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# Street Standards and the Shaping of Suburbia

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The current surge of interest in reassessing the physical form of the American suburb is heightening awareness of the physical and social impacts of local street design. Yet one hundred and fifty years of ideology are so thoroughly embedded in the making of suburban streets that challenges to traditional street layouts and design usually meet with outright rejection. How did the design process and built environment become so dependent on certain regulations and criteria? The historical evolution of suburban residential street standards is traced here through a review of professional and technical publications, as well as historical precedents. Urban designers, planners, and engineers should work together to develop street designs that are more responsive to the diverse users of streets and to varied social and geographic settings.

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Attempts to reshape the form of the American city are often thwarted by the standards and procedures that have become embedded in planning and development. Particularly troublesome are standards for streets that virtually dictate a dispersed, disconnected community pattern providing automobile access at the expense of other modes. The rigid framework of current street standards has resulted in uniform, unresponsive suburban environments. Rethinking of suburban street standards is needed to create more cohesive, livable, and energy-efficient communities and metropolitan areas. Yet attempts to do so meet with resistance from many quarters: engineers, financial institutions, government regulators, the road building industry, and police and fire protection services all have vested interests in the street regulations as they have evolved. Do the existing suburban spatial patterns justify adherence to the rationality of standardization? Why did the design process and built environment come to depend on these criteria and regulations? How did residential street standards come to be? Who has been responsible for their formulation? How have they changed through time?

As a prelude to reevaluation of the suburban environment, we have studied the evolution of suburban residential street standards through a review of professional and technical publications as well as built projects over the past two centuries in both England and the United States. We identify four major periods of historical shifts in the development of street guidelines and standards: 1820–1870—The Origins of Suburban Design Standards in Europe and the United States; 1870–1930—A Search for Social Response; 1930–1950—The Institutionalization of Standards; and 1950–the present—Technocracy and Engineering. We have examined the forces that helped shape each period, as well as its significance for street form today. Each step in the evolution of standards was analyzed according to its conceptual framework, design prototypes, administrative acts, construction techniques, and normative specifications. The most

useful sources on the origin of American suburban street standards are government and professional handbooks for subdivision development such as those issued by the Federal Housing Administration, the Housing and Home Finance Agency, the Institute of Transportation Engineers, and the Urban Land Institute. Of particular interest to urban design is Charles Mulford Robinson's 1911 study, *The Width and Arrangement of Streets*. General works on urban history and the development process such as those by Harold Lautner (1941), Walter Creese (1966), Christine Boyer (1983), Robert Fishman (1987), and Marc Weiss (1987) have been valuable in tracing the chain of events leading to standardization and in studying street standards in the context of larger processes.

## 1820–1870: The Origins of Suburban Design Standards in England and the United States

During the industrial period in Britain, urban road design and improvement often were responses to crowding and degradation of the urban environment. The exploitation of street space arose in the absence of any regulations or restraints to manage the environmental impacts from the growing population. In 1842 only 86 of the nearly 600 streets of Leeds were under municipal control and were sewered and paved (Creese 1966, 76). In 1844 the *First Report of the Commissioners of the State of Large Towns and Population Districts*, published in London, advocated a fundamental rethinking of street design. Regulating street width and direction was seen as the key to controlling growth and ensuring long-term planning.

To avoid the harsh physical and social conditions of the industrial city, affluent citizens of that era chose

to live in new developments at the rural-urban edge. Fishman (1987) traces the origin of this urban edge suburbia to London of the late eighteenth and early nineteenth century, when the London elite began to abandon their combined homes and offices in the heart of the city and moved their families out to large villas in the agricultural settlements that ringed the city. As the suburban notion trickled down from the elite to the middle class, the demand for building sites increased, and landowners at the edge of the city profited from the new living pattern. Their challenge was to design communities to satisfy the new buyers' aspirations.

John Nash, in his design for Park Village (1823) at the edge of Regent's Park, London, intended to appeal to those seeking homes at what was then the rural edge of the city. The plan avoided the formal eighteenth century urban pattern of solid streets and squares. Instead the houses were set within a picturesque landscape with curving paths. Nash integrated scattered elements of the suburban style into a working formula that made the suburban development a reproducible product (Figure 1).

The English picturesque tradition of design strongly influenced American architects and designers such as Andrew Downing, Calvert Vaux, and Frederick Law Olmsted. Olmsted visited London and Liverpool in 1850 and encountered the prototypes of his later work as a park designer and suburban planner. Olmsted and Vaux realized their residential philosophy in pragmatic design in their 1868 plan for the suburb of Riverside, Illinois, which turned a featureless 1,600 acre tract of "low, flat, miry, and forlorn land" (Olmsted, Vaux and Co. 1868, 292) into a picturesque landscaped community. Tree-lined roads, "gracefully curved lines, generous spaces, and the absence of

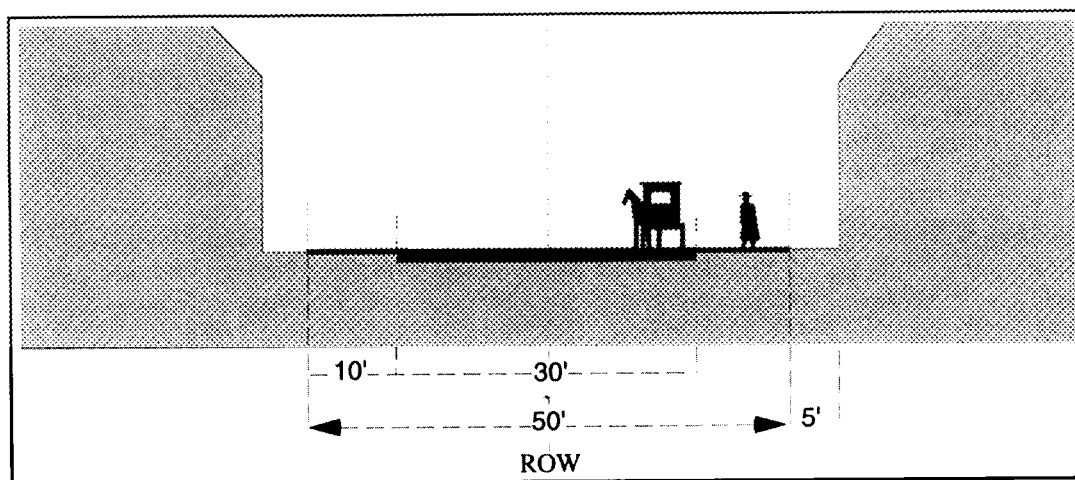


FIGURE 1. Park Village, 1823

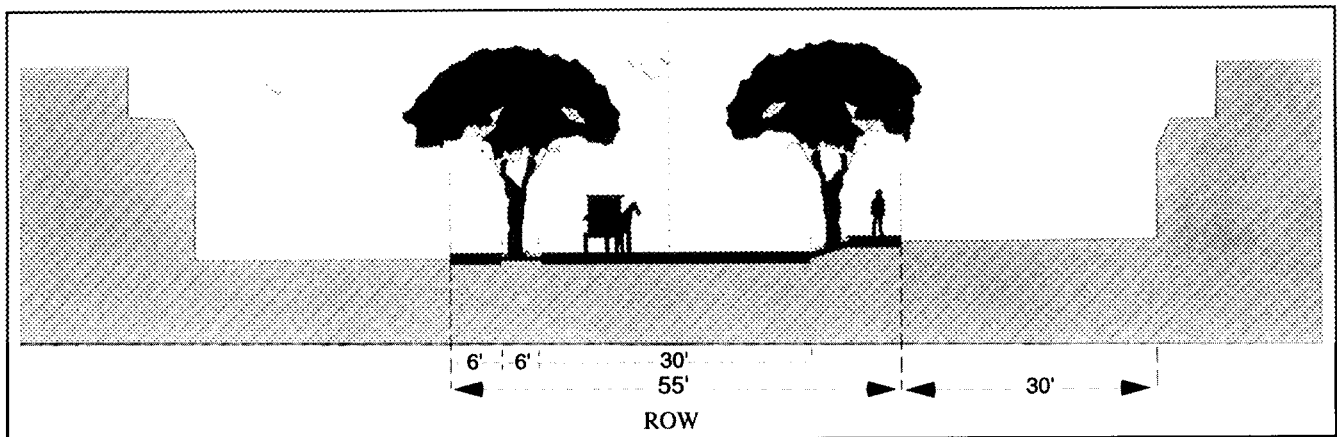


FIGURE 2. Riverside, IL residential street, 1868

sharp corners" (Olmsted, Vaux and Co., 1868, 300) were laid in deliberate contrast to the prevailing city street grid (Figure 2). Houses were set back at least 30 feet from the road to please the eye. The residential roadway was set at a width of 30 feet, with pedestrian walkways on both sides. Trees were planted in a strip between the path and the roadway, the first instance of Olmsted and Vaux systematically carrying out this feature in a suburban context. This use of a planting strip as a physical and visual separator between road and pedestrian became a prominent feature in the American suburban landscape.

### 1870–1930: A Search for Social Response

During the late nineteenth century the environmental chaos of the city was seen as linked to its social problems. Overcrowding and deteriorating sanitary conditions were believed to cause social and moral degeneration. Social and health reformers argued that the inevitable social disorder would be controlled best by improving the environment. Then, as reformers discovered the difficulty of improving the inner city, many began advocating multi-centered growth patterns. Suburbanization was seen as a vital force not only in urbanizing the countryside, but also in revitalizing the city. Howe (1912) and Aronovici (1914) saw the suburbs as representing a shift of emphasis from property to people. "A one or two room tenement, sunless, almost airless, and at a cost that would pay for a comfortable home in an attractive suburb, is worse than a travesty. It is almost a crime" (Howe 1912, 15). Aronovici further stressed the hope that suburbia held for the industrial worker: "the suburbanizing of the wage earner is a great social and economic opportunity. . . . It is for us to say whether this growth will result in a contamination of open country

by the city slums or whether garden communities will look upon the bleak horrors of our urbanized existence and give men, women, and children a new lease on life and industry and a chance to serve men rather than enslave them. . . . The Utopian city of yesterday can be realized in the growing suburbs of our own times" (Aronovici 1914, 238).

### Developments in England

The demand for better living conditions—light, air, cleanliness, and relief from street congestion—prompted intervention by public authority. In England, the Public Health Act of 1875 established the Bye-law [sic] street ordinance. The vision of wide, straight and paved streets entranced the authorities who saw in it the best solution for the ills of their cities. Inspired by European neoclassic urban design of the seventeenth century, with its uniformity and order, they mistakenly adopted it for industrial city conditions. In one project in Leeds, 238 inhabitants were removed and 59 dwellings were dismantled to provide more street space (Creese 1966, 79). Unfortunately, the uniformity of the layout and the rigidity of the design were inappropriate for a residential environment. Although the English by-law street design did not answer residential social needs, its basic principles stressing the importance of light, air and access nonetheless remained prominent. The by-law street right-of-way of 60 to 70 feet established a standard configuration for residential street widths still used today.

At the time that the Bye-law [sic] Street Ordinance came into effect in 1875, developer Jonathan T. Carr acquired orchard land outside of London with the intention of building a suburban community, Bedford Park. Recognizing the potential benefit of the existing trees, Carr and his architect, E. W. Godwin, rejected

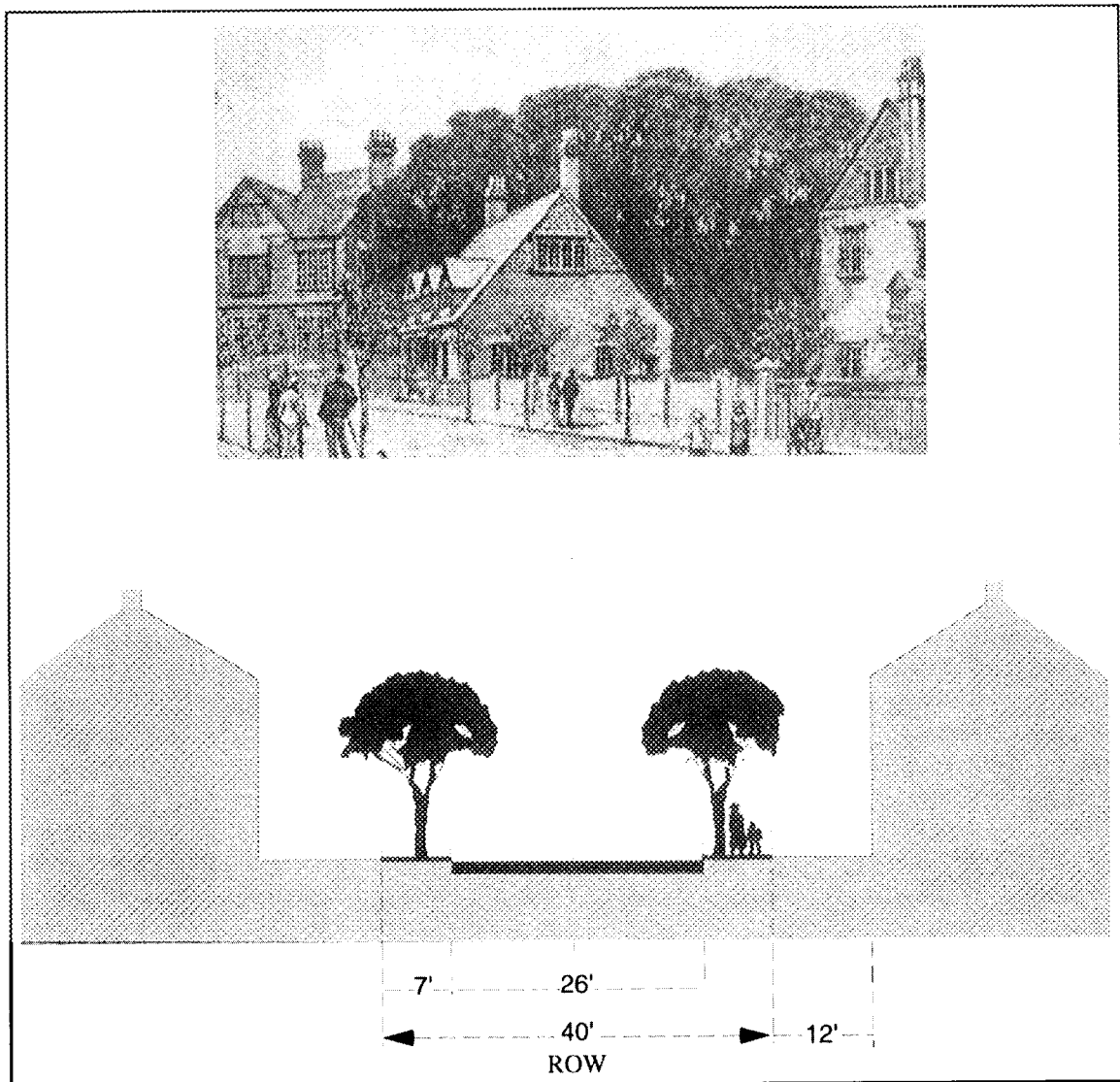
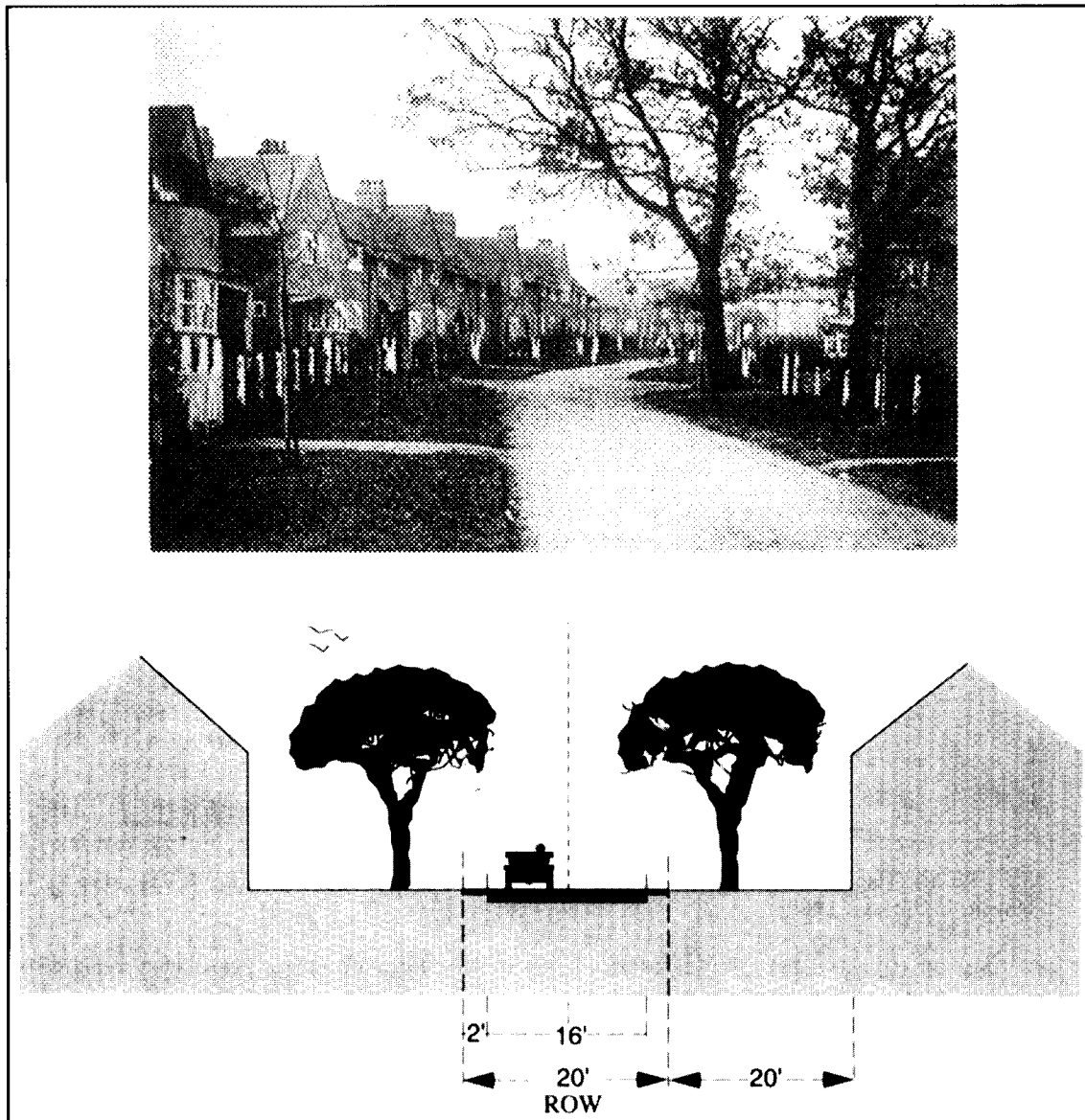


FIGURE 3. Bedford Park (begun 1875)

the idea of the bare and clean by-law street in favor of a layout following the natural pattern of the plantation. The street width was 40 feet, and the houses were set back between 12 to 20 feet, creating an effective relationship between house and street, private and public. The mature preserved trees were a powerful unifying element that set Bedford Park apart from the more conventional suburbs around London (Figure 3). According to *Chambers's Journal* (Dec. 31, 1881), "The peculiar characteristic of these streets is the utter absence of that stiffness which always seems to attend the chilly, regular, and hideous house-rows of our other suburbs" (840). The Bedford Park street layout provided the first challenge to the by-law street. With its rejection of straight vistas, barren width, and uni-

formity, it inspired succeeding suburban street designers to question authoritative prescriptions.

When Raymond Unwin and Barry Parker were commissioned to design the suburban community of Hampstead Garden Suburb near London in 1904, they decided to challenge the impersonal monotonous layouts of the by-law streets, and returned to the intimate and refined spatial forms of courts and yards associated with traditional communities. Unwin argued: "Another bye-law [sic] which is not uncommon is that against roads having no through way, known as cul-de-sac roads. This action has, no doubt, been taken to avoid unwholesome yards; but for residential purposes, particularly since the development of the motor-car, the cul-de-sac roads, far from being unde-



**FIGURE 4.** Hampstead Garden Suburb, residential streets (Barry Parker & Raymond Unwin, Architects, 1909)

sirable, are especially to be desired for those who like quiet for their dwellings" (Unwin 1909, 393). Unwin felt that the physical form of street and building layouts directly influenced social behavior and the well-being of the community. He lobbied for the "Hampstead Garden Suburban Act," a private bill passed by Parliament in 1906, which suspended certain building regulations. The bill allowed creation of cul-de-sacs and permitted roads of less than 500 feet with carriageway widths reduced from 35 feet to 12 and 16 feet.

The annulment of the by-law street regulations in Hampstead allowed Unwin to experiment with a vari-

ety of street forms and configurations that he believed would support the concept of a community envisioned by the Garden City movement and its founder, Ebenezer Howard. For the first time the cul-de-sac and open court clustering were systematically used throughout a development. Road types were hierarchical, and varied in both layout and cross section; Hampstead Garden Suburb thus became the prototype for residential subdivision road planning (Figures 4 and 5). According to Howe, "The roadways in Hampstead ignore right angles. They avoid regularity in every way. They meander about aimlessly, comfortably, following the natural contour and advantages of the

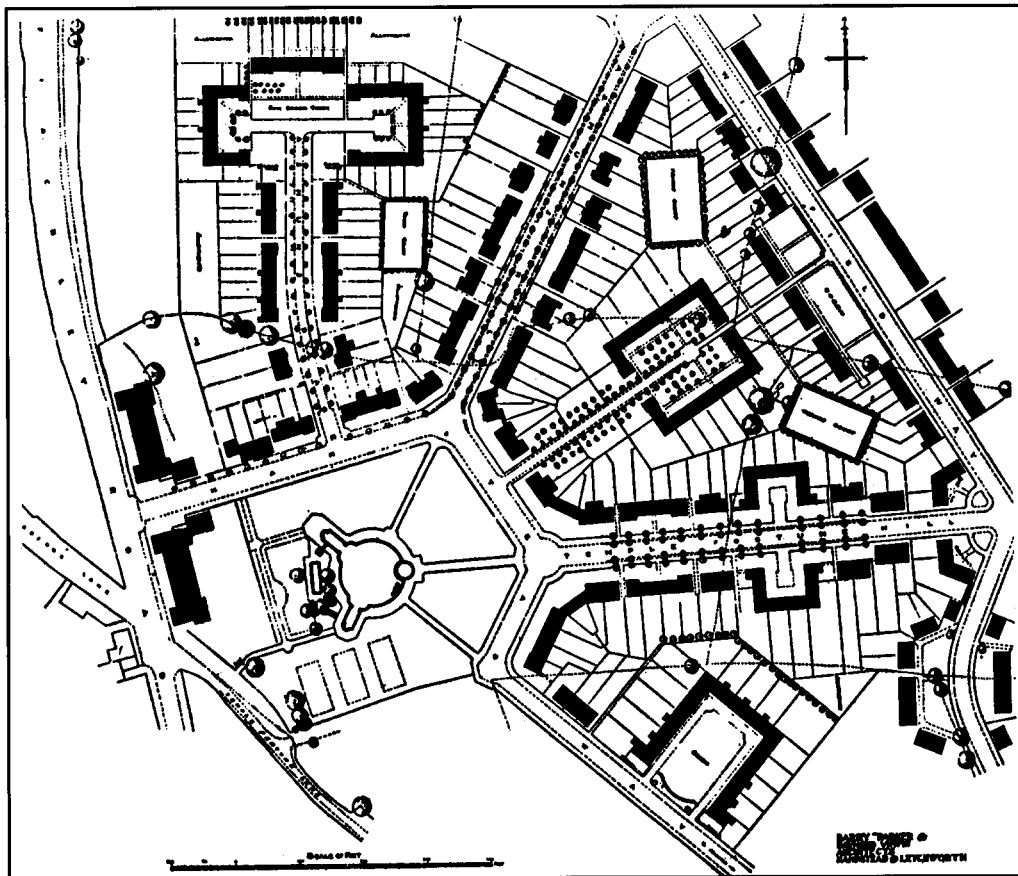


FIGURE 5. Hampstead Garden Suburb, cul-de-sac arrangements (Barry Parker & Raymond Unwin, Architects, 1909)

land. Nor are they of equal width. The residential streets are narrow. They are designed to discourage traffic and keep it on the main thoroughfares" (Howe 1912, 5).

From the middle of the nineteenth century, road development both in Europe and in the United States was held back by the expansion of railroads. Although road building technology advanced during this period, vehicle performance lagged, largely because of governmental limitations and policy that favored rail and stage coaching. Steam vehicles appeared in England as early as 1769 and developed rapidly until 1866, when the Parliament passed the "Red Flag Law." This inhibiting ordinance required that self-propelled vehicles on public roads be limited to a maximum speed of four miles an hour, carry a minimum of two people, and be accompanied by a third on foot, carrying a red flag to give warning and help control frightened horses (Rae 1971).

#### **New Public Attention to Roads: The United States**

The road system's deterioration first aroused public attention, surprisingly, because of the bicycle, a new

mode of travel whose popularity reached its peak in 1877 with the introduction of a low-wheeled, rear-wheel-driven "safety" bicycle. The bicycle captured the public imagination by offering convenience and mobility that was both safe and cheap. In the period from 1890 to 1895, often referred to as the "Bicycle Craze Era," bicycle clubs in both England and the United States lobbied for road improvements. These efforts brought recognition of the need for local road-aid laws, which were adopted by New Jersey in 1891 and were followed by the founding of the National League for Good Roads in 1892 and the establishment of the Office of Road Inquiry within the U.S. Department of Agriculture. These acts established a regular road inspection and improvement program carried out by local authorities as well as the federal government. In particular, the Office of Road Inquiry investigated the system of road management throughout the United States and the best methods of road making, and published this information nationwide.

The 1890s saw the appearance of the motor vehicle on the American scene. Like the bicycle, the motor vehicle increased the pressure for road improvements;

the American Automobile Association was founded in 1902. A key development was the production of the model T Ford, beginning in 1907. A nationwide road census in 1904 showed 2,151,570 miles of roads, of which only 7 percent were classified as "improved" or surfaced with stone or gravel. The remaining 93 percent were dirt roads. Production of motor vehicles, however, exceeded all expectations. In 1900 there were only eight thousand motor vehicles using these roads, but by 1920 there were eight million vehicles (Rae 1971, 32). The popularity of the automobile increased pressure on the government, and in 1916 Congress passed the Federal Aid Road Act, the first comprehensive government action to integrate the country's road system and establish a nationwide state highway system.

During the same period, at the turn of the century, a new direction in civic improvement emerged, committed to using expert knowledge, state regulatory mechanisms, and public welfare provisions. Reformers turned to science and technology as the means for change, with the premise that physical remedies could not only improve living conditions, but also solve social problems. Experts and technocrats were called on to recommend policies and administer scientific approaches. The pressure for professional solutions prompted the First National Conference on City Planning and the Problems of Congestion, held in Washington, DC in 1909. This was the first formal expression of interest in systematic solutions to urban problems. Remedies proposed at the conference included encouraging private enterprise to build at the edge of cities to relieve congestion. Issues such as "The Best Methods of Land Subdivision" and "Street Widths and Their Subdivision" laid the groundwork on which federal, state, and local governments established zoning and subdivision regulations (Figure 6).

### The Influence of the Regional Planning Association

As city boundaries expanded unrestrained, some planners sought ways to bridge the gaps between the city, the suburbs, and the open region. In 1923, twenty planners and architects, among them Lewis Mumford, Henry Wright, Clarence Stein, Frederick Ackerman, Clarence Perry, and Stuart Chase, formed the Regional Planning Association of America (RPAA), hoping to develop guiding principles for designing more satisfying residential environments. Looking for a theory of metropolitan and regional planning, they adopted the garden city ideal of Ebenezer Howard, advocating a regional pattern of economically related but autonomous urban units ringed by open space.

A major issue addressed by the Regional Planning

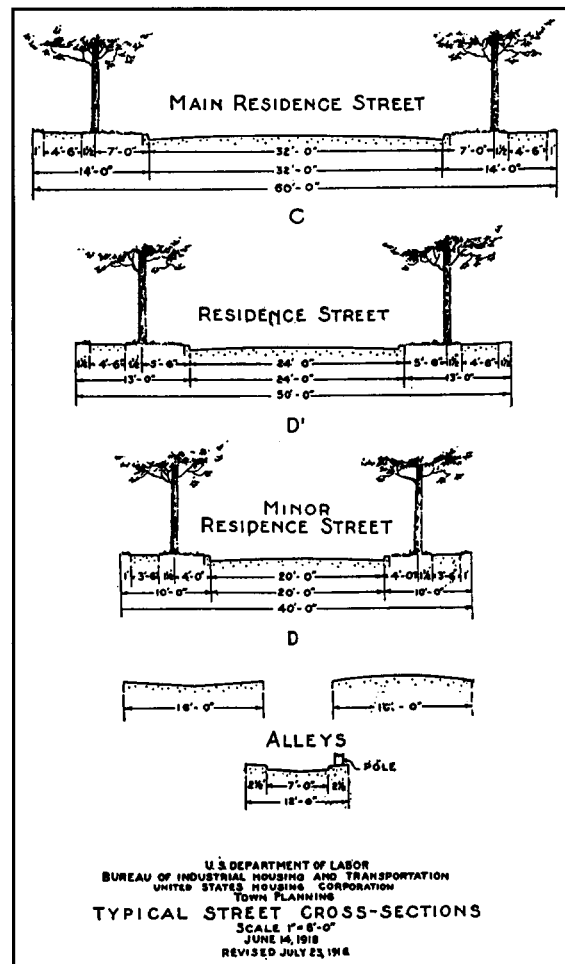


FIGURE 6. Recommended standards published by the United States Bureau of Industrial Housing and Transportation, 1919

Association was the way in which uncontrolled and speculative regional growth diminished the sense of community in residential neighborhoods. As a member of both the Community Center Movement and the Regional Planning Association, Clarence Perry developed a planning concept that he entitled "The Neighborhood Unit—A Scheme of Arrangement for a Family-Life Community" (Perry 1929). His aim was to define a fractional urban unit that would be self-sufficient yet related to the whole. Perry's concepts were much in tune with those of Raymond Unwin, an expert on neighborhood planning. Unwin's presentation to the New York Regional Committee in 1922 argued that increased transportation facilities would not cure congestion and that congestion is bound to be part of urban life; thus, localities should protect neighborhood living through the following planning measures: (1) Allowing fewer streets to traverse residential areas; (2) Locating main streets on viaducts bridging

the cross-street traffic; and (3) Relegating private automobile traffic to specific routes away from transportation facilities. Clarence Perry advocated the reformulation of residential traffic concepts and standards. Together with Thomas Adams, he devised a set of guiding principles for residential street systems in the New York region, which were included in Volume VII of the New York regional plan (1929). The main suggestions were:

- Streets should be adapted to the traffic load and kind of use they are destined to have;
- Street layout should fit the land, for attractiveness and lower cost;
- Main internal streets should be 60 to 80 feet wide;
- Secondary streets should be 30 to 60 feet wide;
- For local streets, a pavement width of 18 to 20 feet is sufficient, and the balance of the right-of-way can be devoted to sidewalks and planting;
- There should be no street through the neighborhood on which the motorist can see ahead a long stretch of uninterrupted road;
- If a long straight street is unavoidable, landscape circles or ovals should be interposed at junctions in such a way as to compel cautious driving;
- Staggered cross streets, dead end streets, and cul-de-sacs contribute to safety, attractiveness, and variety;
- Cul-de-sacs and dead end streets should be used only as part of a complete subdivision plan integrating both pedestrian and vehicular circulation;
- If long blocks are used, pedestrian footpaths should offer shortcuts (New York Regional Plan Association, 1929).

The work of Perry and Adam contributed to the acceptance of the residential neighborhood as a unique entity to be protected and deliberately planned.

In 1924, Alexander M. Bing, a real estate developer and a charter member of the Regional Planning Association, founded the City Housing Corporation "for the ultimate purpose of building an American garden city" (Stein 1951, 23). The corporation's chief architects were Clarence Stein and Henry Wright, who in 1928 planned Radburn in Fairlawn, New Jersey, sixteen miles from New York City. None of the Radburn design features were completely new. Yet, as Stein acknowledged, their synthesis and integration into a comprehensive layout was a breakthrough in subdivision form. Stein and Wright were critical of the grid for its bias in favor of traffic and for its extensive cost. They argued that the costs of through-street pavement and mainline utilities were not fully understood, and they complained that realtors and municipal engineers had perpetuated obsolete forms. Stein said that the idea of purely residential streets was at that time

"contrary to the fundamentals of American real estate gambling" and that "none of the realtors, and few city planners who accepted zoning as their practical religion, seemed to have faith enough in the permanency of purely residential use to plan streets to serve solely that use" (Stein 1951, 47). Stein and Wright advocated the cul-de-sac as a rational way to escape the limitations of the checker-board plan, in which all streets are through streets, with the possibility of collisions between cars and pedestrians every 300 feet. The Radburn cul-de-sac lane was designed at a 300-to-400-foot length, with only a 30-foot-wide right-of-way, as opposed to the prevailing 50-60-foot width. Stein further reduced the paved driving lane to 18 feet and allowed for the 6-foot utility strip on each side to be landscaped and thus visually part of the garden. Building setbacks were 15 feet, and provisions were made for street parking (Figure 7).

The Road System Hierarchy, the most innovative Radburn adaptation, was derived from Olmsted's route separation in New York's Central Park. Stein and Wright, however, went further than physically separating vehicles and pedestrians. They established a road hierarchy that for the first time was unchangeable and regulated. The superblock of 35 to 50 acres was surrounded by 60-foot-wide streets (avenues) serving as feeders to the cul-de-sacs. The hierarchical layout allowed for considerable savings in construction costs. As the cul-de-sacs carried no through traffic, their standard of construction was less demanding. Curbs were not used, and sewer and water lines were smaller. Overall the development was able to reduce street area and the length of utilities by 25 percent from what a typical gridiron street plan required. According to Stein, the cost savings for roads and public utilities, in comparison to those of the normal subdivision, paid for the construction of the main core parks.

## 1930-1950: The Institutionalization of Standards

The second quarter of this century saw the rise of many of the government and professional bureaucracies that formulated street design standards still in use today. In the 1930s the harsh realities of the economic depression rendered American municipal authorities ineffectual. At the 1932 National Conference of Mayors, 29 cities sent a plea for help to the federal government. The Hoover administration was reluctant to increase direct help for the cities, and instead resolved to call a special President's Conference on Home Building and Home Ownership. The conference did not directly intervene or allocate any direct funding, but the proposals put forward there shaped the future



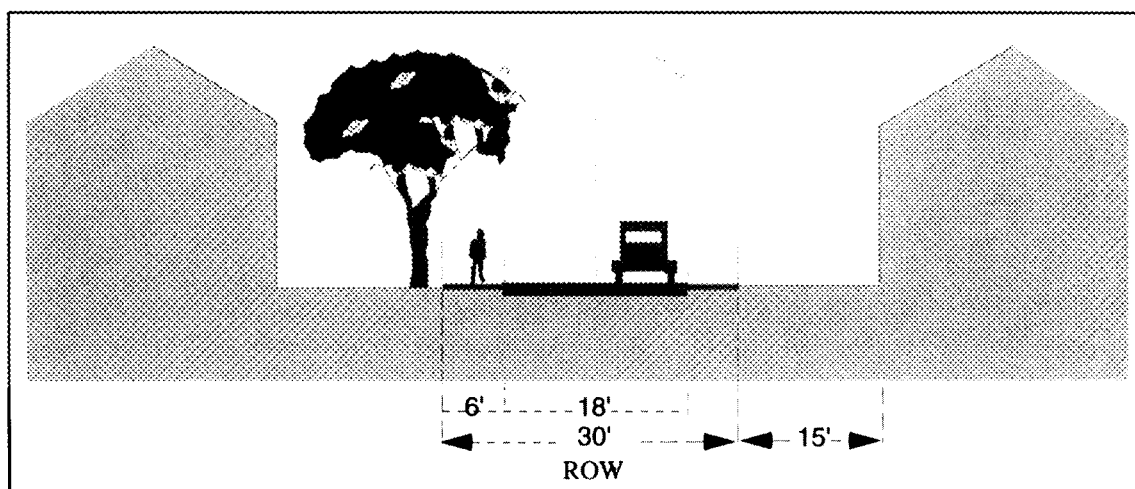


FIGURE 7. Radburn, NJ, 1928

of government intervention in housing. More than 3,700 experts on various aspects of home finance, taxation, and planning of residential districts formed committees and put forward the following recommendations:

- To pass state enabling acts granting city planning powers to municipalities
- To give priority to housing
- To follow the Neighborhood Unit principles in designing residential areas
- To adopt a set of subdivision regulations to control the design of new areas
- To adopt comprehensive zoning plans for cities, urban regions, towns and counties
- To develop comprehensive mass transportation plans
- To preserve and develop open space systems in residential neighborhoods

The recommendations put forth by the Committee on Subdivision Layout were based on the principles of Perry's *The Neighborhood Unit*, Thomas Adams' *Residential Development*, and the previous National Conferences on City Planning (especially the 7th in 1915). The committee recommended that several aspects of streets be regulated (Figure 8):

- Relation of proposed streets to adjoining street systems
- Street alignment
- Street intersections
- Street width
- Roadway width
- Street names
- Street trees

For the next decade, planning discourse and its physical outcomes were shaped by three major federal

actions: the adoption of the 1932 President's Conference recommendations, the establishment of the National Planning Board under the authority of the Public Works Department in 1933, and the establishment of the Federal Housing Administration as part of the National Housing Act (1934-1935).

#### The Key Role of the Federal Housing Administration

The Federal Housing Administration was established to restructure the collapsed private home-financing system through government mortgage insurance plans. FHA financial assistance and mortgage insurance created the most ambitious suburbanization plan in United States history. In 1934 more than 70 percent of the nation's commercial banks had FHA insurance plans. By 1959, FHA mortgage insurance had helped three out of every five American families to purchase a home and helped to repair or improve 22 million properties (FHA 1959, 12-16).

To secure its investments against risk, the FHA established appraisal procedures that required lenders, borrowers and developers to have detailed plans approved. The FHA underwriting criteria soon became the prevailing standard. Moreover, the FHA, unlike other planning agencies, was largely run by representatives of real estate and banking, so developers felt that its intervention protected their interests. Establishing standards and underwriting also supported the established builders, enabling them to further expand and construct large-scale residential subdivisions with governmental backing, and to put the 1920s speculative style "curbstone subdividers" and "Jerry-builders" out of business (Weiss 1987). Thus, FHA officials found themselves in a powerful position, far greater than any planning agency's, to shape development for generations.



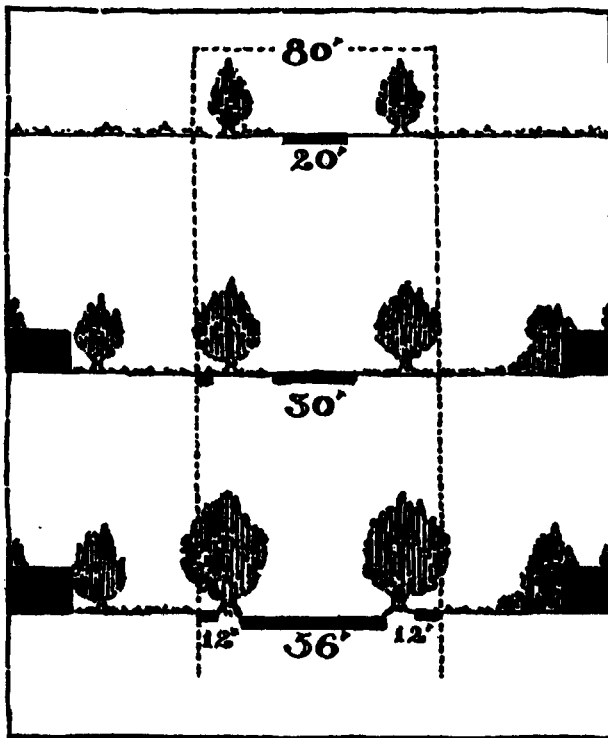


FIGURE 9. FHA's first publication of a recommended street width, illustrating how street improvements on an 80-foot right-of-way may be gradually increased as the neighborhood grows (FHA, 1936)

- Minimum setbacks for houses should be 15 feet;
- Front yards should avoid excessive planting, for a more pleasing and unified effect along the street.

Subsequent publications by the FHA adhered to the standards set in 1936 and 1937, with no changes in street layouts or widths until 1941, when the minimum width of residential street pavement was increased from 24 feet to 26 feet, and concrete curb construction was recommended.

In 1938 the FHA Technical and Land Planning divisions initiated a free review program in which prospective developers could submit preliminary plans to the FHA, whose consultants would then suggest layouts conforming to FHA. It was a powerful control mechanism, and naturally almost all subdivision developers submitted their plans for review to ensure a guaranteed mortgage.

Thus, the federal government was able to exercise tremendous authority and power through the simple act of "making an offer that could not be refused." FHA minimum standards and design regulations had set the ground rules for modern subdivision development, which shaped the wartime housing projects of the Federal Public Housing Authority and provided

the basis for the post-World War II suburbanization drive; these standards were also the foundation for local government subdivision regulations (Figure 10).

By 1941, thirty-two States had passed legislation granting the power of subdivision control to locally elected planning commissions. Through this exercise of legislative "police power" by the state, the right of a landowner to sell property became subject to approval by an authority designated to "promote the community health, safety, morals, and general welfare" (Lautner 1941, 1). The regulations that these local

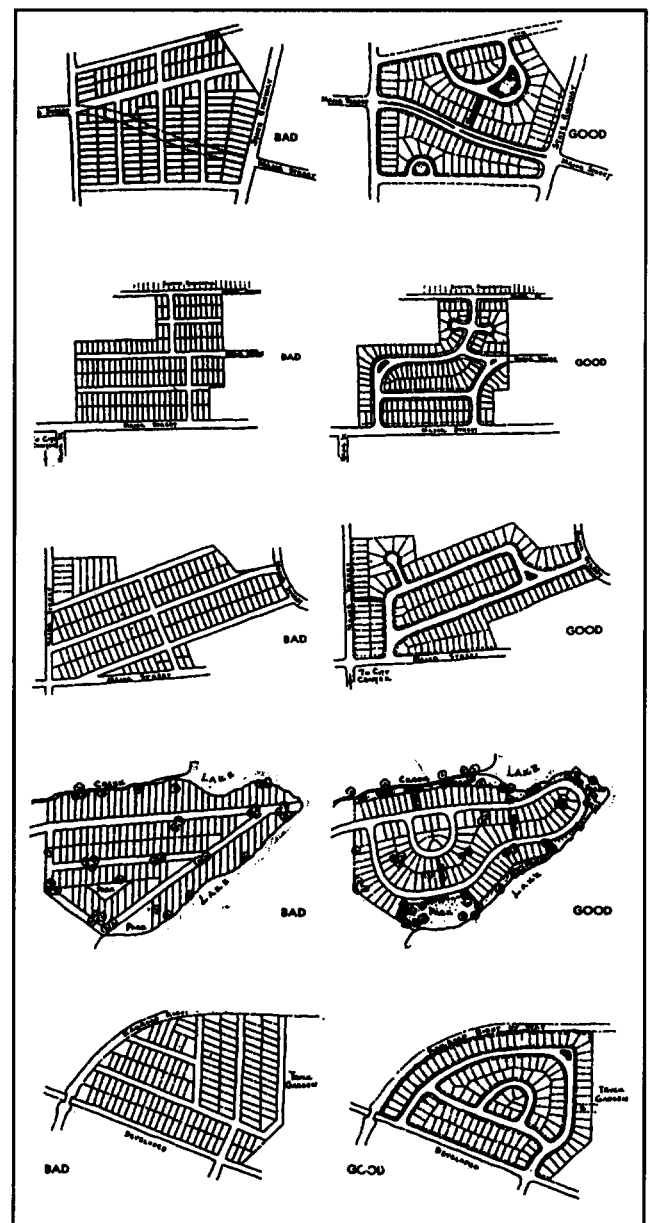


FIGURE 10. FHA recommended subdivision layouts (from FHA publications, 1938–1952)

planning commissions adopted to govern subdivision procedures were largely based on federal criteria, in particular those of the FHA. A nationwide survey of more than two hundred cities' requirements by the Public Administration Service in 1941 found them to be similar. All required proposed subdivision streets to conform to the street plan of the community, particularly for major streets, and encouraged discontinuity and the elimination of through traffic, as well. An interesting shift had occurred with regard to dead-end streets. Early in the century developers disregarded overall circulation planning when constructing dead-end streets, thus making problematic configurations; in the 1940s, however, properly designed dead-end streets were seen as desirable home locations.

The 1941 survey found that the width of minor streets and dead-end streets varied, from 22 to 40 feet for roadway width and from 50 to 60 feet for right-of-way. Prevailing minimum measurement for planting strips was 6 feet, for sidewalk width 4 feet, and for curb radii 20 to 25 feet. In 1941, 160 cities of the total of 213 surveyed required a right-of-way of 50 to 60 feet; two cities required only 33 feet (North Adams, Massachusetts, and Bronxville, New York); and one city, 80 feet (Great Falls, Montana). Traffic lane widths for minor streets were generally recommended to be 9 feet, and parking lanes 7 feet as a minimum. Most regulations dealing with sidewalks set no definite rules, but required the approval of the planning authority. The 4-foot sidewalk was recommended for outlying residential streets but not necessarily for the inner ones. In contrast to earlier practice, during the late 1930s and early 1940s almost all cities required that any street trees be planted on the property side of sidewalks, for safety and maintenance (Lautner 1941, 113).

Subdivision regulations as exercised by a local planning agency were effective in implementing the community master plan. One might expect that in each locality, unique guidelines appropriate to its character would be developed. Indeed, local planning administrative acts often stated as much: "Good subdivision design cannot be standardized and applied universally to all tracts, but only basic principles and minimum standards of design can be formulated" (International City Managers Association 1941, 256). In the design of residential streets diversity and freedom of choice were advocated (Lautner 1941, 117). However, achieving diversity and adaptation to local conditions have often remained theoretical. The gap between a principle and a standard has not been bridged. Thus, most local agencies have ended up adopting the nationally prevailing set of subdivision standards put forward by the FHA.

## The Influence of the Building Industry

The building industry, which supported a comprehensive national set of regulations such as the FHA standards, clearly was apprehensive about local agencies' guidelines, viewing them as unpredictable, hard to plan for, costlier and less supportive of development. To help counter them and also help the home builders and real estate community, a few private organizations were formed, the most influential of which was the Urban Land Institute (ULI). Organized in 1939 as an independent, nonprofit research organization in urban planning and land development, ULI was sponsored by the National Association of Real Estate and was a consultant to the National Association of Home Builders. The information it provided to developers and home builders about community development advocated the FHA approach to subdivision layout and adopted many of its recommendations, while trying also to deter unconventional approaches to subdivision (ULI 1947, 7). ULI publications pointed to inconsistencies in local agency requirements and often urged modifications to facilitate construction and reduce costs. Thus ULI has often supported change within the structural planning framework. As most local streets and their utilities were located, financed and constructed by the subdivider of the land, whose main aim was profit, ULI emphasized: "There is a tendency in many municipalities to require excessive width for minor single family residential streets. This is reflected in a similar tendency to require excessive road pavements" (ULI 1947, 62).

ULI's intention to cut construction costs and to lessen the burden on the developers was reflected in its recommendations for minor streets in detached residential streets, published in 1947:

- Right-of-way: maximum 50 feet
- Pavement Width: maximum 26 feet
- Sidewalks: 4 feet wide with regular curb, and 3 feet, 6 inches with rolled curbs (In general, ULI recommended a sidewalk on at least one side of the street, but also noted: "Sidewalks tend to encourage use of the street for play rather than off-street areas such as the rear yard or play ground.")
- Curbs: "Rolled curbs are favored. They provide a pleasing unbroken street line, do not require expensive curb cuts, and are one of the most practical cost reducing items in street construction."
- Intersection Radii: 15-foot radius
- Planting Strip: Recommended mainly for use with vertical curbs as a way to overcome the curb cuts and the gradient of the driveway. A minimum of 8 feet on each side of the street was recommended for tree planting.

ULI's publication of *Residential Streets* in 1974 and 1990 continued to advocate lower standards for local streets and also renewed emphasis on accommodating other street uses besides just vehicular access (ULI 1961a, 1961b, 1974).

An organization closely related to ULI was the National Association of Home Builders. NAHB strongly opposed what it saw as excessive standards. In its 1950s *Manual for Land Development* the organization asked: "Why is it that the widths of local residential roadways up to 36 and 40 feet are still advocated by some highway engineers and planning commissions?" The manual gave as the apparent reasons (1) misunderstanding of the relationship between street location, alignment width, and use; (2) adherence to the obsolete theory that every street should be designed as a traffic street; (3) insistence on continuous alignment of minor streets; and (4) disregard of economic aspects such as the cost of constructing, maintaining, and repairing from 38 to 54 percent more roadway surface than is needed (National Association of Home Builders 1950, 114–118).

The building industry's emphasis on reconsidering street standards was met with considerable reluctance by local planning agencies. The specter of substandard street layouts along with the rise in vehicular ownership promoted a continuation of technocratic design for subdivisions.

## 1950–Present: Technocracy and Engineering

Rapid changes in transportation prompted the formation of a professional specialty in transportation engineering in 1930, through the national Institute of Transportation Engineers (ITE) and a specialized program at Yale University. The new profession was defined as: "... a branch of engineering which is devoted to the study and improvement of the traffic performance of road networks and terminals. Its purpose is to achieve efficient, free, and rapid flow of traffic; yet, at the same time, to prevent traffic accidents and casualties. Its procedures are based on scientific and engineering disciplines. Its methods include regulation and control, on one hand, and planning and geometric design, on the other" (Matson and Smith 1955, 3). In 1939, ITE was asked by the federal government, the National Conservation Bureau, and the American Association of Highway Officials to suggest traffic engineering guidelines and standards. In 1942 the first *Traffic Engineering Handbook* was published, providing the basis for professional practice.

Most of the early publications were concerned with efficient, high-speed road networks, rather than

local residential networks. In the 1940s, the recommended lane widths and cross sections emphasized driver comfort and safety at high speeds. A lane width of 12 feet was usually recommended for mixed truck and passenger vehicles, and 11 feet for passenger cars. Street parking lanes on urban streets were recommended to be 13 to 15 feet. The justification often given for these dimensions was: "The important factor in the width of parking lanes is the effect of the parked cars upon the capacity of the highway. A further reason for this width was the possibility that at some future time parking may be prohibited and the lane will become a through traffic lane. Wider parking lanes also decrease the interference with through traffic when vehicles are parking and unparking" (Matson and Smith 1955, 410).

## The Decline of the Grid Pattern

The safety problems associated with through traffic in residential streets were first addressed by traffic engineers only in the mid-1950s, when the emphasis shifted to preventing through traffic by means of a hierarchical street network. Yet the cross sections of residential streets and their geometric configurations remained unchanged. One of the first engineering studies on street safety in residential subdivisions, conducted in Los Angeles between 1951 and 1956, examined the accident rates in developments with a grid pattern, as compared to those in developments with the prevailing FHA limited-access and curvilinear pattern. The results showed that the accident rate was substantially higher for grid-pattern subdivisions: 77.7 accidents per year, as compared to 10.2 accidents per year for an equivalent area of limited-access subdivision—a ratio of almost eight to one. Fifty percent of all intersections in the grid pattern had at least one accident during the five-year period. In contrast, only 8.8 percent of the intersections in the limited-access pattern had accidents during that period. This difference was particularly significant, since there were 65 percent more intersections in the limited-access tracts than in the grid tracts. Especially significant was the number of T intersections with no accident record. Overall, T intersections were found to be fourteen times safer than four-leg intersections (Marks 1957, 308–325). These performance-based findings enabled the traffic engineering profession to justify applying a discontinuous street pattern in residential subdivisions. Yet these findings should be interpreted cautiously, since the study seems to have several limitations including control of variables such as traffic volume and neighborhood density, topography, and pattern.

Expanding on the land use study and its findings,

ITE devised a technical publication to establish an engineering format for the discontinuous form of subdivision layout, incorporating the following:

- Limited access to the perimeter highway
- Discontinuous local streets to discourage through traffic
- Design patterns with curvilinear alignment, cul-de-sacs, short street runs, and elbow turns
- Numerous three-leg T intersections
- Local street widths with 40–60-foot rights-of-way and 26–36-foot pavements (Marks 1961, 105–116)

The 1965 ITE publication *Recommended Practice For Subdivision Streets* stated: “The primary objective of subdivision design is to provide maximum livability. This requires a safe and efficient access and circulation system, connecting homes, schools, playgrounds, shops and other subdivision activities for both pedestrians and vehicles.” Yet, after stating these principles, the publication proposed a set of standards for geometric configurations that aimed mainly at efficient vehicular movement, thus illustrating the conflict between flexible principles and rigid standards. On the one hand, ITE stated: “Although it is extremely important that sound standards be followed in the layout and design of neighborhoods and of neighborhood street systems, it is equally important that there be room for variety, experimentation and improvements in residential design,” and on the other hand, it prescribed these standards (Figure 11):

- Right-of-way: Minimum 60 feet
- Pavement width: 32–34 feet
- Curb: Vertical curb with gutter; rolled curbs not recommended
- Sidewalks: At both sides, minimum width 5 feet
- Planting Strip: 6–7 feet, sloping towards street
- Cul-de-sac: Maximum length 1,000 feet, with 50-foot radius at end
- Parking lane: 8 feet
- Driveway: Minimum width of 10 feet for one car, with 20-foot-wide curb cut (5-foot flare at each side)

These standards and geometric configurations have continued in subsequent publications (1984, 1991) and have been widely used as the basis for subdivision regulation by local agencies and public works departments. They established a professional framework and a reference source that could claim a scientific basis in empirical research. Despite the stated interest in variety and experimentation, the solution they provided was presented as absolute and indisputable, leaving little room for new design approaches.

## Conclusion

The street design standards in use today have a long history, and their use has improved the safety, efficiency, health, and privacy of streets and neighborhoods. While standards can of course help prevent the worst conditions, they also can stifle creativity and inhibit adaptation to local situations. What began as visionary design with valid motivations has often evolved into a rigid, over-engineered approach. Once they are established, it is too easy to apply standards automatically; in the case of street standards, they have become deeply embedded in engineering and design practice, as well as in the legal and even the financial structures that support development. The results are all too visible in look-alike developments that often are unresponsive to their users and to their geographic contexts.

Often, local governments adopt standards by mechanically following federal or state models, without considering the character and requirements of each project. Fear of liability has also helped to embed such standards in codes as valid absolutes. As a result, modifications or new standards have been very slow to develop. Although some different approaches to road layouts have been made, for example in the work of Peter Calthorpe, and Duany and Plater-Zyberk (Figure 12), institutionalized guidelines and standards have not changed. And since federal agencies have not advocated changes, lesser agencies are reluctant to do so. Local authorities see the federal guidelines as rules flatly recognized by all road-related groups, which clears them of responsibility. Consequently, local planners and citizen groups rarely challenge existing street standards. Unconventional approaches to suburban layout face a nearly impossible barrier to approval. Current problems in subdivision street design may be attributed to the single-minded focus on traffic control and the failure to integrate that with concerns for functional accessibility and livability.

It is now time to look at what has been created with a fresh eye and to rethink suburban street standards. This is a major research task for the next decade. We must look at streets as complex community settings that serve a variety of functions—not simply as channels for moving traffic and emergency vehicles. Streets are also environments used for walking, bicycling, and jogging, for socializing, and for children’s play. They are the staging spaces for community interaction and neighborhood development. As such, their design requires an understanding of social behavior, architectural and urban design, and general planning.

We now need an interdisciplinary approach to street design and planning. Urban designers, planners,

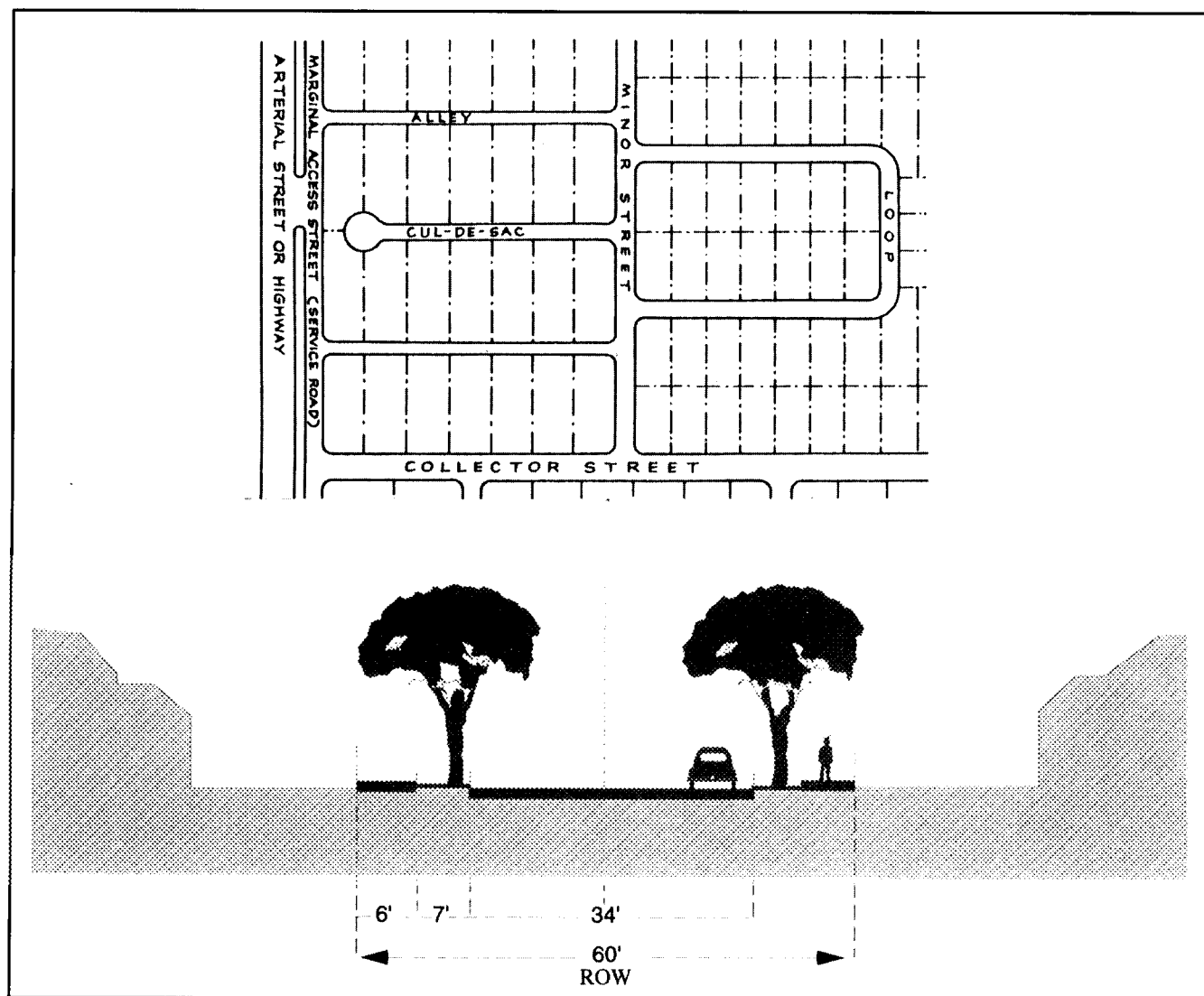


FIGURE 11. ITE typical cross sections and recommended street layout (ITE, 1965 & 1984)

and engineers should work together to develop new and revised standards that are more adaptable and responsive to the diverse users of streets and to varied social and geographic settings. Research on performance standards—their creation, use, and effectiveness—is needed to explore the possibility of standards that can respond to varied user needs and environmental values while also meeting basic requirements for safety. We should reexamine the safety and traffic studies that generated street standards in the 1950s and 1960s, and also compare safety performance and accident rates of suburban streets according to their specific layouts, particularly the discontinuous pattern versus the traditional grid. Residents' sense of traffic safety and their preferences in street layouts should be studied. Also valuable would be case studies of situa-

tions that have departed from conventional standards, as in privately owned streets and some neotraditional developments. Through what process were the standards revised? How well are the revisions working? Investigation of design prototypes and planning processes that have successfully changed street standards here and abroad can suggest ways of modifying guidelines in the United States.

The development of explicit yet variable standards for residential street design could open up new possibilities that would induce users to alter their travel behavior, their choices of routes, and their modes of transportation. A renewed effort to establish such standards through technical and official publications would provide a basis for change and legal backing for local planning agencies. At the same time, interim pro-

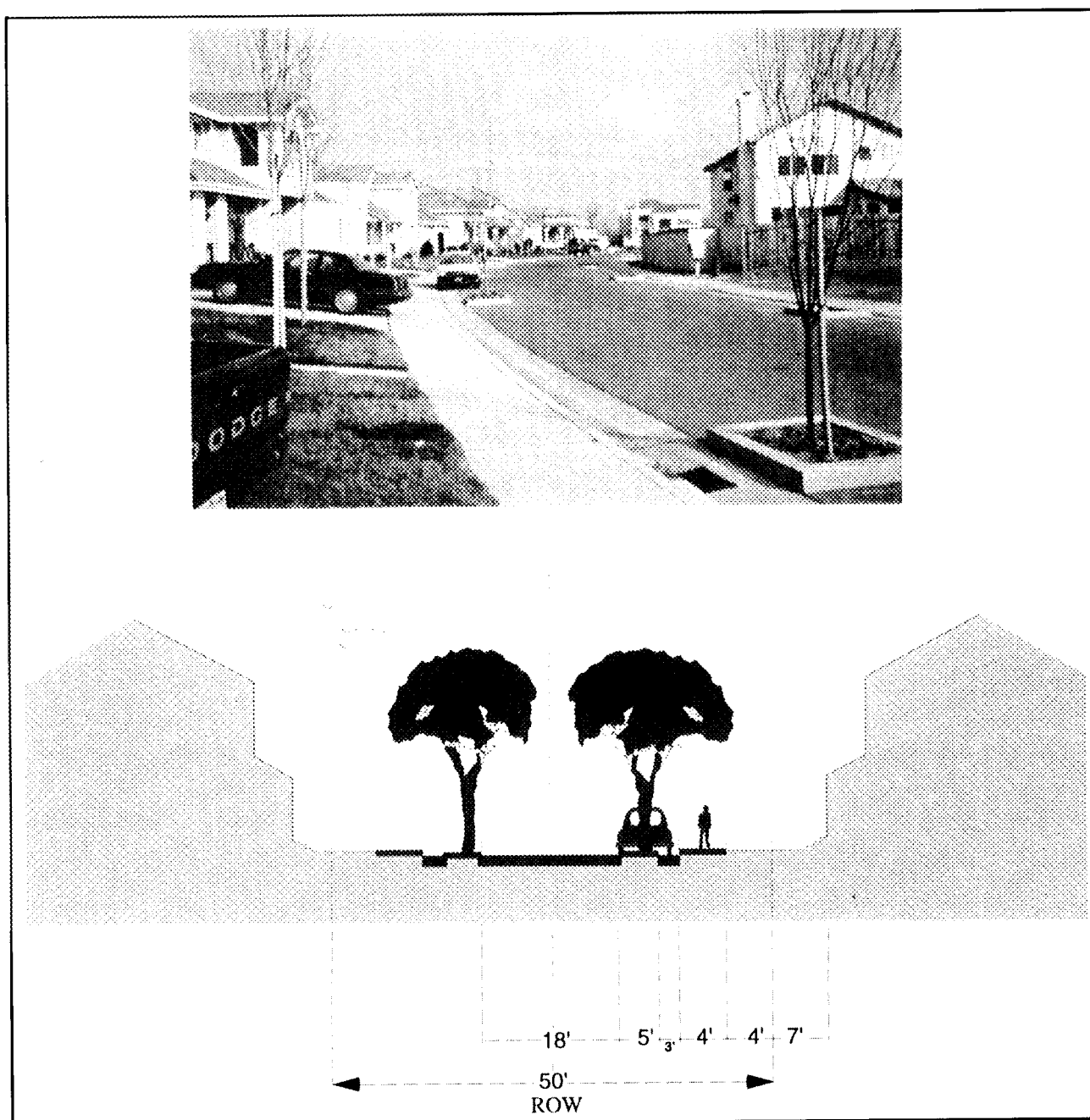


FIGURE 12. Laguna West, CA, 1991

visions should allow for alternative subdivision layouts that challenge existing standards and focus on habitat as well as movement.

#### AUTHORS' NOTE

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