ratio*

Pod: a unit of development without through roads 26–27, 678

Podium or *plinth*: lower levels of a mixed-use development that cover the entire site, usually with retail uses, topped by housing, offices, hotels, or other uses, a common form of development in Hong Kong 500–501, 513, 650, 664–668

Polytechnics: universities that focus on science and engineering research and teaching 591–592, 609–613

Pop-up stores or outlets: short-term or seasonal stores intended to test retailing ideas or capitalize on short-term demand (such as a Halloween store) 514

Precinct traffic pattern: neighborhood traffic circulation organized so that there are limited routes into and out of the area, and neighborhood cross traffic is prevented 291, 296, 298

Preinsulated heating and cooling pipes: pipes for transporting hot water, steam, or chilled water, surrounded by insulation that minimizes heat loss or gain 444–445

Present value: the amount that an investor would pay today for an investment that returns money in the future, discounting future revenues based on the time value of money to the investor 208–214,

frontal rainfall: a cold polar air mass meets a warmer tropical air mass forming a front; when the air becomes fully saturated it rains 61
relief rainfall: rain is formed when air is forced to cool as it rises over relief features such as mountains and hills 61
Rainfall maps: maps providing data on frequency and intensity of rain events for local areas 368–370
Rain garden: a shallow depressed area use to collect rainwater from impervious areas such as roofs, driveways, roads, walkways, parking lots, and compacted lawn areas, planted with species that quickly absorb water 116, 260, 374–375, 487, 676–677
Rain shadow: an area having little rainfall because it is sheltered from prevailing rain-bearing winds by a range of hills or mountains 61
Raster-based graphics (or bitmapped graphics): digital images created by specifying each coordinate (or pixel) on an *x*-y grid, commonly used for photographic images, renderings, or graphic design 152
Rational choice: decisions made in self-interest based on information available to decision makers 174
Rational method for computing runoff: a simple technique for estimating a peak stormwater discharge from a site based on storm intensity, area, and a coefficient reflecting the absorptive capacity of the land 371–372
Real property: fixed property, principally land and buildings, as distinguished from *personal property* (books, cars, or other movable objects), *intangible personal property* (stocks, bonds, or licenses), or *intellectual property* (such as patents or trademarks) 93
Reclamation: filling of land or creating polders to allow its use for cultivation or development 49–51, 85, 402
Recontouring: adjusting the surface profile of land through grading, filling, and extraction of soils 50, 73
Recreation areas: a broad-ranging category of facilities or sites designed for exercise, public and family events, team competition, and relaxation 7, 15, 30, 48–49, 71–72, 83, 130, 132, 190, 198–199, 245–246, 267, 351, 381, 484, 490, 567–589, 594, 599, 606–609, 620, 639–643, 671–673, 676–677, 690–695
Recycling points. See *Material recovery station*
Regulatory taking: the imposition of government regulations that limit the uses of private property to such a degree that it cannot be used or developed 89
Remediation: mitigating the presence of pollutants on a site, through *containment*, *removal*, *ex-situ treatment*, or *in-situ remediation* 114, 460–465
Render: the process of making a drawing that is easily read by lay individuals, usually by creating a three-dimensional sketch or pictorial image (a *renderin*g) 138, 150–160
Renewable energy sources: energy from sources that are not depleted when used, such as wind or solar power 188, 422–431, 691
Residual value: the salvage value or the remaining value of an asset after it has been fully depreciated. Also known as *terminal value* 209
Resilience: the capacity of a place to return to its original form after a major weather event, flooding, or a manmade disaster 4–5, 689–692
Return on investment (ROI): the benefit (return, gain or loss) generated by an investment relative to the amount of money invested, usually expressed as a percentage 212–214
leveraged ROI: gain or loss relative to the equity invested after accounting for loans taken out to execute the project, also known as *return on equity* (ROE) 212–213
return on cost (ROC): the ratio of the gain or loss from sales of a project to its total cost 210–212
unleveraged ROI: gain or loss, assuming that all of the capital needed for a project is equity, that is sourced from the investors 212–213

Right-of-way: lands used for passage of vehicles, pedestrians, and infrastructure, acquired by the public through purchase, dedication, or easements 81, 87, 94, 195, 198, 255, 257–258, 279, 281–291, 317–323, 340–341, 361, 390
Riparian corridor: the land that borders either side of a stream or the edges of lakes or other water bodies 52, 66, 71–72, 462
Roadway density (RD): the number of km (mi) of roadways per unit of area (typically km2 or sq mi), alternatively the *link*:node ratio (LNR) computed by dividing the number of link segments per unit area by the number of intersections in the same area 294–296
Roadway hierarchy: a functional classification system that differentiates roadways by type, each with its own standards 278–287
  arterials: main arteries of a city, emphasizing flow of through traffic, usually restricting access to adjacent properties to locations that don't interfere with traffic flow; includes *parkways*, *multiway boulevards*, and *grand avenues* 283–286
  collector streets: streets that transport vehicles from local streets to citywide arterial roadways; may also provide access to adjacent properties 281–283
  limited-access highways: roadways for long-distance movement with limited locations to enter and exit; includes *expressways*, *freeways*, and *motorways* 286–287
  local access streets: streets providing access to adjacent properties; includes *grid streets*, *loops*, *cul-de-sacs*, *alleys*, *mews*, and *auto courts* 278–281
Rumble strip: a series of raised strips across a road or along its edge, warning drivers of speed restrictions or danger ahead 296–297, 338
Runoff: the portion of precipitation that is not absorbed by the soil but travels by gravity to ponds, streams, or lakes 5, 13, 16, 64, 67–73, 114–118, 145, 158, 173, 226, 236, 241, 254–258, 260, 303, 360, 366–381, 383, 385–386, 390, 393, 456, 466, 470, 487, 565, 677, 687, 690, 694–695

Safety: an environment that is largely free of danger, risk, or injury 7, 82, 85, 120, 135, 231, 236, 258–259, 265, 274–275, 277, 287, 294–297, 316, 322–323, 335–338, 347, 378, 387, 432, 574, 582, 687
Sales kiosks or pushcarts: small booths or carts for sale of specialized items in the public spaces of shopping areas 354, 357, 361, 531
Salt marsh: an area of coastal grassland that is regularly flooded by seawater 68
Sand: small particles of disintegrated rock, often rounded by water motion, typically .0625–2 mm in size 25, 36–39, 42, 49, 52, 56, 68–69, 260, 368, 371, 378, 386, 391, 399, 458–459, 467, 574–576, 580
Sanitary wastes: nonhazardous and nonradioactive liquid or solid waste materials from agricultural, commercial, domestic, or industrial sources 393
Sankey diagram: a graphic illustration of flows, like those of energy, material, or money, in which the width of the arrows is proportional to the size of the represented flow 563–564
Secondary plan (Canada): a detailed area plan that is an elaboration of the citywide plan 81, 100, 123, 197
Security: an environment that is relatively free of crime, personal assaults, and threats 7, 134–135, 201, 245, 249, 294, 334, 342, 353, 362, 364–365, 432–433, 482, 484–485, 490, 523, 554, 618, 629–630, 650, 654, 660
Semilattice structure: a distributed set of nodes with nonhierarchical relationships 681
Sense of place or topophilia: a strong identity and character (in buildings or places) that is deeply felt by local inhabitants and many visitors 2, 3, 11, 115, 177, 240–241, 456
Sensors: devices located in the environment that are capable of recording, transmitting, and in some instances analyzing environmental conditions; they may collect *video*, *numeric data*, *binary data*, or

Sidewalk: a pedestrian way for passage along a street, generally with three zones: the *curb zone* or furniture zone for lighting poles, utilities, or seating; the *pedestrian zone* for passage; and the *interface* or frontage zone, often adopted by merchants for display of goods or signage; also known as a *pathway*, *platform*, *footway*, or *footpath* 346–348, 352–355, 363, 432, 451, 467, 521, 629

Silt: fine clay or other material carried by running water and deposited as sediment 4, 36, 38–39, 41–42, 377, 379, 466, 487

Site coverage ratio: the total area occupied by buildings on a site divided by the site area 98

SITES®: a sustainability-focused rating system for sites that promotes climate mitigation, flood protection, reduced energy consumption, improved health, and increased outdoor recreation activities 187, 190–193

Sky cover: the extent to which the sky is obscured by clouds, usually expressed as an average over the year 58

Sky lobbies: high floors in buildings where passengers can transfer from express to local elevators serving floors above, or from low-zone to high-zone elevators 546, 648

Sky view factor (SVF): the fraction of the sky that is visible from the ground up, usually a dimensionless value ranging from 0 to 1. Also known as *sky plane exposure* 55–56

Skywalk or *upper-level pedestrian walkway*. See *Pedestrian concourse*

Sludge: semisolid slurry that is the result of sewage treated in a tank or treatment facility 392, 396–397, 402, 462

Slurry wall: a belowground wall at the edge of a building site, usually constructed by trenching and filling the cavity with concrete, which protects a site from intrusion of soil and groundwater 43, 461

SmartCode: a model transect-based planning and zoning document focusing on all scales of planning from the region to the community to the block and building 164, 166

Social capital: economic and social relationships in which social networks are central; the underpinning of local institutions 672, 690

Social infrastructure: facilities and spaces for social needs of communities, such as schools, civic buildings, community centers, recreation facilities, and religious places 83, 100, 193

Soil: the upper layer of the earth in which plants grow, typically a mixture of organic remains, clay, loam, and rock particles 2–3, 34, 36–43, 48, 51, 53, 56, 63–73, 108–110, 114, 191, 192, 226, 303, 352, 367–368, 370–373, 375–379, 392–394, 397–399, 460–469, 475

Soil horizons: layers of soil distinguished by color, texture, and material composition 37

Soil salinity: the salt content of a soil 61, 67–68

Soil surcharging: preloading or mounding of water-laden soils, often reclaimed land, to compact and remove water before developing, sometimes with the help of wick drains, vacuum consolidation, or electro-osmosis 61

Soil test boring: a vertical sample of the soil profile at a location, collected using a hand tool or drill rig 36

Solar array: a connected set of solar panels or reflectors that power a solar furnace or generate electricity for the grid or local consumption 5, 307, 423, 425, 443, 464, 690–692

Solar rights: the right to benefit from sunlight without obstruction by neighbors 57, 100

Solidification: the process of creating a solid mass from liquid or gaseous materials 462

Solid waste reduction strategies: strategies to reduce the outputof solid waste in an area or jurisdiction, which may include *reducing* the original use of materials (such as by eliminating paper plates or not printing messages received in computers); *reusing* materials (such as by substituting reusable bottles for disposable ones or burning combustible wastes to produce energy); or *recycling* (reusing materials by crushing or melting and reforming them into new materials) 406

Solid wastes: items disposed of by residential, commercial, agricultural, or industrial uses, also called *garbage*, *refuse*, or *trash* 226, 234, 404–416, 443, 694

Solstice: the two times in the year when the sun reaches its highest point in the sky at noon (summer solstice) or lowest point (winter solstice), marking the longest and shortest periods of sunlight in the year 53–54
Sound attenuation: the use of barriers to reduce sound levels on adjacent sites, such as *sound barriers* or berms lining highways 86–87, 226
Souq (or *souk, soq*, *esouk*, or *suk*): a dense marketplace or commercial quarter in Asian, Middle Eastern, or North African cities 516
Source separation: the separation of recyclable materials in the solid waste stream before collection 406, 413
Space Syntax: a set of theories and techniques for analysis of spatial configurations, emphasizing geometric relationships 168
Specific area plan. See *District plan*; *Neighborhood plan*; *Secondary plan*
Specific heat: the amount of heat needed to raise the temperature of one gram of a material 1°C 55
Stable ecology. See *Balanced ecology*
Stakeholders: those with a direct financial or other tangible interest in a site 112, 115, 117, 119–127, 176, 237
Standard-gauge track: railway with a gauge of 1,435 mm (4 ft 8½ in), though standard gauges depart from this in some countries 321
Statement of intent: a proposal by a landowner to complete specific improvements on a site, generally within an agreed timetable 178
Storm frequencies or events: the expected size and frequency of maximum rainfall events, usually stated in terms of the largest storm that recurs on average in a specified number of years, such as a 10-year storm event or 100-year storm event 61–64
Street-oriented housing: housing where each unit has a front door facing a street 10
Structured survey: a method for collecting data on behavior and preferences using a survey with defined questions 137
Subdivision plan: a plan for dividing a site into multiple properties, providing for access roadways and other forms of infrastructure; a *draft or preliminary plan of subdivision* generally must be approved before any site work begins, and the *final plan of subdivision* is filed when the developer has completed all obligations for staking, creating roads, and installing infrastructure 116–117
Subdivision regulations: rules and requirements of the local government or utility districts that specify minimum property sizes, dimensions of rights-of-way, and specifications for infrastructure 93, 97, 195–197
Subsidence: the gradual sinking of an area of land, often the result of extraction of groundwater, mining, or petroleum activities 43, 50–51, 100, 226, 385
Sump tank: a bottomless tank sunk into the ground that allows for extraction of water in an area with a high-water table 402
Sunlight: sun moving across the sky and falling on a site, its location generally defined by *altitude* (the angle from the ground) and *azimuth* (its compass direction) 53–55
Superblock: a large block through which direct cross traffic is not possible 293, 609, 679
Supply chains: ordering and logistics systems for acquiring components from a variety of locations for assembly or sale 508, 512, 543–544
Surface form: the topography of a site 34
Surficial geology: the shape and materials of a site, including unconsolidated terrain 34–36
Sustainability: in site development, the goal of avoiding depleting natural resources to maintain an ecological balance, minimizing the effects on climate and the larger environment, and fostering a site's ability to rebound after extreme stress (see also *Resilience*) 2, 4–5, 12, 16, 175, 185–194, 262, 601, 690, 699

Sustainability metrics: measures that allow tracking of the draw on resources, emissions, induced travel, and other aspects of sustainability 4, 690, 691
Sustainability rating systems: local, regional, and national standards for development of sites, usually coupled with a certification system, the most common being those administered by LEED, BREEAM, CASBEE, and BEAM 185–194
Swale or swail: a shallow depression of the land, usually intended to collect and detain runoff; *vegetated swales* or bioswales also absorb some of the runoff and filter it, improving the water quality 16, 73, 116, 241, 254, 373–375, 377–378, 380–381, 466

Take part workshop: a community engagement process in which participants act out creative life patterns to arrive at understandings of a site, originated by Lawrence Halprin 176
Taking. See *Expropriation*
Taxi queue, *cab stand*, or hack stand: a zone where taxis are allowed to wait for passengers 311–312
Taylorism: a scientific approach to management, originated by Frederick W. Taylor, that analyzed each step in the work process and sought to optimize how it was carried out 546
Technical colleges: educational institutes specializing in practical training in technical fields, also known as *vocational schools*, *trade schools*, *career schools or colleges*, *community colleges*, *business academies*, *Berufsfachschulen*, *technicums,* and senmon gakko 591, 593
Terroir: the unique characteristics of a location, a subtle blend of landform, soils and subsoils, rainfall, climate, and human traditions 2–3, 79, 104, 118, 456, 459
Thermal mass: the ability of a material to absorb and store heat energy, with high-density materials like concrete and brick holding energy longer than lightweight materials such as timber 56
Thermal storage systems: systems for storing energy overnight or seasonally, using materials that include water, ice, rocks, gravel, or salts, or by injecting water into the rocks below 443–445
Tikkun olam: a Jewish concept defined by acts of kindness performed to perfect or repair the world 176
Time of use (TOU) tariffs: pricing electricity or other commodities to discourage peak use 443
Topography: the surface form of land 2, 13, 15, 43–48, 60, 65, 67, 81–82, 104–106, 149–150, 156–157, 167–170, 226, 277, 279, 286, 290–293, 304, 328, 341, 348, 357, 380, 399, 402, 448–449, 466, 468, 470–471, 491, 498, 540, 662, 686
Town common: lands owned by all residents of the town, usually in the center, originally used for grazing of animals in New England 8, 92
Townscape: the form and visual appearance of a town or urban area, a term popularized by Gordon Cullen 135–136
Traditional neighborhood development (TND): a neighborhood pattern consisting of streets, blocks, modest-sized lots, parks, and local services that promotes walkability through linkages and density 215–217, 268
Traditional sewage (or *sewer* or sewerage) system: a system for collecting, treating, and disposing of liquid wastes; its components may include *lateral sewer*, *collector* or *main sewer*, *interceptor sewer*, *primary treatment*, *secondary treatment*, and *tertiary treatment* (see also *Gravity sewer system*) 255, 367–368, 383, 393–396
Traffic calming measures: elements in the design and detailing of streets that slow traffic and improve the safety of pedestrians crossing the roadway (also referred to as *Verkehrsberuhigung*, *traffic mitigation*, *traffic abatement*, *stille veje*, *tempo 30 zones*, and *local area traffic management*); measures may include *speed bumps*, *speed humps or tables*, *rumble strips*, *narrowing lane widths*, *road diets*, *curb extensions* or pinchers or chokers, *chicanes* or diverters, and medians 278–279, 291, 296–298
Transect: a cross section through a typical settlement from dense urban center to the countryside,

identifying prototypical development patterns 164, 166–167
Transfer of development rights (TDR): the ability to sell or otherwise transfer unused rights to develop a site to an adjacent site, or to a receiving zone 94, 101–102, 222
Transformer (electrical): a device used to transfer power from one circuit to another, changing voltages but not frequency 82, 260, 354, 417, 420–421
Transit-oriented development (TOD): a pattern of higher-density development around transit stops, encouraging walking and transit use rather than driving; also called a *transit village* 178, 314, 332–334, 527–529
Transit platforms: loading areas for mass transit, configured either as side loading platforms (serving one direction), or center loading platform (serving two directions) 321–323, 325
Trolleybuses: rubber-tired electrically powered buses, drawing energy from overhead electrical lines 310–311

Underground solid waste storage chambers: belowground storage areas emptied either by lifting the container and dumping or by vacuum suction 406–407
Underground storm drainage system: piped system to remove excess runoff from a site; components include *catch basins, trapped inlets* or drainage boxes for receiving water, *lateral lines* for transporting it from private properties to *collector sewer* lines running in public rights-of-way, *manholes* at junction points, *pumping stations* to lift water in relatively flat terrain, and *outfall*s for releasing water into larger water bodies 379–381
Underspace: the area below elevated expressways, rail lines, or transit lines 324
Undivided interest in property: property owned by two or more individuals with shared interest and responsibility 93, 198–199
Unearned increment: the rise in property value beyond general inflation and improvements made to it, attributed to actions of others and the community at large 201
Universities: institutions of higher learning that generally combine undergraduate education with postgraduate research and study and professional schools 10, 147, 184, 201, 260, 343, 404, 436, 449, 472, 477, 590–621
Unstructured dialogue: conversation without a strict agenda 135
User: an individual who uses a site but may have no ownership interest in it 5, 7, 9–10, 78, 112, 119–123, 130–135, 138–140, 163, 259, 296, 299, 307, 314, 328, 336, 340, 350, 389, 405, 408, 444, 450, 453, 456, 484, 513, 574, 587–588, 625, 630, 632
User advocate: an individual charged with speaking for or promoting the interests of users 140
Usufruct rights: a limited real right in civil law jurisdictions to use or enjoy a site or thing possessed without altering it 90
Utility corridors: conduits or structures created for multiple use by several infrastructure components, sometimes doubling as service connections 192, 445, 596

Vacuum sewer system: an underground system for waste collection in which solid wastes are drawn from *local holding tanks* via *pressure-sealed collection lines* to a *collection tank* for disposal or reuse 402–403
Valet parking: an arrangement in which valets take vehicles from a dropoff point to a parking area, retrieving them on call when needed 299, 303, 313, 523, 540, 654
Value creation: the value of a property that is greater than the cost of creating and selling it by virtue of the quality of the environment in which it sits 216–223
Value recapture: reclaiming a portion of the increased value of private properties when public improvements are made, such as construction of a transit line or park 201
Vastu Shastra: a traditional Hindu system of principles that guide the design, layout, measurements,

and spatial geometry of sites 169–170
Vector-based graphics: the use of polygons, created by points or nodes, connected by lines, customarily used in CAD programs 152
Vegetated swales: open-air channels lined with vegetation that helps filter and slow runoff before it is released into storage areas 16, 373, 377
Vending carts. See *Sales kiosks*
Vernalization: exposure of plants or seeds to cold to stimulate flowering, usually expressed in terms of days of cold 472
Vertical mixed-use structures: structures containing two or more distinct uses vertically layered, such as housing over offices over shops 660–662
Very-high-bit-rate digital subscriber line (VDSL): a local subscriber technology that can operate over twisted pair copper telephone lines and provide data service at an upstream rate of 12 Mbps and downstream at 52 Mbps 447
View easement or view plane: an area where development is restricted by contract or regulation so that views are not obstructed 94
Viewshed: the surroundings that are visible from a single point on a site, often natural features 79–80
Virtual universities: teaching institutions in which students receive the majority of their instruction via the Internet or through materials mailed to them, meeting faculty face to face only occasionally; also known as open universities and Internet universities 593, 618–619
Vision Zero: a road improvement and traffic safety program that aims to achieve a system with no fatalities or serious injuries 275
Visualization: a method of portraying the form and character of a proposed development; it can range from a quick sketch to a model to a watercolor rendering to a computer-generated image 115, 138, 151, 152, 154–158
Visual preference study: a method for eliciting viewer preferences by asking them to make pairwise comparisons of structures or scenes 138
Vulnerable populations: groups likely to bear the greatest impacts of environmental change, who do not have the resources or means to counteract them 231, 259

Walkability: the ability to conduct daily life on foot, fostered in part by nearby destinations and the presence of safe walkways and absence of threats, partially quantified by computing WalkScore 187, 257, 672
Walkable commercial areas: shopping areas that are sustained by a significant number of walk-in patrons and have a desirable range of shops 644
Walking buffer zone or shy distance: the distance between pedestrians as they pass each other on a pathway 346
Walking speed: the speed of pedestrians on a path, culturally determined and affected by bordering opportunities 348–350
Waste-to-energy systems: systems for converting wastes to energy, including *incineration*, *pyrolyzation* (combustion in the absence of oxygen), *anaerobic digestion* (decomposition by microorganisms), *gasification* (high-temperature treatment with controlled oxygen or steam), and *plasma arc gasification* (use of plasma to create synthetic gas) 415–416, 417, 422
Waste transfer station: a solid waste receiving station where items are sorted by those delivering materials (in small local facilities), or by mechanized operations within the station (in larger facilities) 404, 406, 408, 411–412
Water conservation: strategies for reducing the use of water, such as low-water planting, reuse of gray water, and elimination of evaporative chillers 194, 381
Water pressure or *hydrostatic pressure*: the fluid pressure created by the weight of water above the

elevation where it is measured; may also be created by pressure pumps 43, 387, 390
Water quality: the chemical, physical, biological, and radiological characteristics of water, with standards generally prescribing the minimum qualities for specific purposes 71–72, 231, 237, 368, 381, 385–387, 393, 396–397
Water rights: rights to withdraw water from groundwater sources or watercourses based on the size of a property; rights may be sold to or acquired from other property owners 94
Water sources: origins of water used for potable or irrigation purposes 374–375, 383–386, 390–391
desalination: processes for removing salt from seawater 383, 386, 691
gray water: recycled water treated to remove harmful impurities and used for irrigation and other nonpotable purposes 368, 390–391, 693, 696
groundwater: water drawn from subsurface wells 42–43, 383–385
surface water: water from rainfall and snowmelt 366, 374–375
Water storage system: methods of collecting and holding water for use 387–388
cisterns: generally underground water tanks 17, 377, 383–384, 387–388
reservoirs: holding areas open to the air 368, 382, 384–387, 389, 425
storage tanks: enclosed aboveground structures, often elevated to increase water pressure in distribution lines 387–388, 444
Water table: the upper level of soil saturated by water 36, 39, 42–43, 50, 69, 228, 237, 297, 367–368, 378–379, 402, 414
Water treatment systems: a variety of techniques for assuring that water supply is safe for consumption 386–387
coagulation and flocculation: adding chemicals with a positive charge that neutralize the negative charge of dirt and other dissolved particles forming floc 387
disinfection: adding chemicals to the water or treating it with electromagnetic radiation (UV) to kill any remaining parasites, bacteria, and viruses 387
filtration: passing water through filters to dissolve particles such as dust, parasites, bacteria, viruses, and chemicals 386–387, 400–401
fluoridation: addition of fluoride that helps protect against dental cavities 386
reverse osmosis systems: systems to remove impurities by pushing water through a semipermeable membrane 386
sedimentation: removal of floc by settlement due to its weight 386, 402
Wayfinding: the legibility of routes through a city, often aided by maps and other devices 363, 365, 432
Wetland: an area characterized by permanent or seasonal standing water, with plant materials adapted to wet conditions and hydric soils (see also *Constructed wetland*; *Engineered reed bed*) 69–70
Wide curb lane (WCL): a curb lane on a roadway that has been widened to permit loading or as a buffer for bicycles 337
Wind break or shelter belt: a row of trees planted to provide shelter on the lee side 60
Wind chill factor: the perceived air temperature on a cold day, accounting for wind speed that makes exposed skin feel colder 59
Wind power: electric power generated by wind turbines of various kinds, including the conventional *horizontal axis* turbine, *vertical axis* turbine (vertical blades that spin around a vertical shaft), *Darrieus rotor* turbine (curved airfoil blades on a vertical shaft), and *Savonius rotor* turbine (cupped vertical blades on a vertical shaft) 426–429
Wind rose: a diagram of wind speed and direction for a particular time, or averaged over the season or year 69–70
Woonerf or *living street* or *home zone*: a local street designed to slow or restrict traffic so that the

street can also be used for recreation or social activities 280–281

Xeriscaping (or *zeroscaping or xeroscaping*): landscape forms, materials, and practices that reduce or eliminate the need for irrigation 475

Zero net criterion: a target of having on-site production or offsets equal to or greater than on-site consumption, such as zero net energy, zero net runoff, or zero net carbon emissions 5, 367, 380, 677
Zoning regulations: development rules that prescribe the uses, area, form, and other characteristics of buildings on a site 13, 57, 81, 481, 644, 648, 655, 644