REGULATED STREETS

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"Standards are of the nature of habit. And habit is an outstanding characteristic of all human action."
(National Industrial Conference Board, 1929)

Abstract. *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 streets on the environment. One hundred and fifty years of ideology are so thoroughly embedded in suburban street forms that challenges to traditional street layouts and design are often met with outright rejection. Yet these standards and regulations form a rigid framework that has resulted in uniform, unresponsive suburban environments. Does the existing suburban spatial pattern justify adherence to the rationality of standardization? How did residential street standards come to exist and how have they changed through time? Why did the design process and built environment become so dependent on these regulations and standards? This paper traces the historical evolution of suburban residential street standards through a review of professional and technical publications, as well as historical precedents. Five major periods of historical shifts in the development of suburban street guidelines and standards are identified: 1800-1870 (The Industrial Order), 1870-1930 (A Search for Social Response), 1930-1950 (The Power of Control and Authority), 1950-1985 (Technocracy and Engineering) and after 1985 (A Return to Former Values). Each period is studied in terms of the forces that helped shape it and its significance in shaping present day street forms. These incentives are then analyzed according to five categories: Conceptual Framework, Design Prototypes, Administrative Acts, Construction Techniques, and Normative Specifications. We now need to approach street design and planning in an interdisciplinary way. Urban designers, planners, and engineers need to work together in developing new and revised standards that are more responsive to the diverse users of streets and that are more adaptable and responsive to varied social and geographic settings.*

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Introduction

"The question of the character of building roads in this country certainly requires much re-consideration. The width of roads has been used, under our form of building bye-laws, to determine the distance between the houses, and as a means of securing a greater degree of open space than would otherwise be obtained. The result is that the width of roads under the bye-laws commonly in force in the English towns, are not regulated with regard to requirements of traffic, a minimum width for streets is arbitrarily fixed, 40 to 50 feet being usual, and all roads are required to be laid out at least this width . . . As consequences, roads have to be widened at vast expenses to allow for trams and for traffic, while cottages are built fronting to dreary wastes of asphalt and macadam, one half of which could with great advantage be added to their gardens or laid out as grass margin." Raymond Unwin, London, 1909. [1]

Raymond Unwin's concern with the character of roads in 1909 is still valid today. The question of the character of roads has yet to be challenged. In the more than 80 years that have passed since Unwin asked for re-consideration, the physical character of our residential street layout has been virtually unchanged. Typically the suburb is still dominated by single-family residences fronting an extensive paved street. The prevailing right-of-way width for a residential subdivision street, as specified by the Institute of Transportation Engineers, has remained at 50 to 60 feet.[2] This ample space, designated for an exclusive mono-functional land use within a residential environment, has contributed to the supposition that "the present form of suburban city is grossly wasteful in its use of energy, materials and land."[3] In a typical suburban subdivision, with 5000 square foot lots and 56 foot rights-of-way, streets amount to approximately 30 percent of the total development. When typical 20 foot driveway setbacks are included the total amount of paved space reaches to about 50 percent of the development.[4] Cumulative figures show that worldwide at least one-third of all urban development is devoted to roads, parking lots, and other motor vehicle infrastructure, and in the urban United States, close to half the area is used to accommodate the automobile. (In Los Angeles the figure approaches two thirds).[5] Moreover, much built road space is actually wasted considering that local residential streets compose 80 percent of the total national road miles while they carry only 15 percent of total vehicle miles.[6] Waste of street space and its economic impact has been a prolonged phenomena. Just as Raymond Unwin criticized English practice in 1909, so did Frederick Law Olmsted in 1910, when addressing the second national conference on city planning in New York. "There has been," he said, "a decided tendency on the part of official street planners to insist with quite needless and undesirable rigidity upon certain fixed standards of width and arrangement in regard to purely local streets, leading inevitably in many cases to the formation of blocks and lots of a size and shape ill adapted to the local uses to which they need to be put. Another instance is that of fixing a minimum width of street and minimum requirements as to the cross section and construction thereof which make the cost needlessly high for purely local streets, and thus inflicts a wholly needless and wasteful burden of

annual cost upon the people."[7]

The extensive allocation of land for circulation purposes in the context of residential suburbia has not just resulted in the depletion of land and an increase in the economic burden for all, but also has affected the social behavior of the community. The function of the street in residential areas as a facilitator of social interaction has been diminished by the emphasis on motorized accessibility. "It was often forgotten that residential streets become part of the neighborhood and are eventually used for a variety of purposes for which they were not designed. Residential streets do not only provide direct auto access for the occupants to their homes, but they also provide a visual setting, an entryway for each house, a pedestrian circulation system, a meeting place for residents, a play area (whether one likes it or not) for children, etc. To design and engineer residential streets solely for the convenience of easy automobile movement overlooks the many overlapping uses of residential streets."[8] The paradigms of traffic oriented streets have been directed toward expanding their capacity to accommodate traffic. Street codes and standards which were established to facilitate travel performance negated the essence of residential livability.

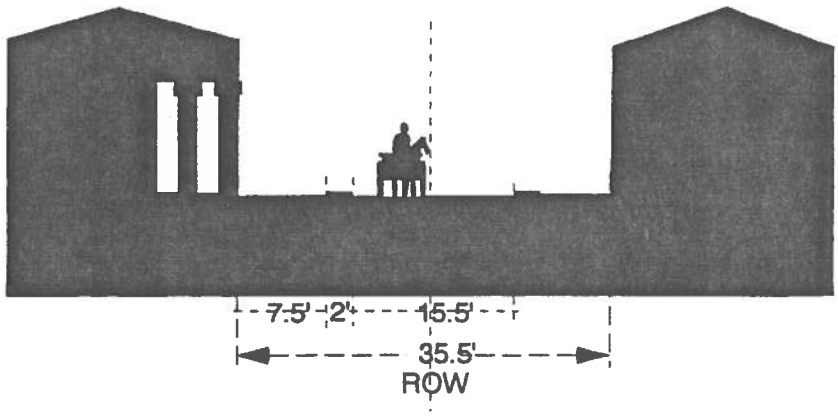
Regular administration of public works, the centralized supervision over land development in the 1930s, and the rise of the transportation engineering profession have established street standards as justifiable absolutes. Developed standards were then mechanically adopted and legitimized by local governments shielding themselves from any responsibility to road performance.[9] Federal funds for street improvements further entrenched uniform standards. Local agencies were required to adhere to minimum geometrical design criteria in order to be eligible for monetary assistance. Modifications were discouraged and because higher governmental agencies did not openhandedly allow flexibility, lesser agencies were reluctant to do so.[10] Additionally, financial institutions and retailers embraced conventional suburban street and parking layouts. Lenders were hesitant to support a development outside the mainstream, particularly when it did not conform to established standards. Retailers favored segregated land use and dependency on the "drive, park, and shop" concept. As a result they required traditional standards of wide streets, ample parking, and ease of movement in return for embracing a project.[11]

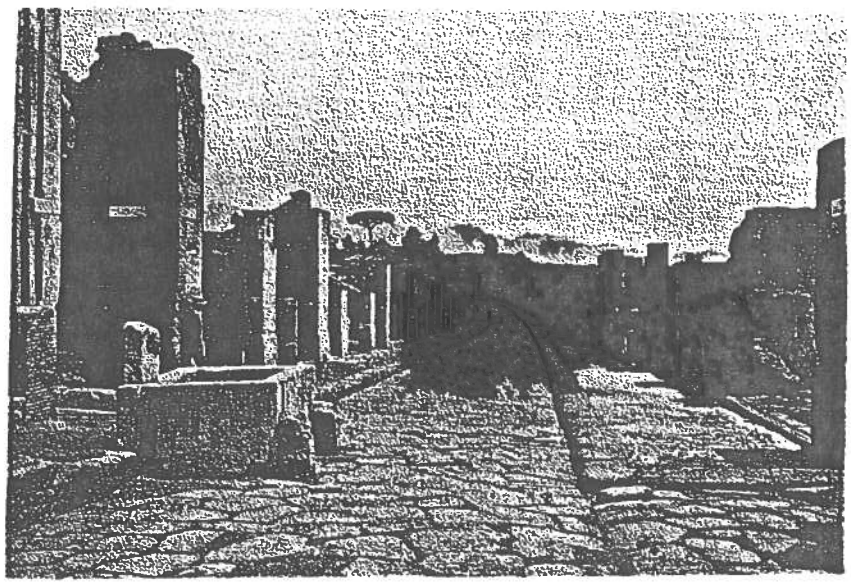
Standards and regulations pose a rigid framework that has resulted in an unchanging suburban environment. At stake is not only the construction of the physical realm along technological rules, but also the legitimization of a specific philosophical model. Does the existing suburban spatial pattern justify the adherence to the rationality of standardization? Why did the design process and built environment become so dependent on these regulations and criteria? How did residential street standards come to exist? What are the sources and the processes that generated them? Who is responsible for their formulation? How have they changed through time? These are some of the issues and inquiries that should be understood and evaluated as a prelude to reevaluation of the suburban environment.

Road Building and Technical Achievements. Modern road building techniques and design are an outgrowth of the Roman Empire's *viae militares* (military roads) built 2,000 years ago. By the peak of the Empire in 300 BC almost 53,000 miles of roads had been built connecting Rome with the frontiers. The typical Roman road was constructed of four layers of flat stones, crushed stones, gravel, and coarse sand mixed with lime. On the surface paving stones and a wearing surface of mortar and a flint-like lava were laid. The width of the road was usually about 35 feet, with two central lanes 15.5 feet wide (going in two directions) lined by free standing curb stones 2 feet wide and 18 inches tall. On the outer side of the curbs a one-way lane of 7.5 feet was laid (Fig 1). This basic section and construction technique set the standard for road construction in Europe until the late eighteenth century.[12]

Between 1500 and 1800 two major factors contributed to technical improvements in road building. First, the power of the merchant class grew and exerted pressure on the authorities to improve the road network. Second, there was a revival of interest in the documents and monuments of antiquity by Renaissance architects who stressed the building of better roads.

Andreas Palladio (1518-80) studied Roman planning and architecture and proposed a typical road section for cities. The center was a crowned paved surface (to encourage side drainage) for the sole use of pedestrians. The two sides were made of sand and gravel and were for carriages and cattle. A stone curb separated the two areas and incorporated large mile stones (Fig. 2). Another Italian author, Guido Togiletta (1587) advocated the construction of cobble pavements on a mortar

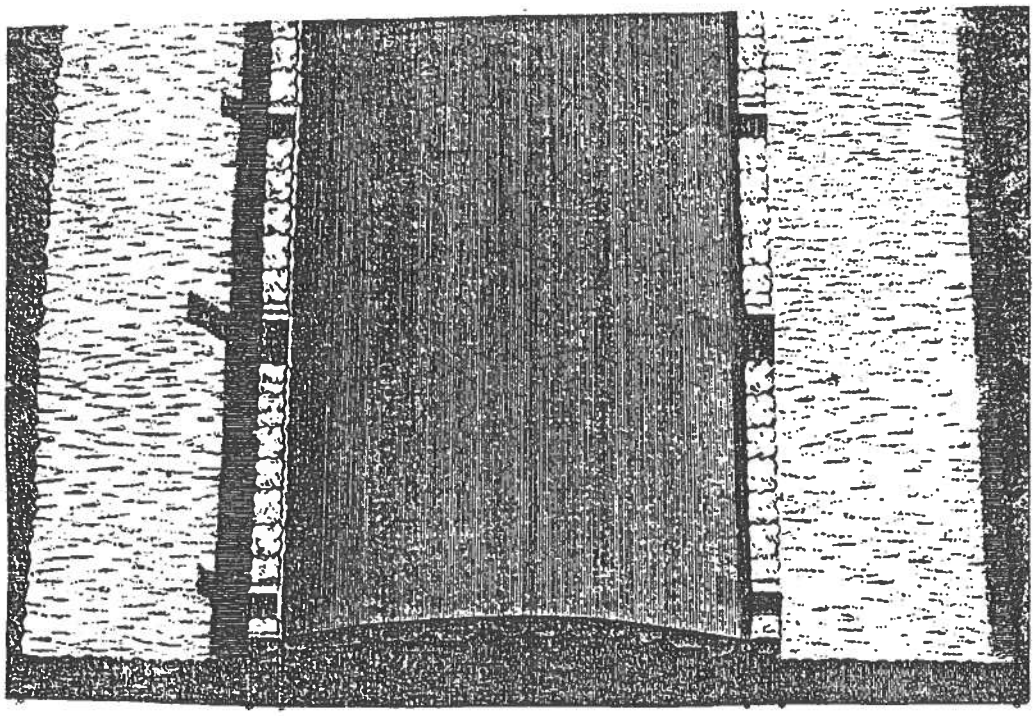




1. Typical Roman Street. (79 AD). (Unwin)

foundation well above the ground water level. Gautier (1660-1737) a French Engineer of the army corps proposed a road body enclosed by a stone wall and built from earth. In 1716, Louis XIV formed the Corps des Ponts et Chaussees, a body of road and bridge experts and engineers, to supervise public work. This was the first body of civil engineers in Europe maintained by a government. An associated school (the first professional civil engineering school in Europe) was established in 1738. In 1764, Pierre-Marie-Jerome Tresaguet, the head engineer for the board, developed a new type of relatively light road surface to replace the Roman cross section that was still in use. His section was constructed with compacted soil, rather than stones and the surfacing stone was laid diagonally rather than in straight courses. The roadway crown rose six inches and had a consistent cross section of 18 feet.

In 1765 London's Westminister street improvement program created the first known "modern" city street section. Streets were lowered and leveled and footpaths on each side were elevated, paved, and defined by curb stones. The carrigeway was paved with smooth granite sloping to small drainage channels on both sides of the curbs.[13] In 1816 John Loudon McAdam, the general surveyor of Bristol, started a road building program utilizing his design for a new surface. McAdam advocated the use of a well-drained, compacted subgrade soil that supported the load while the surface acted only as a wearing surface to shed water. His design consisted of an 18 foot crowned carriage way with only 10 inches of surfacing material consisting of 1.5 to 2.5 inches of stones laid in loose layers and compacted under traffic. His



2. Palladio's plan of a street. The center is paved for pedestrian use while the sides are for carriages and cattle. (History of Technology)

solution was widely accepted and by 1820 more than 125,000 miles of roads were surfaced in England using this method (Fig. 3).

Road building in the United States paralleled that of England in the 1800s. The first engineered road was a private toll turnpike from Philadelphia to Lancaster, Pennsylvania, constructed in 1795. Its 62-mile length was 20 feet wide and was covered with broken stone and gravel. It lacked curbs but had cleared unpaved shoulders on both sides. The leading act of road improvement in the United States was initiated in 1816 with the creation of the first American State Board of Public Works in Virginia. The act provided for a corporate body that was given the power and funding to appoint and improve public projects supervised by a principal engineer or surveyor. Soon after, a similar action was passed in South Carolina in 1817 and in Kentucky in 1835.[14] The result of these actions was mainly confined to improvements in resurfacing using the McAdam technique. During the next 60 years (1840-1900), with the era of railroad building worldwide, major road building was virtually brought to a halt and was confined to essential urban improvements.

***Leeds and the* Report of the Commissioners for Inquiry into the State of Large Towns and Population Districts.** Urban road design and improvement during the industrial period was often a response to crowding and degradation of the urban environment. The *Report on the Conditions of the Laboring Classes in the Town of Leeds* (1845) states: "Let the poor family, consisting of a man, his wife, and five children, two or three of whom are adolescent, be imagined occupying one of these chambers, in a cul-de-sac, or in an undrained and unpaved street, seven human beings, each requiring 600 cubic feet of breathing room, shut up in a chamber not containing more than 1000 feet for the whole . . . both parents and children rising in winter and summer at five o'clock in the morning and labouring in other unhealthy atmospheres. . . and returning to the limited atmosphere of the

3. First American Macadam road, Maryland 1823. (Rose)

night, unchanged, because unable to be improved, owing to the defective sanitary regulation, or an entire absence of them; - and the mind that so thinks, draws a picture which the theatre of any large manufacturing town pourtray (sic) in thousands instances."[15]

The exploitation of street space resulted from the fact that there were no regulations or restraints to manage the effect of the growing population. In 1842 only 86 of the nearly 600 streets of Leeds were under municipal control and were sewered and paved.[16] In 1844 the *First Report of the Commissioners for Inquiry into the State of Large Towns and Population Districts*, was published in London and advocated a major rethinking of street design. Regulating street width and direction was seen as a key for controlling growth and forcing long term planning. The commission set up a hundred year program that stated: "The widening and straightening of streets should be done in concert, rather than leaving improvement to an occasional widening project. The determining feature in each street would be an imaginary center line drawn on an official map from which all building lines could be controlled in the future. As the old houses became ruinous they would be pulled down and new structures erected farther back."[17]

Park Village and John Nash. To avoid the harsh physical and social conditions of the industrial city, affluent citizens sought other living alternatives offered by new development at the rural-urban edge. Fishman (1987) traces the origin of this urban edge suburbia to late eighteenth and early nineteenth century London. Wealthy bankers and merchants were starting to experiment with a variety of different housing forms to create a synthesis that reflected their changing values toward the industrial city. The intense living conditions of the mixed class neighborhoods and the physical harshness of the urban environment increased the search for segregation.[18] The bourgeoisie who pushed for housing forms that were both class segregated and purely residential, were also going through a change in family structure. Stone (1977) calls this change "the rise of the closed domesticated nuclear family." These families strived to separate themselves from the intrusion of the workplace and the city on their lives and therefore sought a separation of places of work and residence.[19] The London elite began to abandon their homes and offices in the heart of the city, moving their families out of town to large villas in the agricultural settlements that ringed the city. They realized that "with their private carriages and ample funds, they were no longer limited to the area traditionally considered the city. On relatively inexpensive land still a surprisingly short commute to the core, they could build a world of privilege, leisure, and family life that reflected their values."[20]

As the suburban notion trickled down from the elite to the middle class, the demand for more building sites increased. Coincidentally, landowners at the edge of the city found in the new living pattern an opportunity for profit. The challenge that arose was how to deliberately design such communities that would satisfy buyers' aspirations.

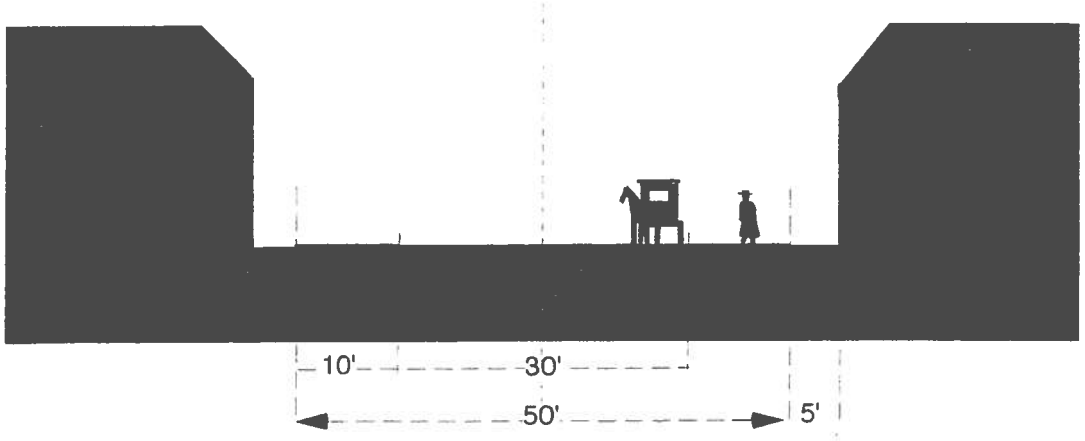
The first architect to conceive of suburban planning principles was John Nash in his design for Park Village (1823), at the edge of Regent's Park, London. Nash's design

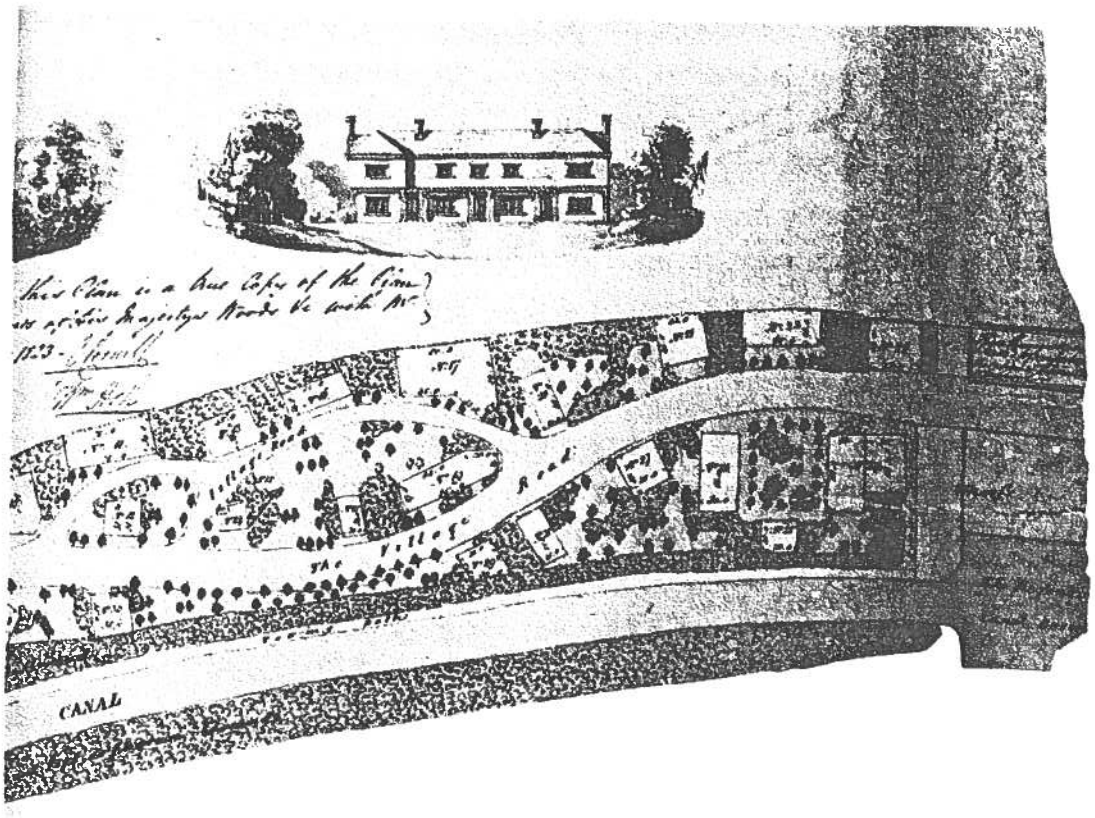
responded to those seeking to live at what was then the rural edge of the city. He was able to synthesize and borrow from a full range of styles and translate them into a picturesque village within a park-like setting. The plan avoided the formal style of the eighteenth century urban form of solid streets and squares. Instead the houses were set within a picturesque landscape with curving paths and arranged landscape. Nash's ability to integrate scattered elements of the suburban style into a working formula transformed the suburban development into a reproducible product (Fig 4).

Olmsted, Vaux, and the English Influence. Concern over the spread of industrial urban ills and the creation of the old world conditions in America generated anti-urban attitudes in the United States. Mumford (1958), Jackson (1985), and Fishman (1987) identify the most important authors in shaping American attitudes toward suburban living as Catharine Beecher, Andrew Downing, Calvert Vaux, and Frederick law Olmsted. Downing saw three major outcomes in advocating suburban country living environment in America: (1) establishment of order and culture, (2) re-construction of social structure and form, and (3) establishment of moral influence. In 1850 he wrote: "When smiling lawns and tasteful cottages begin to embellish a country, we know that order and culture are established . . . the individual home has a great social value for people. Whatever new system may be needed for the regeneration of the old and enfeebled nation, we are persuaded that, in America, not only is the distinct family the best social form, but those elementary forces which give rise to the genius and the finest character may, for the most part, be traced back to the farm house and the rural cottage. . . It is the solitude and freedom of the family home in the country which constantly preserves the purity of the nation, and invigorates its intellectual powers."21

Downing, Vaux, and Olmsted, who were architects and designers, were much influenced by the English picturesque tradition of design. Both Downing and Olmsted visited Europe around 1850, and Vaux, who was born in England, was convinced by Downing to come and practice in the United States. Olmsted was interested in the new English design trends as manifested in Paxton's and Nash's work. He visited London and Liverpool in 1850 and encountered the prototypes of his later work as a park designer and suburban planner — Birkenhead Park and its surrounding suburb. The suburb that Olmsted saw in 1850 typified the traditions of English suburban design as created by Nash's Park Village. With its curving roads and picturesque layouts it provided Olmsted with principles which he was to apply in the United States.

Olmsted's experience as an urban designer while working on New York City's Central Park further enhanced his belief in suburban living. Reflecting upon urban dwelling conditions, he stated that in suburbia "there are to be found the most attractive, the most refined and the most soundly wholesome forms of domestic life, and the best application of the arts of civilization to which mankind has yet attained. It would appear then, that the demands of suburban life, with reference to civilized refinement, are not to be a retrogression from, but an advance upon, those which are characteristics of town life, and that no great town

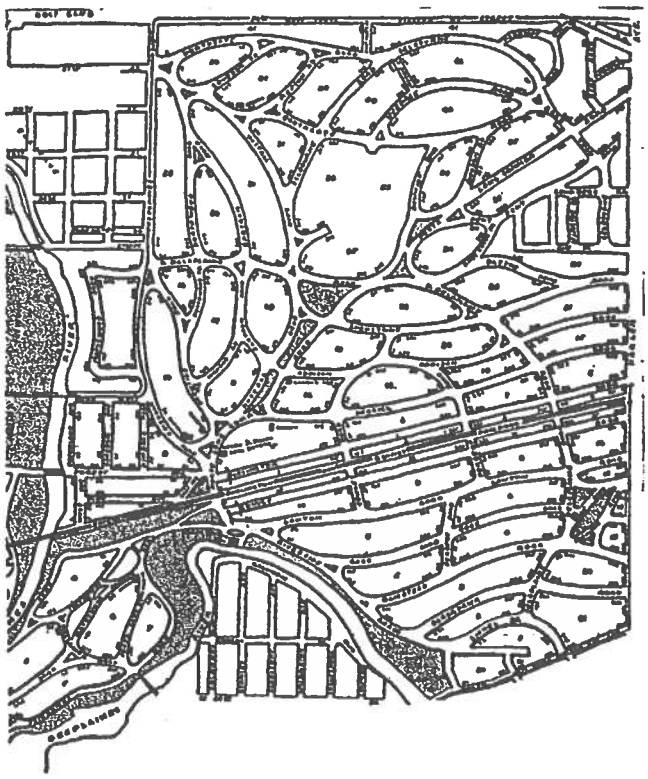




4. Park Village, London, 1823. (Fishman)

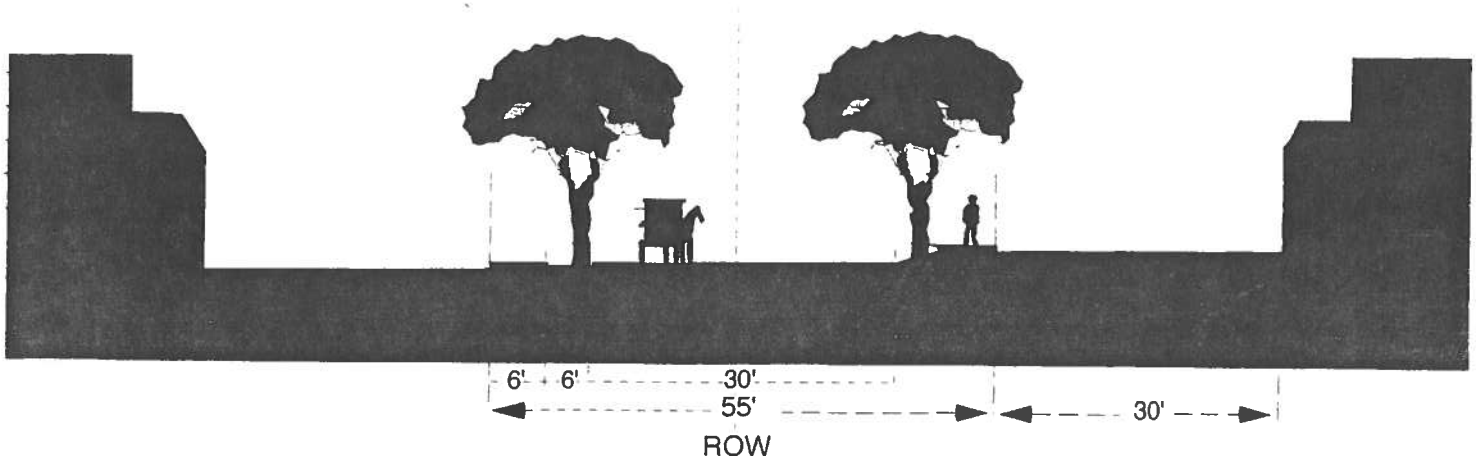
can exist without great suburbs."[22] Olmsted also associated poor urban living conditions with the physical layouts of American cities. Along with landscape architect H.W.S. Cleveland he criticized the street grid system as generating rectangular blocks with overcrowded row houses. Olmsted was even critical of the popular New York brownstone row houses which he described as: "a confession that it is impossible to build a convenient and tasteful residence in New York adapted to the civilized requirements of a single family, except at a cost which even rich men find prohibitive."[23] The rejection of the grid and the adoption of the curvilinear road epitomized the suburban ideal of the placid and pastoral in contrast to the efficient and mechanistic order of the urban environment.

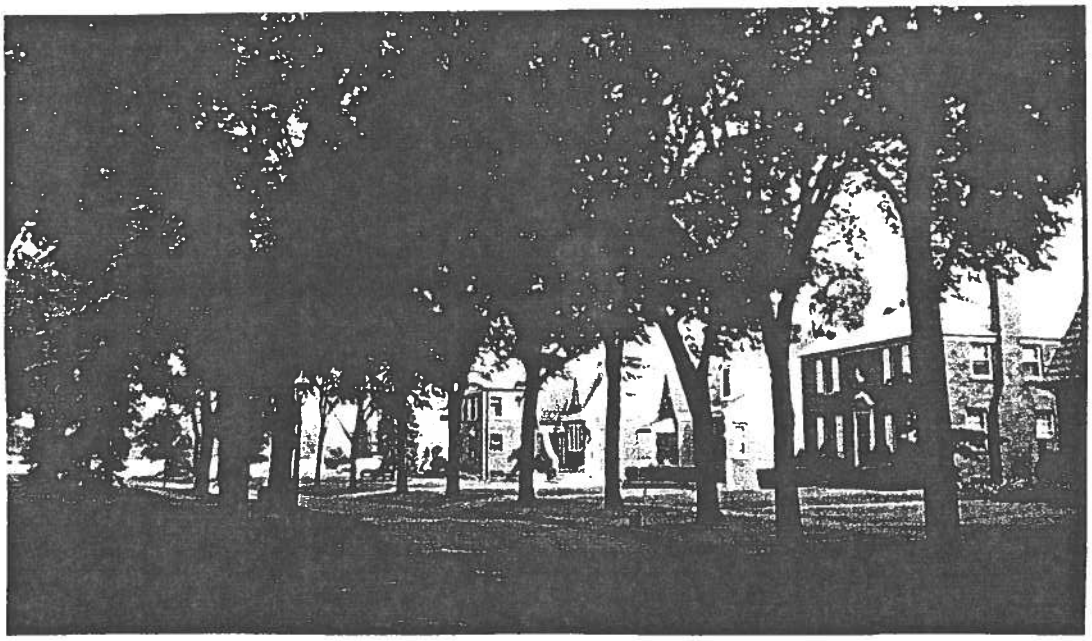
Olmsted and Vaux realized their residential philosophy when they were asked in 1868 to plan the suburb of Riverside, Illinois. A featureless 1,600 acre tract of "low, flat and forlorn land"[24] was to be turned into a picturesque landscaped community (Fig. 5). Tree-lined roads, "gracefully-curved lines, generous spaces, and the absence of sharp corners"were purposefully laid to contrast the prevailing city street grid "to suggest and imply leisure, contemplativeness and happy tranquility."[25] Houses were set back at least 30 feet from the road to prevent visual displeasure. " We can not judiciously attampt to control the form of the houses which men shall build, we can only, at most, take care that if they build very ugly and inappropriate houses, they shall not be allowed to force them disagreeably upon our attention when we desire to pass along the road upon which they stand.We can require that no house shall be built within certain number of feet

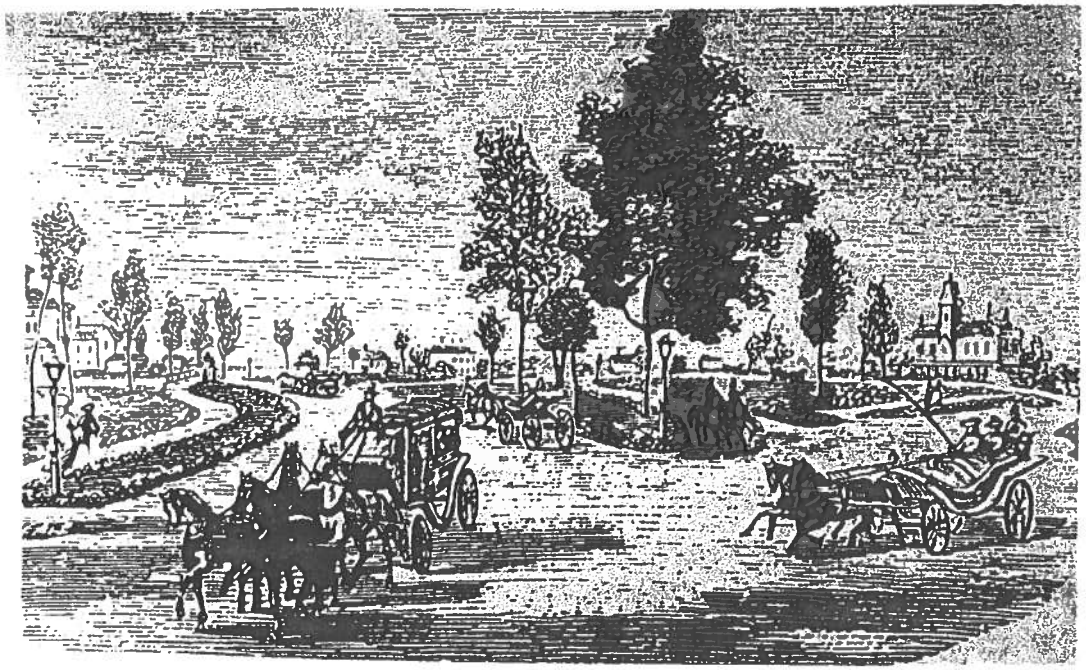


5. Riverside street plan. (Adams)

of the highway, and we can insist that each householdershall maintain one or two living trees between his house and his highway line."[26] The residential roadway was laid at a width of 30 feet with pedestrian walkways on both sides. Trees were planted in a strip between the path and the roadway. For the first time Olmsted and Vaux, systematically carried out this feature in the suburban context. This form of road planting was probably influenced by the planting design schemes of Haussmann's 1860s boulevard in Paris. The application of a planting strip as a physical and visual separator between road and pedestrian became a prominent feature in the American suburban landscape.







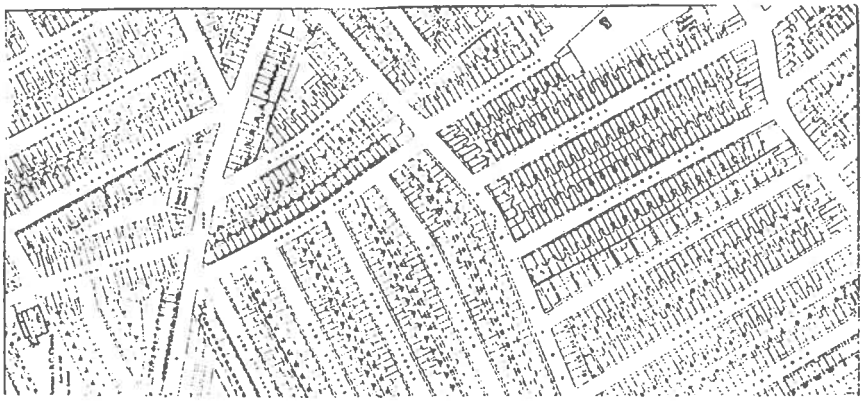
5b. Riverside residential streets. (UC Berkeley Dept. of Landscape Architecture)

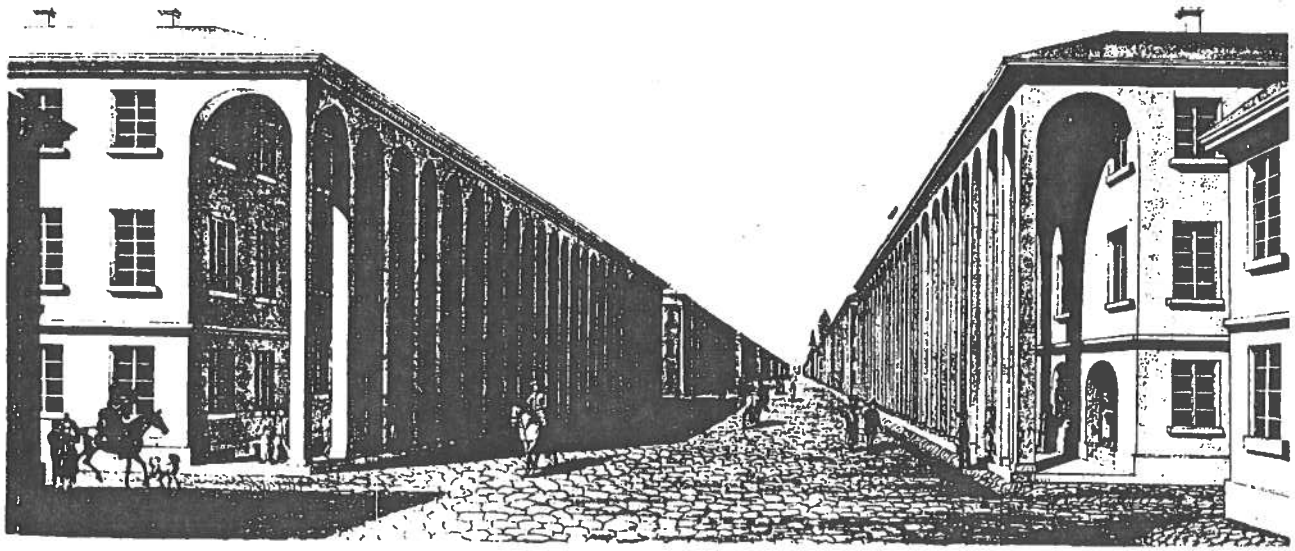
2. A Search for Social Response, 1870-1930

During the latter part of the nineteenth century the environmental chaos of the city became linked to the social problems of urban life. Congestion, overcrowding, and deteriorating sanitary conditions were believed to cause social and moral degeneration. Social reformers argued that social disorder, which was bound to happen, would be best disciplined by proper environmental conditions: "Experience has shown that people living in clean, quiet, orderly streets, in tenements well kept, both as to sanitary arrangements and cleanliness, keep, as a general thing, their own apartments neat and clean, and also that their whole bearing is one of self respect."[27] As reformers realized the difficulties in attaining inner city improvements, many started advocating multi-centered growth patterns. Dispersal of population from the city center was seen as the perfect solution to the urban dilemma. Suburbanization was seen as a vital force in not only 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. "Once man is reunited with the land from which he had forcibly been divorced for a generation by inadequate transit and prohibitive land values, American cities would no more tolerate the slum and the tenement."[28] Aronovici further stressed the hope of suburbia for the industrial worker: "the suburbanizing of the wage earner as 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 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."[29]

The "Bye-law" Street, England. The desire for better living conditions — light, air, cleanliness and relief from street congestion — prompted intervention by public authority. The Public Health Act of 1875 established the "bye-law" street ordinance in England. The vision of wide, straight and paved streets entranced the authorities and was seen as the best solution for the ills of their cities. Inspirational visions of European seventeenth century neo-classic urban design with its uniformity and order were mistakenly deemed appropriate for industrial city conditions. In Leeds, 238 inhabitants were removed and 59 dwellings were dismantled in one project to provide for more street space.[30] (Fig. 6). Unfortunately, the uniformity of the layout and the rigidity of the design were inappropriate for a residential environment. "Nothing remained of the past intimacy . . . nor are there any mitigating effects from nature — no intervening grass or trees between the street and the houses. The street space is swept so clean as to approach emotional emptiness and complete negation."[31]

Although the English bye-law street design did not answer residential social needs, its basic principles stressing the importance of light, air, and access remained prominent. The bye-law street right-of-way of 60 to 70 feet established a standard configuration for residential street widths still used today.



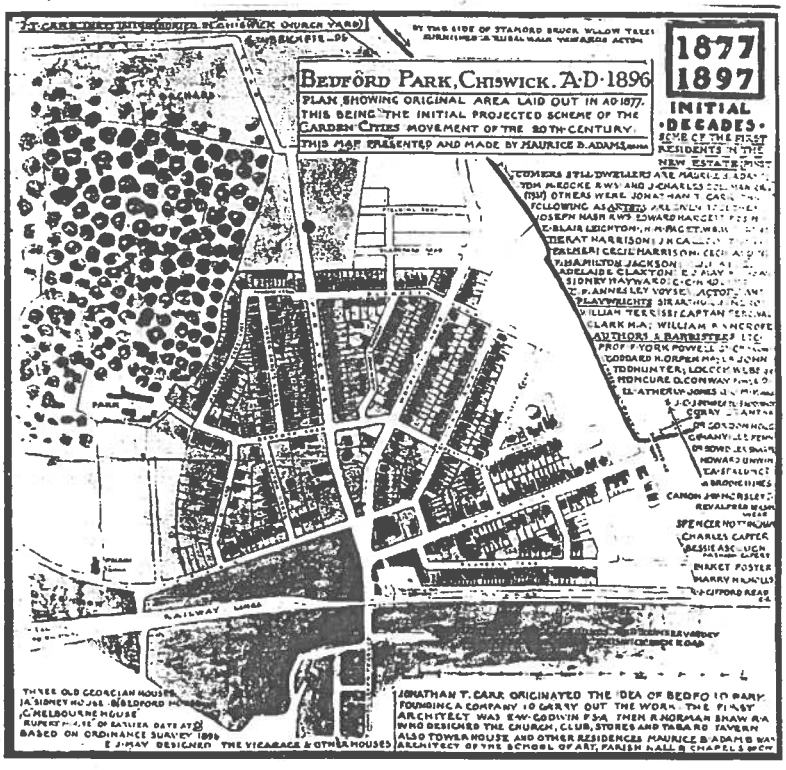


6. Examples from Fulham, London, show a neighborhood arrangement under English bye-laws. (top and middle) The neo-Classic streets (bottom) preceded the bye-law streets of England. (Creese)

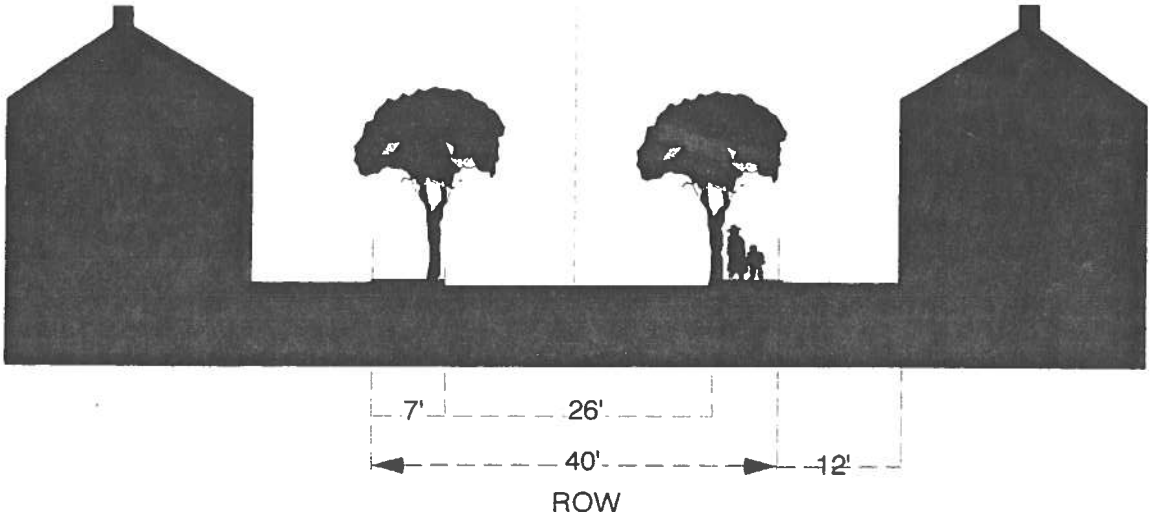
Bedford Park and the Street Compromise. At the same time the Bye-law Street Ordinance came into effect in 1875, developer Jonathan T. Carr acquired orchard land outside of London with the intention to build a suburban community. Realizing the potential of the existing trees, Carr and his architect, E.W. Godwin, rejected the idea of the bare and clean bylaw street in favor of a layout that followed the natural pattern of the plantation. Although the street width remained at 50 feet, the houses were set back between 15 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 (Fig. 7). "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." (*Chamber's Journal*, Dec. 31, 1881) "All the others (roads) appear closed at the end by trees and houses, and form a succession of views, as if the architect has taken a hint from nature."[32] (*Daily News*, May 5, 1880)

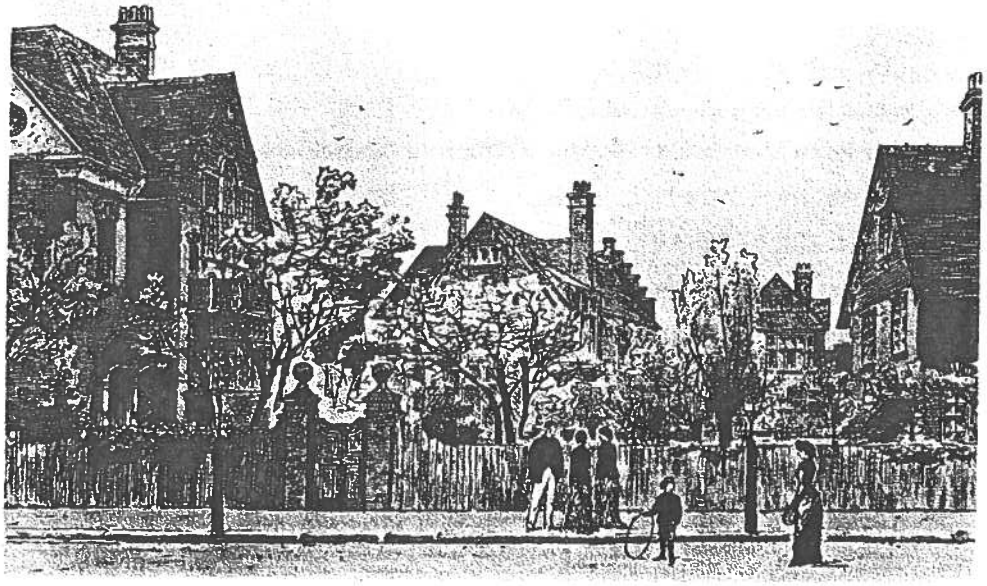
The Bedford Park street layout provided the first challenge to the bye-law street. With its rejection of straight vistas, barren width, and uniformity, it inspired succeeding suburban street designers to question authoritative prescriptions.

Unwin, Parker and The Garden Cities. In 1904 when Raymond Unwin and Barry Parker were commissioned to design the suburban community of Hampstead Garden near London, they consciously revived motifs that had been outlawed by earlier bylaw regulations. They decided to challenge the impersonal monotonous layouts and return to the intimate and refined spatial forms of courts and yards associated with traditional communities. Unwin argued that "Another bye-law 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 undesirable, are especially to be desired for those who like quiet for their dwellings."[33] Unwin felt that the physical form of street and building layouts had a direct influence on social behavior and the well-being of the



7. Bedford Park general plan. (Greeves)

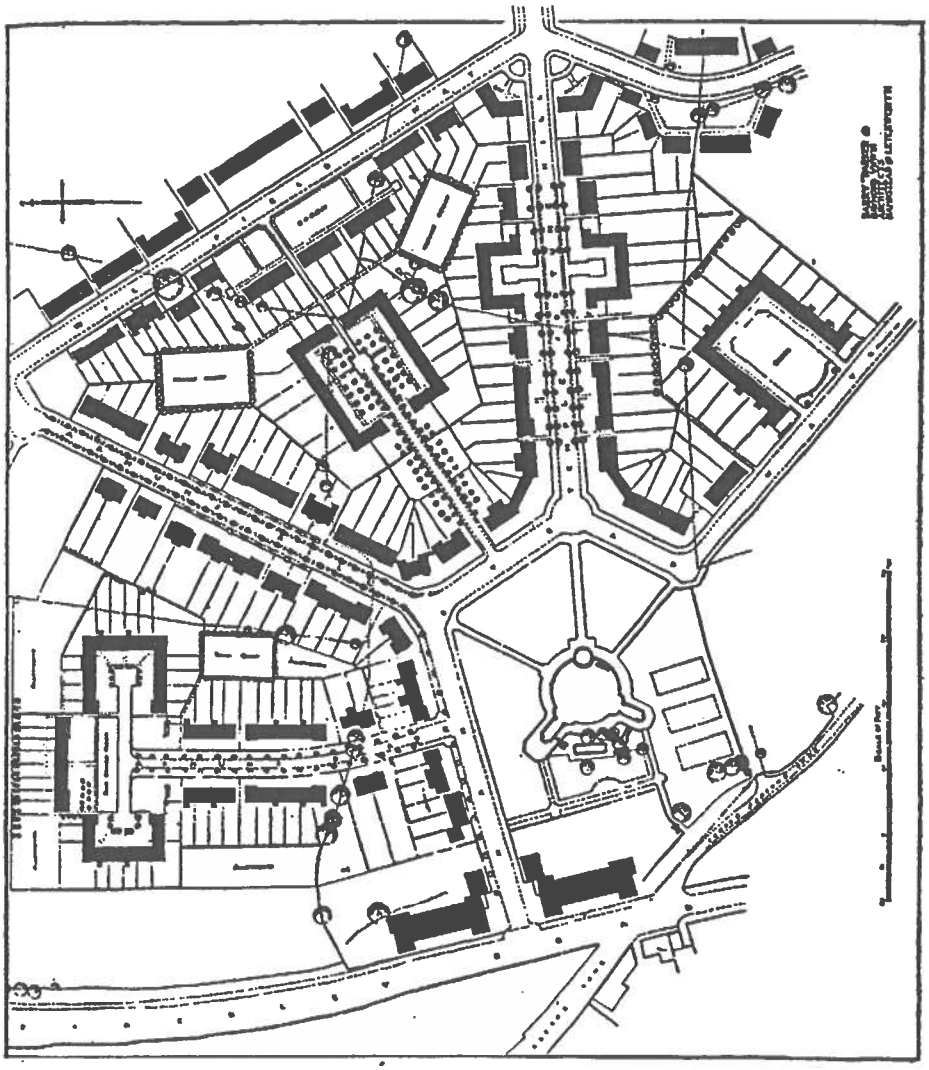




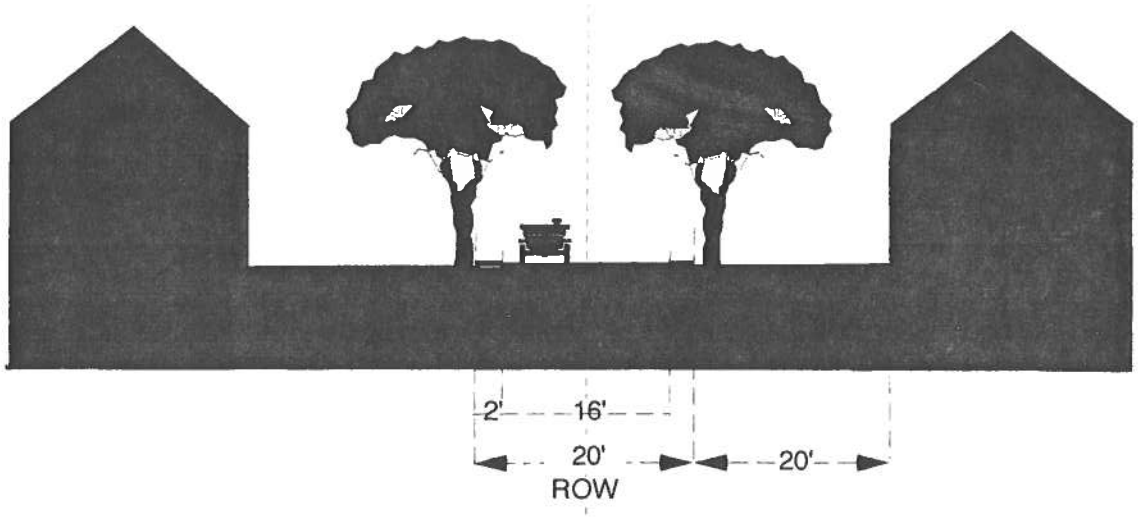
7b. Bedford Park, street scenes. (Greeves)

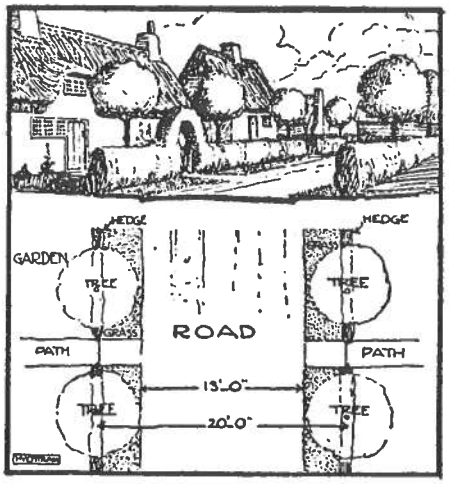
community. As a result of his persistence and conviction, Unwin lobbied for the "Hampstead Garden Suburban Act", a private bill passed in the Parliament in 1906. This bill was geared toward suspending building regulations. The bill allowed creation of cul-de-sacs and permission for roads to be less than 500 feet long and their carriage way width reduced from 35 feet to 12 and 16 feet (Fig. 8).

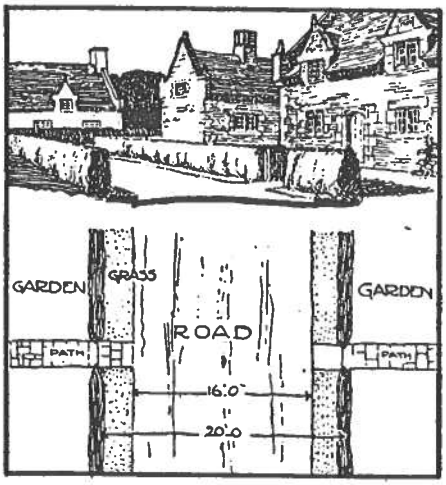
Unwin and Parker's desire for urban space modification was rooted in their effort to translate prevailing social belief into physical form. The two significant proclamations that shaped their philosophical discourse were Camillo Sitte's *Der Stadtebau* (1889) and Ebenezer Howard's *Tomorrow a Real Path to Real Reform* (1898; later published as *Garden Cities of To-Morrow*, 1902). The Sitte book argued that informal urban form of the Middle Ages possessed compositional qualities that were more in tune with human aspiration than formal geometrical patterns. Supporting this view Unwin wrote: "There can be no doubt that much of the interest of the old irregular streets and towns lies in the sense of their free, spontaneous growth, their gradual extension under changing influences, much of which must be lacking in the case of a town built to order and according to a prearranged plan."[34] Howard was a social reformer who advocated a new economy and social order that integrated social and physical well-being: "Town and country must be married, and out of this joyous union will spring a new hope, a new life, a new civilization."[35] His utopian dream was to be manifested in "a town designed for healthy living and industry; of a size that makes possible a full measure of social life, but not larger; surrounded by a rural belt; the whole of the land being in public ownership or held in trust for the community."[36]



8. Hampstead Garden, cul-de-sac arrangements, 1905. (Unwin)







8b. Hampstead Garden, residential streets. (Unwin)

Unwin and Parker attempted to realize Howard's goals of social reform through the spatial arrangements of their work. The design and promotion of Hampstead Garden Suburb emphasized the integration of different classes through the introduction of different unit types and sizes. "The growing up of suburbs occupied solely by any individual class is bad, socially, economically, and aesthetically . . . If, then, the site that is being planned is one which we expect mainly to have a working class population, we should still try to arrange some attractive corner in which a few rather large houses may be built; we should induce the doctor to live among his patients by affording him a suitable site, and give an opportunity for those who have been successful in life, to live in suitable homes among others not so fortunate. And whether or not we shall succeed will depend very much upon the arrangement."[37]

The annulment of the bye-law street regulations in Hampstead allowed Unwin to experiment with a variety of street forms and configurations that he believed would support the notions of a community as envisioned by Howard and the Garden City movement. For the first time the cul-de-sac and the open court clustering were systematically used throughout a development . Road types were hierarchical and varied in both layout and cross section. As such, Hampstead Garden provided the first prototype for contemporary residential subdivision road planning.

The Road Improvement Movement. From the middle of the nineteenth century, road development both in Europe and in the United States was held back by the expansion of the railroad. Although road building technology experienced major developments during this period, vehicle performance lagged largely due to governmental limitations and a policy that favored rail and stage coaching.[38] 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 all self-propelled vehicles on public roads must be limited to a maximum speed of four miles an hour, with a minimum of two people in the vehicle and a third on foot carrying a red flag to give warning and help control frightened horses.[39] The state of the road system's deterioration came to the attention of the public with the introduction of a new and popular mode of travel, the bicycle. Invented in 1580, it reached its peak in 1877 with the low-wheeled, rear wheel driven "safety" bicycle. The bicycle captured the imagination of the people — it was cheap, safe, and offered convenience and mobility. The period between 1890 to 1895 was often referred to as the "Bicycle Craze Era" by newspapers and periodicals.[40] As a result, both in England and in the United States, bicycle clubs started to lobby for road improvements. The League of American Wheelmen was formed in 1880 and it constantly lobbied for road improvements. These efforts resulted in the realization of the need for local road-aid laws, an action adopted by New Jersey in 1891 and followed by the founding of the National League for Good Roads in 1892 and the establishment of the Office of Road Inquiry within the Department of Agriculture.[41]

The 1890s saw the appearance of the motor vehicle on the American scene. The motor vehicle increased pressure for road

improvements based on the same incentives as the bicyclists. The founding of the American Automobile Association in 1902, a nationwide road census in 1904, the construction of the model "T" Ford in 1907, and the fact that in 1914 the production of motor vehicles exceeded the output of wagons, increased pressure on the government and resulted in the passage of the Federal Aid Road Act of 1916.[42] This law was the first comprehensive act of government aimed at integrating the country's road system and establishment of a nationwide state highway system through the "power to establish Post Offices and Post Roads over which the United States mails are now or may hereafter be transported."[43]

The Rise of Comprehensive Planning. At the turn of the century the American city was regarded as a chaotic environment of congestion and social unrest. Against it stood the ideal of a disciplined technological city with perfect spatial order. A new direction for civic improvement was emerging that would reform the environment and discipline it through the employment of expert knowledge, state regulatory mechanisms, and public welfare provisions.

Science and technology were seen as a vehicle for change based on the premise that physical remedies could resolve social problems and upgrade living conditions. Salvation could come through the employment of experts and technocrats who could recommend policies and administer scientific solutions. In his 1911 book *The Principles of Scientific Management*, Frederick Winslow Taylor wrote: "The goal of human labor and thought is efficiency. Technical calculation is in all respects superior to human judgment, in fact human judgment cannot be trusted because it is plagued by laxity, ambiguity and unnecessary complexity. Subjectivity is an obstacle to clear thinking . . . That which cannot be measured either does not exist or is of no value . . . The affairs of citizens are best guided and conducted by experts."[44]

The principle of scientific management captured the minds of business, industry, and developers. It applied calculated conduct and insured profitability. Architects and planners were soon to follow. In the 1917 publication of *City Planning Progress* by the American Institute of Architects the editors stated that: "City planning in America has been retarded because the first emphasis has been given to the 'City Beautiful' instead of the 'City Practical'. We insist with vigor that all city planning should start on the foundation of economic practicableness and good business; that it must be something which will appeal to the businessman, and to the manufacturer, as sane and reasonable."[45] Intervention by guiding expert agencies was viewed as a practical tool to encourage change and promote the private sector. It was not seen as paternalism but as a "deliberate intention to use the government machinery for doing those things for which experience shows it to be more efficient and economical than any other means yet devised."[46]

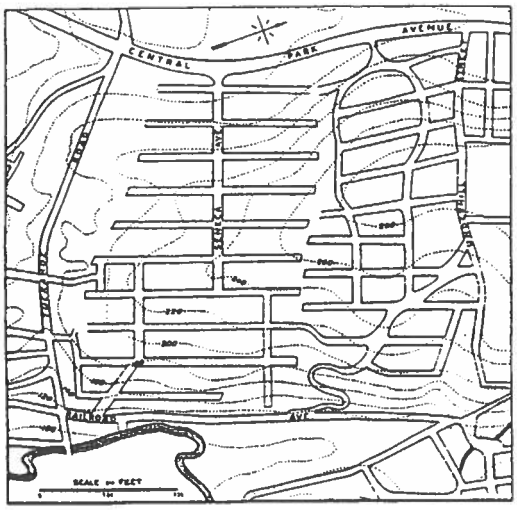
Congestion, overcrowding, and unsanitary conditions increased the concern for public health. Thus, tenements and slums were the first focus of many early planning remedies. The rise of scientific surveys and social statistics movements led Congress to authorize an investigation of slums in the cities in 1892. By 1900 more than three thousand surveys were

produced, many of them by private organizations.[47] With the prevailing spirit of technology and science, rational planning and utilitarian ethics guided policy. Rationality inspired a fresh approach to planning, notably the adoption of the German concept of zoning and transportation systems, and the English comprehensive plan. Pressure for professional solutions prompted the First National Conference on City Planning and the Problems of Congestion held in Washington in 1909. The Conference was the first formal expression of interest in a systematic approach to solving the problems of America's urban environment. Remedies encouraged private enterprise to build at the edge of cities to relieve congestion. Redistributing the population to the outlying urban areas was believed to result in the removal of the middle class from competition for older homes in the central city, thus allowing the lower-class to obtain better housing. Theoretically, older housing was to serve as a ground for upward social mobility, while home ownership in new areas would establish social and economic stability. By advocating redistribution of the population into outlying areas, providing fast and low cost transportation, and enticing industry to locate at the fringe, it was believed that city density would decrease. The conference attracted the attention of senators and representatives, and President Taft showed his interest by consenting to make the opening address. At this conference, and those that followed, the ground work for city planning structure and implementation techniques were formed. Issues such as "The Best Methods of Land Subdivision" and "Street Widths and Their Subdivision" established the groundwork by which federal, state, and local governments established zoning and subdivision regulations at a later stage (Fig. 9).

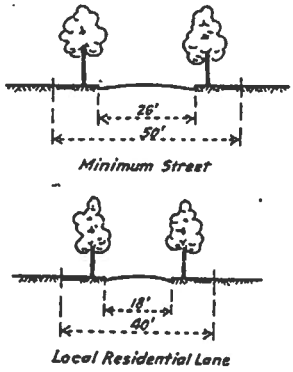
World War I gave planners and architects a chance to experiment with their ideas with government backing. Starting in 1917 Congress apportioned $110 million to the Bureau of Industrial Housing to plan and construct (through subcontractors) housing and transportation needed for shipbuilding and armament centers. Under the direction of F.L. Olmsted, Jr. architects, landscape architects, planners, engineers, contractors, physicians, and social workers drew up a set of recommendations for war and postwar industrial housing. These recommendations were aimed at producing self-sufficient neighborhood units fitted to the natural topography. They also provided guidelines and measurements for building arrangements.[48]

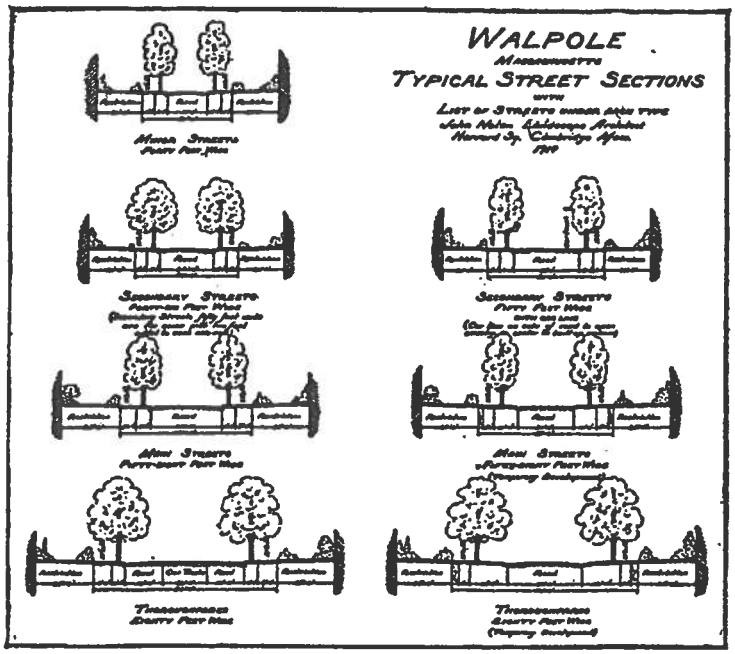
Decentralization of the American city had a major boost at the end of World War I. A search began to stimulate investment in order to keep the expanded war economy aloft. The effort culminated in the formation of a network of developers and interest groups called Better Homes in America. The movement encouraged home ownership and spread knowledge of financing associated with home purchasing and home improvements. With the new construction cycle — the aquisition of land, the opening of routes to the suburbs for the automobile, and the highway development program — speculative uncontrolled development produced a new metropolitan fringe.

As the city boundaries expanded, in an unrestrained fashion, a new apparatus of planning that would bridge the gap between the city, the suburbs and the open region was



RESIDENTIAL STREETS





9. Misfit of adjoining subdivision streets, Yonkers, New York, 1914. (Regional Plan of New York). Suggested residential street widths, Walpole, Massachusetts, 1915. (Bird)

sought. In 1923 20 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, hoping that together they could develop and understand the principles and motives behind community planning so that they would be able to design satisfying residential environments. Looking for a theory of metropolitan and regional planning they adopted the garden city ideals of Ebenezer Howard, advocating a regional pattern of economically related but autonomous urban units ringed by open space.

In 1924 Clarence Stein and Henry Wright made a pilgrimage to England to study Unwin and Parker's design of Letchworth and Hampstead and to synthesize it to the American scene. Raymond Unwin was asked to help shape the theoretical framework of the group and was thereafter actively involved in the American planning scene. Mumford, the historical and theoretical force behind the group, proclaimed that: "The only hope for the American city is outside itself — to think of the region as a whole and the city as part of it. The suburb is a public acknowledgment of the fact that congestion and bad housing and blank vistas and lack of recreational opportunity and wendless subway rides are not humanly endurable. The suburbanite is merely an intelligent heretic who has discovered that the mass of New York or Chicago or Zenith is a mean environment."[49] Yet Mumford also acknowledged that existing suburbs needed reshaping and redesign in order to correspond to the new visions of residential communities. "Forces that created the suburb moved out, inexorably, with icy relentlessness,

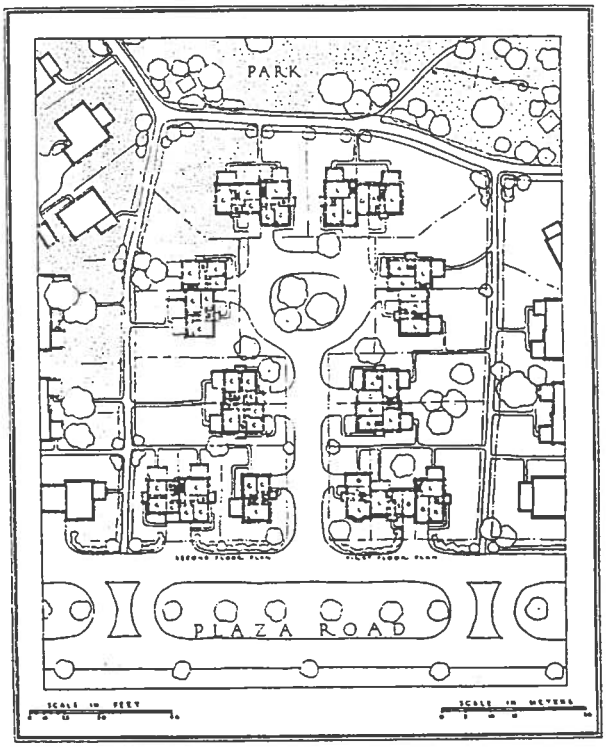
and began to destroy this idyllic environment, which had the neighborliness of a small community and the beauty of gardens and parks and easy access to nature. Inevitably the suburb grew and growing, it became more like the city it had only apparently broken away from: the market street lengthened into a garish main street . . . land values boomed; but taxes, alas, rose too . . . All the costs of sewers, paving unnecessarily wide residential streets, street lighting . . . went up so rapidly that presently newcomers could no longer afford a roomy, comfortable house."[50]

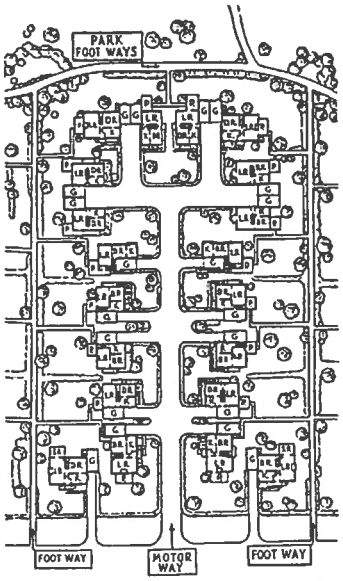
Stein, Wright, and Radburn. In 1924, Alexander M. Bing, a real estate developer and a charter member of the Regional Planning Association, founded the City Housing Corporation "for the ultimate purpose of building an American garden city."[51] The corporation's chief architects were Clarence Stein and Henry Wright. Their first project was Sunnyside Gardens in New York, a small scale development of row houses, not a full scale Garden City. Yet its economic success provided the basis for a larger project, Radburn, sixteen miles from New York City in Fairlawn, N.J. The complete garden city of Radburn was planned in 1928 on two square miles with an ultimate population of 25,000. Although the English Garden City model was the inspiration for their design, Stein and Wright realized that their project had to respond to American living conditions and the growing use of the automobile. Stein acknowledged that the Radburn plan was a reaction to the state of the city. "American cities were certainly not places of security in the twenties. The automobile was a disturbing menace to city life in the U.S.A. — long before it was in Europe . . . The flood of motors had already made the gridiron street pattern, which had formed the framework for urban real estate for over a century, as obsolete as a fortified town wall . . . The checkerboard pattern made all the streets equally inviting to through traffic. Quiet and peaceful repose disappeared along with safety. Porches faced bedlams of motor throughways with blocked traffic, honking horns, noxious gases. Parked cars, hard gray roads and garages replaced gardens."[52] Radburn's design was a reaction against city traffic and the impact of cars on residential living and as such it had to "accept the role of a suburb" rather than that of a garden city.[53]

None of the design features were completely new. Yet, as Stein acknowledged, it was their synthesis and integration into a comprehensive layout that was a breakthrough in subdivision form. *Superblocks* with a green garden core were used by Unwin in Letchworth and Hampstead Garden suburbs. At Radburn the blocks were increased to between 30 and 50 acres, were aligned according to the topography, and were lined with fewer units facing the main streets. The cul-de-sac was another adaptation from Hampstead Garden (Fig. 10). Stein and Wright were critical of the grid in its support of traffic and its cost. They advocated the cul-de-sac as a rational escape from the limitations of the checker-board plan in which all streets are through-streets with the possibility of a collision between cars and pedestrians every 250 feet. They argued that the cost of through-street pavement and mainline utilities were not fully understood, and they complained that real-estate and municipal engineers had perpetuated obsolete forms. The Radburn cul-de-sac lane was designed at a 300 to 400 foot length with

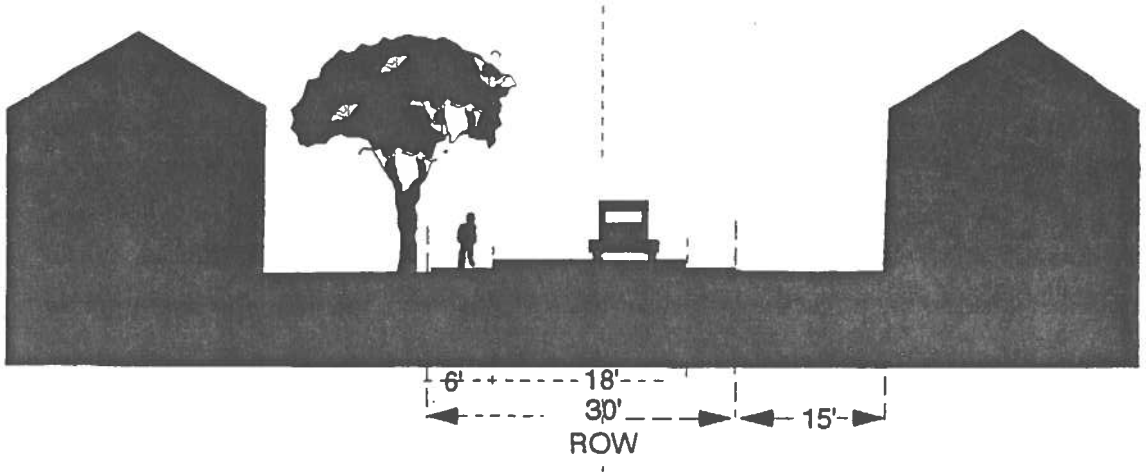
only a 30 foot right-of-way as opposed to the prevailing 50-60 foot layout. Stein further reduced the paved driving lane to 18 feet and allowed for the 6 foot utility strips on both sides to be landscaped and visually included with the garden. Building setbacks were set at 15 feet with provisions for of street parking. The Road system hierarchy was the most innovative adaptation of Olmsted's route separation in New York's Central Park. Yet Stein and Wright went further than to physically separate vehicles and pedestrians. For the first time they established a road hierarchy that was unchangeable and regulated. Stein felt 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."[54] 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-sac carried no through traffic, their standard of construction was less demanding. Curbs were not used and sewer and water lines were of lesser size. Overall the development was able to reduce street area and the length of utilities by 25 per cent as compared to a typical gridiron street plan. According to Stein the cost savings for roads and public utilities, in contrast with the normal subdivision, paid for the construction of the main core parks.

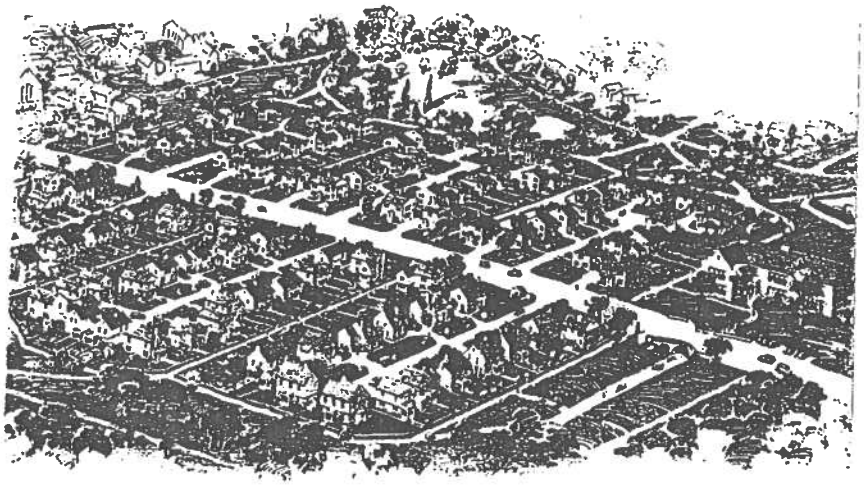
The Radburn experience provided a new basis for residential planning and a new prototype for neighborhood layout based on a

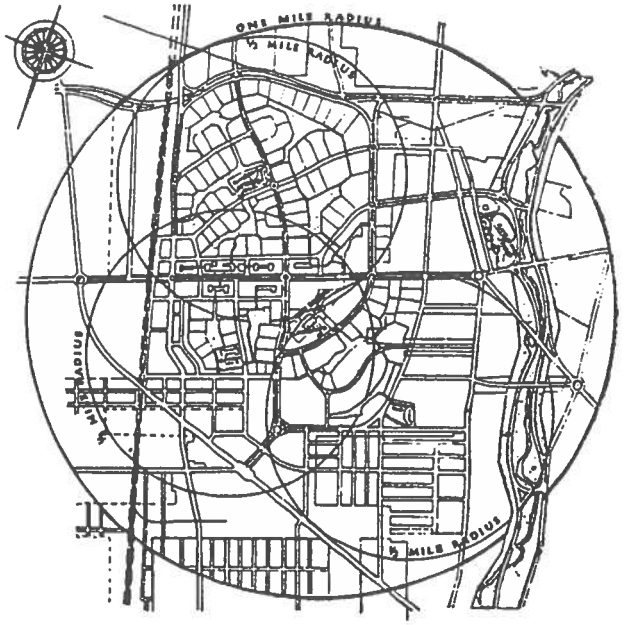




10. Radburn cul-de-sacs. (Stein)







10b. Radburn residential street structure and cul-de-sac cross section.(Stein)

circulation hierarchy. With the influence of the car growing stronger, Radburn's structure exemplified the ideal for subdivision layout. As stated by Geddes Smith in 1929: "A town built to *live* in — today and tomorrow. A town 'for the motor age.' A town turned outside-in — without any back doors. A town where roads and parks fit together like the fingers of your right and left hands. A town in which children need never dodge motor-trucks on their way to school. A *new* town — newer than the garden cities, and the first major innovation in town-planning since they were built."[55]

Perry, Adams, and the Neighborhood Unit. One of the main issues addressed by the Regional Planning Association was the lack of a sense of neighborhood or community in residential development because of uncontrolled and speculative regional growth. As a member of the Community Center Movement and the Planning Association, Clarence Perry devoted his research and writing to the development of a planning concept that he titled "The Neighborhood Unit — A Scheme of Arrangement for a Family-Life Community."[56] Perry's concept was part of an extended process of regional planning for the New York area done between

1922 and 1929.[57] He sought to find a fractional urban unit that would be self-sufficient yet related to the larger whole. His physical solution was composed of six principles:

Size: The residential unit should be determined according to the population for which one elementary school is required. (750 to 1,500 families on a 150 to 300 net acre site with 40% of the area devoted to streets and open space)

Boundaries: The unit should be bounded on all sides by arterial streets, sufficiently wide (120 foot right-of-way) to eliminate through traffic in the neighborhood.

Internal Street System: The unit should be designed with a hierarchical street system, each road proportioned to its probable traffic load and facilitating circulation within the unit but discouraging through traffic. Residential streets would have a 50 foot right-of-way.

Open Spaces: A system of small parks and recreation spaces should be provided.

Institutional Sites: Sites for schools and other neighborhood institutions should be grouped at a central point.

Local Shops: One or more shopping districts adequate to the population size, should be placed at the edges of the unit, at traffic junctions, and adjacent to other neighborhoods.

Perry's concepts were much in tune with ideas presented to him and the New York Regional Committee in 1922 by Raymond Unwin. Unwin, regarded as an expert on neighborhood planning, argued that increased transportation facilities would not cure congestion and that congestion is bound to be part of urban life. Thus, there was a need to protect neighborhood living through the following planning measures: (1) Fewer streets should be allowed to traverse residential areas; (2) Main streets should be located on viaducts bridging over cross street traffic; (3) Private automobile traffic should be relegated to specific routes away from transportation facilities.[58]

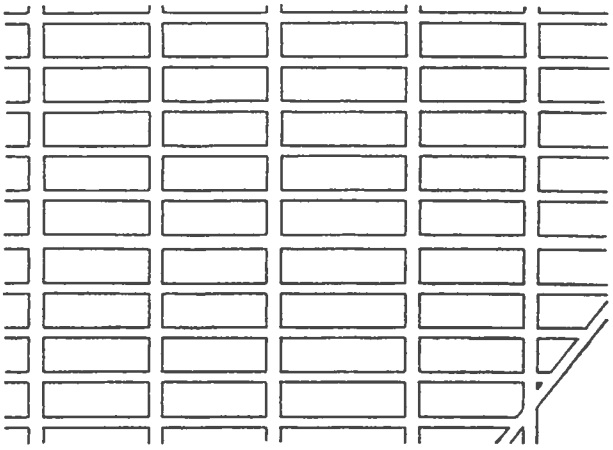
Perry advocated the reformulation of traffic concepts and standards for the residential unit, and according to Mumford, he was instrumental in many of the ideas incorporated in Radburn. Together with Thomas Adams a set of guiding principles for residential street systems was devised and recommended for the New York region in Volume VII of the regional plan (1929). Its main suggestions included:

- Streets should be adapted to the traffic load wand kind of use they are destined to have.
- Street layout should fit the land to secure attractiveness and lower the cost.
- Main internal streets should be 60 to 80 feet wide.
- Secondary streets should be from 30 to 60 feet wide.
- A pavement width of 18 to 20 feet is sufficient for the local streets and the balance of the right-of-way can be devoted to sidewalks and planting.
- There should be no street through the neighborhood in 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 will contribute to safety, attractiveness, and variety.
- Cul-de-sacs and dead end streets should

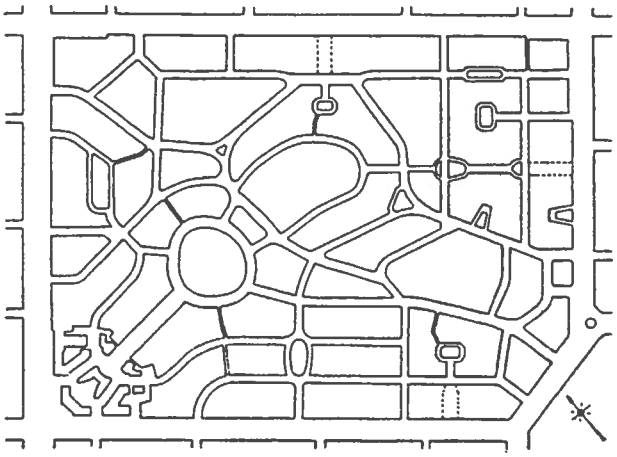
be used only when they are part of a complete subdivision plan in which they form an integrated systemof both pedestrian and vehicular circulation.

• If long blocks are used, pedestrian footpaths should offer shortcuts.[59] (Fig. 11).

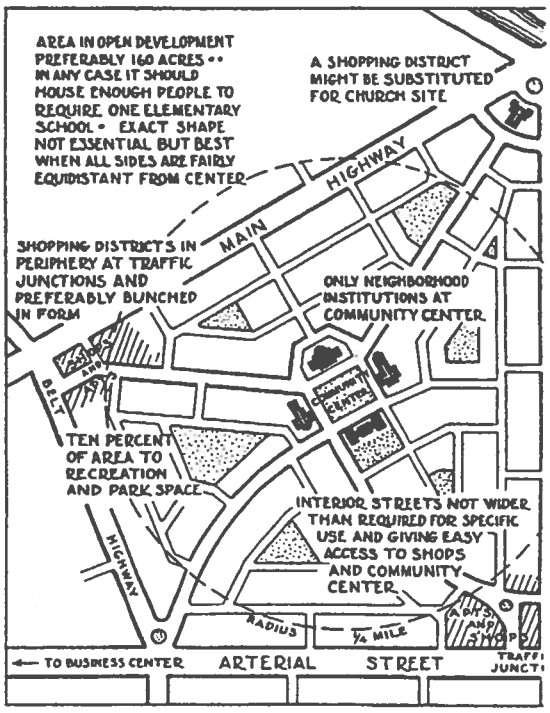
The work of Perry and Adams contributed to the acceptance of the residential neighborhood as a special entity that needed to be protected and deliberately planned for. Although innovative and extensively published, the concept was not adopted by the private sector. It was endorsed by the Federal Government as early as 1932, but was only put into large planning schemes in the mid-1930s in correlation with the Greenbelt Town projects. Perry himself acknowledged that the chief obstacle to effective implementation of the concept was due to the prevailing small scale building enterprises in the United States and the lack of comprehensive planning policies able to implement projects on a large scale.[60] The publication of Perry's work coincided with the economic catastrophe of 1929. With the collapse of the building industry, the lending and mortgage structure, and the halting of construction, a new planning structure had to emerge, one that would direct and control conprehensive policies through governmental authority.

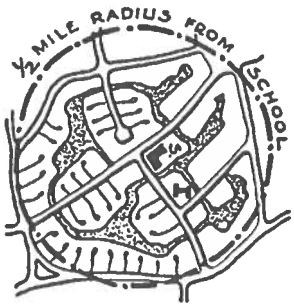


A.—Leading Nowhere in Particular



B.—Leading to Places Where People Go





11. Neighborhood Unit principles. (Perry)

3. The Power of Control and Authority, 1930-1950

The harsh realities of the economic depression turned American municipal authorities into ineffectual entities. Limited by depleted local revenues and soaring unemployment rates, many municipalities reached fiscal crisis and approached bankruptcy. When angry crowds of unemployed workers turned their frustration toward the local government, alarmed mayors and city officials turned in desperation toward the federal government. In 1932 the major cities knew that "nothing short of federal aid would help them feed and clothe their destitute, maintain basic municipal services, and offset bankruptcy."61 In June of 1932, at the National Conference of Mayors representing twenty-nine cities, a plea for help was sent to the federal government. Yet with the 1932 national election at stake, the Hoover administration was reluctant to increase direct help for the cities and resolved to call a special President's Conference on Home Building and Home Ownership. Although the conference did not directly intervene or allocate any direct funding, the proposals put forward by its participants shaped the future 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 an open space system 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:

- Relation of proposed streets to adjoining street systems.
- Street alignment.
- Street intersections.
- Corner radii.
- Dead-end streets.
- Street width *(minimum 60 feet).*
- Roadway width *(24 feet minimum with 4-6 foot sidewalk).*
- Building lines *(measurements not given).*
- Street grades *(measurements not given).*
- Street names.
- Street trees *(species list given).*
- Easement.
- Block length, width and area *(Maximum. length 1000 feet).*
- Lot lines *(minimum of 15 feet as side yard between houses).*

"There should be a differentation in the width and arrangement of streets. Main thoroughfares should be established not only for the accommodation of a large volume of traffic, but also to lessen the traffic on minor streets

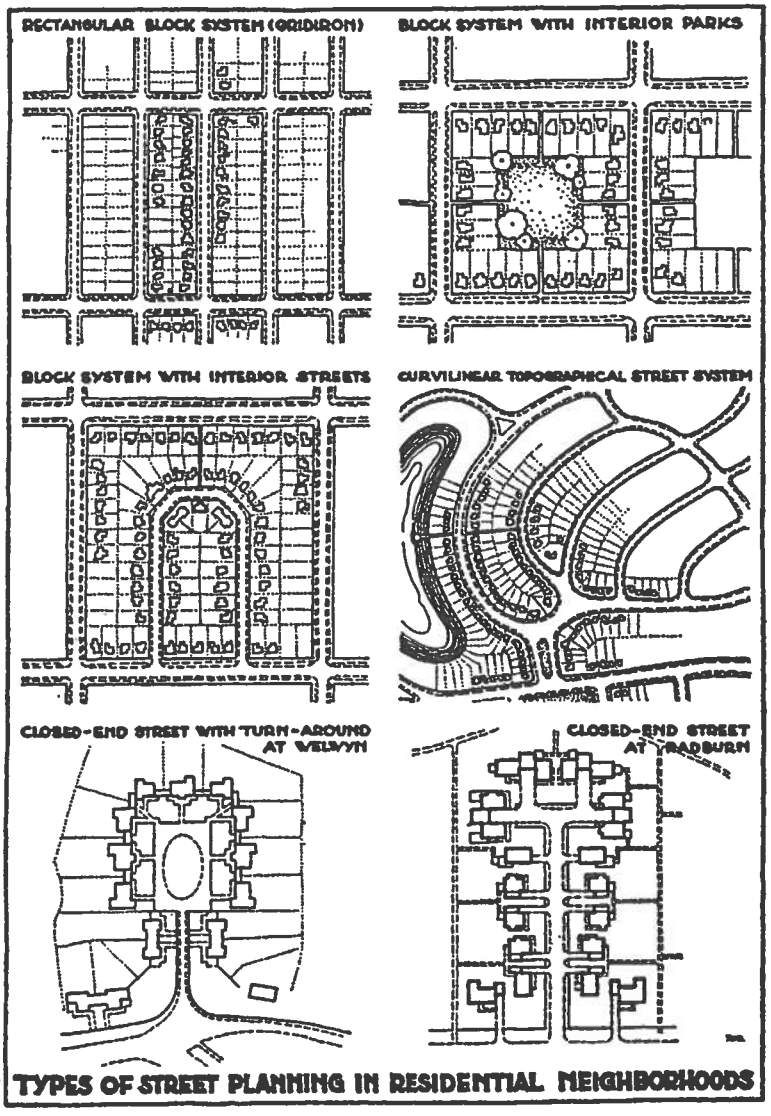
where the majority of dwellings will be located. As an added inducer of privacy and safety, minor streets should be of less width. Minor streets should also be designed with a certain curvature or indirectness so as further to discourage traffic and at the same time, to produce a departure from the usually monotonous rectangular pattern."[62] (Fig. 12)

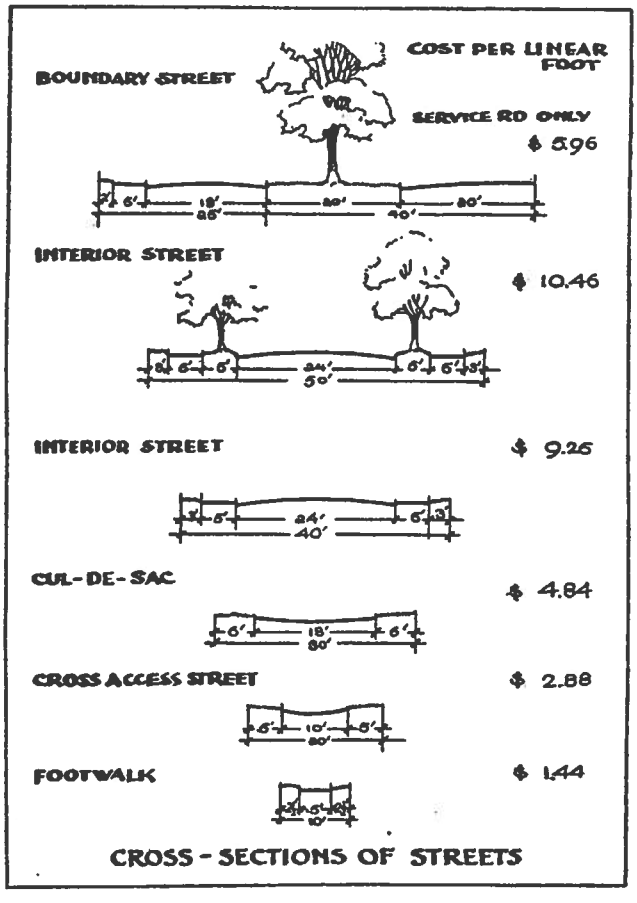
The President's Conference findings were not directly implemented by the Hoover administration. With election in sight it was left for the new Democratic Administration to adopt and integrate the conference recommendations into its policy. The new federal government embraced most of the recommendations of the conference experts and its planning outlook. For the next decade the planning discourse and its physical outcome 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 (1933), and the establishment of the Resettlement Administration and the Federal Housing Administration as part of the National Housing Act (1934-1935).

The President's most influential recommendations of the Conference came from the Committees on City Planning and Zoning, Subdivision Layout, and Home Finance and Taxation. The Committee on Finance suggested that private enterprise acting alone cannot guarantee stabilized, successful, and affordable housing. Private enterprise gears itself to the upper income market share, and only through cooperation between government and the business sector can large scale affordable housing be guaranteed. They encouraged the establishment of a federal regulatory procedure to aid the building industry with financial information on available mortgages, real estate transfers, and newly planned subdivisions. They also recommended the establishment of an adequate system of home credit through a system of home mortgage discount banks to make mortgage money more readily available and to encourage sound home financing practice. This proposal led to the establishment of the Federal Home Loan Bank Act of 1932 and formed the basis for the FHA financial policies.[63] The Subcommittees on City Planning and Zoning asserted that the success of large scale decentralized development could be achieved only through a new outlook on regional planning and a readjustment and restructuring of laws, codes, and standards. They recommended giving more power to local and city planning officials. They endorsed the neighborhood unit concept and recommended its usage in new planning as well as in the restructuring of existing neighborhoods through zoning and regulations. The Committee on Subdivision Layout was concerned with controlling speculative developers. They proposed that the adoption of good subdivision engineering and design and the enforcement of minimum standards to eliminate de-stabilizing practices.[64]

In 1933 the National Planning Board was established by executive order under the authority of the Public Works Administration. This new advisory planning body adopted most of the President's Conference findings, as well as the prevailing philosophies of the Regional Planning Association and the design remedies suggested by its members. They endorsed the notion that urban decentralization could act as a

catalyst for economic recovery, as long as it was controlled and not speculative in nature. With regard to the structure of the community, they recommended the Neighborhood Unit and the Garden City ideals as supportive of healthy and stable forms of living. They promoted the idea of coordinated planning and encouraged the preparation of comprehensive regional plans through the cooperation of city, regional, and state agencies. The National Planning Board gained support from social activists and from President Roosevelt who was known to maintain an anti-urban opinion and often stated that economic stability could be achieved by moving away from an emphasis on the city and developing a regional structure. In 1931 he said: "The question we need to exercise is whether we cannot plan for a better distrubution of our population as between the larger city and the smaller country communities . . . Conditions have changed since the rush of workers to the cities began. They have changed materially even since the war period. One of the most significant transformation is that wrought by the automobile, and the improvment in highways that has come along as a consequance. . . It is no longer





12. Street planning and subdivision layouts. (The President's Conference on Home Building and Home Ownership, 1932.)

necessary that an industrial worker should live in the shadow of the factory in which he works . . . the worker should have a wide range of choices for his home in terms of physical distance." 65 Other social scholars pointed at the uneven distribution of class between the suburbs and the city. They concluded that rapid development was catering to the upper class and as a result the social fabric of the city was deteriorating. They also attributed the slump in land values to the fact that developers were catering to a limited market. The 1933 Report of the President's Research Committee on Social Trends indicated that "special attention has been given in the past decade to the promotion of exclusive residential districts designed for occupancy by the higher income class. The lure of the rural scenery is indicated by the extremely high rates of increase of suburbs bearing names denoting attractive physical features, such as heights, vistas, parks and water frontage. Here are some well-known suburbs with their percentage increase from 1920 to 1930: Beverly Hills, 2,485.9%; Glendale, 363.5%; Inglewood, 492.8% . . . Cleveland Heights, 234.4%; Shaker Heights, 1,000.4%; Garfield Heights, 511.3%."66

In 1934 the National Housing Act was passed as a measure to implement the various commissions' and agencies' findings into constructive actions. The Resettlement Administration and its Suburban Division were established in 1935 to promote and develop new regional dwellings amalgamating the three basic concepts of the Garden City, the Radburn idea, and the Neighborhood Unit into the Greenbelt New Town projects. Their purpose as officially stated was: (1) To give useful work to men on unemployment relief; (2) To demonstrate in practice the soundness of planning and operating towns according to certain Garden City principles; and (3) To provide low-rent housing in healthful surroundings, both physical and social, for families that are in the low-income bracket.

The Greenbelt New Town projects never materialized into an influential force in the American urban landscape. Only three towns were constructed and all failed to develop as centers of industry, business, or government, but became specialized suburban communities. Yet the planning philosophies behind their development strengthened the emphasis on the need for dwellings for low and moderate income groups in multi-family units, as well as single family residential developments.67

As a result of the continued emphasis by the government on multilateral coordinated planning many local governments established regional plans to guide the growth of their communities. In the Northeast, for example, more than twenty regions had produced plans between 1932 and 1935. It was a major undertaking to provide a "framework to which all future detailed plans of various localities can be made to conform."68 It was also an effort to coordinate suburban subdivision development through the integration of road planning and road standards and to prevent inadequate and inappropriate street layouts. An official plan and an established guidelines map were seen as new tools to control and maintain governing policies. Thus "the more common evils attended upon land subdivision: premature development, resulting in idle land, economic loss, and unsightly blots on the landscape; subdivision of land unsuitable for building; failure to adapt the street plan to the topography of the land; misfit

subdivisions, that is, failure to co-ordinate the streets of adjoining tracts; failure to adapt street widths to their uses (too narrow thoroughfares and too wide residential streets); failure to set aside adequate spaces for play and recreation" could be eliminated through regional planning and coordination.[69]

Large scale planning efforts and integrated governmental policies resulted in a new planning and design structure. For the first time an inclusive outlook of planning was considered for both region and nation. Such a structure also demanded a centralized apparatus to manage, coordinate, and control the emerging landscape.

The Federal Housing Administration. Although the federal government encouraged long range housing policies through professional planning discourse, it was its financial mechanism that dominated the new built environment. The FHA was established in 1934 as part of the National Housing act with the main purpose of restructuring the collapsed private home financing system through government mortgage insurance plans. By providing a governmental protective shield, the FHA was able to eliminate the risk for lenders, as well as to provide a financial resource for home buyers. Developers found new stimuli for existing project sales as well as incentives for new construction. Through its long term, low interest rates and low down payments a larger portion of the population found itself eligible and secure in buying a home and maintaining affordable payments.

FHA designated financial assistance and mortgage insurance created the most ambitious suburbanization plan in the United States history. To secure its investments the FHA established a comprehensive system of appraisal procedures designed to eliminate risk and failure. In order to qualify for a loan, lenders, borrowers and developers had to submit detailed plans and documentation of their projects to the administration to determine whether or not they had sound prospects. The FHA underwriting procedure soon turned into the prevailing standard. With monetary support at stake, developers preferred to comply with the published standards. Thus, FHA officials found themselves in a powerful position, far greater than any planning agency, to direct and shape development for generations to come. In 1934 nearly 4,000 financial institutions, representing more than 70 percent of all the commercial banking resources of the country, had FHA insurance plans. By 1959 FHA mortgage insurance had helped to provide homes for 5 million families and helped to repair or improve 22 million properties. Three out of every five American families were helped by the federal government to purchase a home.[70]

FHA's successful control over development and developers was not only due to their financial power, but also to the fact that they were not a "pure" planning agency. Weiss (1987) suggested that community developers and the National Association of Real Estate Boards were enthusiastic about the FHA's intervention role, in contrast to their fear and anxiety of government and local planning commissions. The FHA, unlike other planning agencies, was largely run by representatives of real estate and banking industries, and thus developers felt their needs would be served. 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. The paradox of the FHA system was that, although it imposed strict requirements through underwriting manuals and property standards, "it always appeared to be non-coercive to the private sector. The FHA was generally perceived as engaging in a simple business operation — to insure only low-risk mortgages with a sound economic future. Property owners and real estate entrepreneurs viewed FHA rules and regulations as similar to deed restrictions — private contracts which were freely entered into by willing parties — rather than as similar to zoning laws, which were sometimes seen as infringing on constitutional liberties."[71]

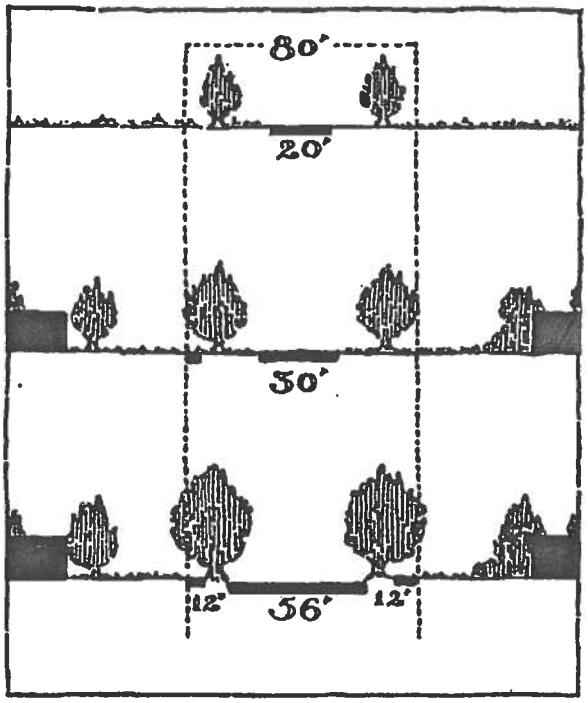
In January 1935, the FHA's first technical standard publication appeared in five circulars: *Standards for the Insurance of Mortgages on Properties Located in Undeveloped Subdivisions - Title II of the National Housing Act. Subdivision Development* (Circular Number Five) was the basis for further publications by the Technical Division. In this publication the FHA stated its goals and visions for successful development in general terms. Attempting to avoid any implication of rules or obligatory procedures the document states that: "The Administration does not propose to regulate subdividing throughout the country, nor to set up stereotype patterns of land development," and yet it continues by saying: "It does, however, insist upon the observance of rational principles of development in those areas in which insured mortgages are desired, principles which have been proved by experience and which apply with equal force to neighborhoods for wage earners as they do to those for the higher income groups." These rational principles are then described in a detailed narrative, with precise measurements under the section "Minimum Requirements & Desirable Standards." Some of the standards include the following:

- The subdivision layout should fit the topography of the site and take advantage of natural features.
- Streets should be planned as to width and construction to suit the local requirements.
- Not all streets should be designed for through or heavy traffic.
- Paving for streets bearing purely local traffic may be of inexpensive materials and may, depending on the character of the neighborhood, omit curbs and sidewalks.
- Width of paving should be based on allowance of 10 feet for each traffic lane and 8 feet for each parallel parking line.
- All street intersections should be built on a radius of at least 20 feet.
- Long lived, hardy trees should be planted along all streets.
- Blocks should generally range from 600 feet to 1000 feet in length.
- A desirable lot for detached dwellings should be at least fifty feet wide, with an area of no less than 6,000 square feet. For semi-detached dwellings density should not exceed 12 units per acre.[72]

Setting the framework for regulation through written standards, the FHA also provided suggestions and recommendations for development layout. The 1936 Bulletin on *Planning Neighborhoods for Small Houses*

demonstrated the Administration's preference for Unwin, Perry, and Stein's approaches to town and neighborhood planning concepts. Using plans and diagrams, some of which appeared in Unwin and Perry's publications, the bulletin illustrated the measures needed to build an ideal "well-balanced, carefully planned subdivision" that would also add up to "the creation of real estate values through devising a layout which is not only economically sound, but which provides to the maximum degree those conditions which make for pleasant and healthful living." (Fig. 13)

Regarding an overall subdivision layout, the FHA for the first time indicated a rejection of the grid pattern for residential neighborhoods, an assertion carried through all of its later publications and suggested requirements. Using Perry's concept the bulletin declared: "The gridiron plan which has been so universally adopted in most of our cities has several very decided disadvantages when applied to residential areas. In the first place it creates waste by providing a greater paved area than necessarily adequate to serve a residential community. Secondly, it causes the installation of a more expensive type of paving by dispersing the traffic equally through the area, which in turn creates an increased traffic hazard. In addition to these disadvantages it creates a monotonous uninteresting architectural effect and fails to create a community aspect." Street patterns are recommended to follow a hierarchical structure. Major thoroughfares which provide access to centers are located along the borders and minor residential streets within the development. Initiating a regular format the bulletin used diagrams and section drawings to establish enduring standards for streets and lots.



13. FHA's first publication of a recommended street width. It illustrates the way in which street improvements on an 80 foot right of way may be gradually increased as the neighborhood grows. (FHA, 1936)

Three forms of residential street layouts were put forward: Curvilinear, Cul-de-sacs, and Courts and their design was guided by descriptive and prescriptive measurements, some of which were:

- Layouts should discourage through traffic.
- Wide intersections should be eliminated.
- Streets should follow the topography to reduce cost, create interesting vistas, and eliminate the monotony of long straight rows of houses.
- Minimum width of a residential street should be 50 feet with 24 feet of pavement, 8 foot planting/utilities strips, and 4 foot walks.
- Cul-de-sacs are the most attractive form for family dwellings. Street

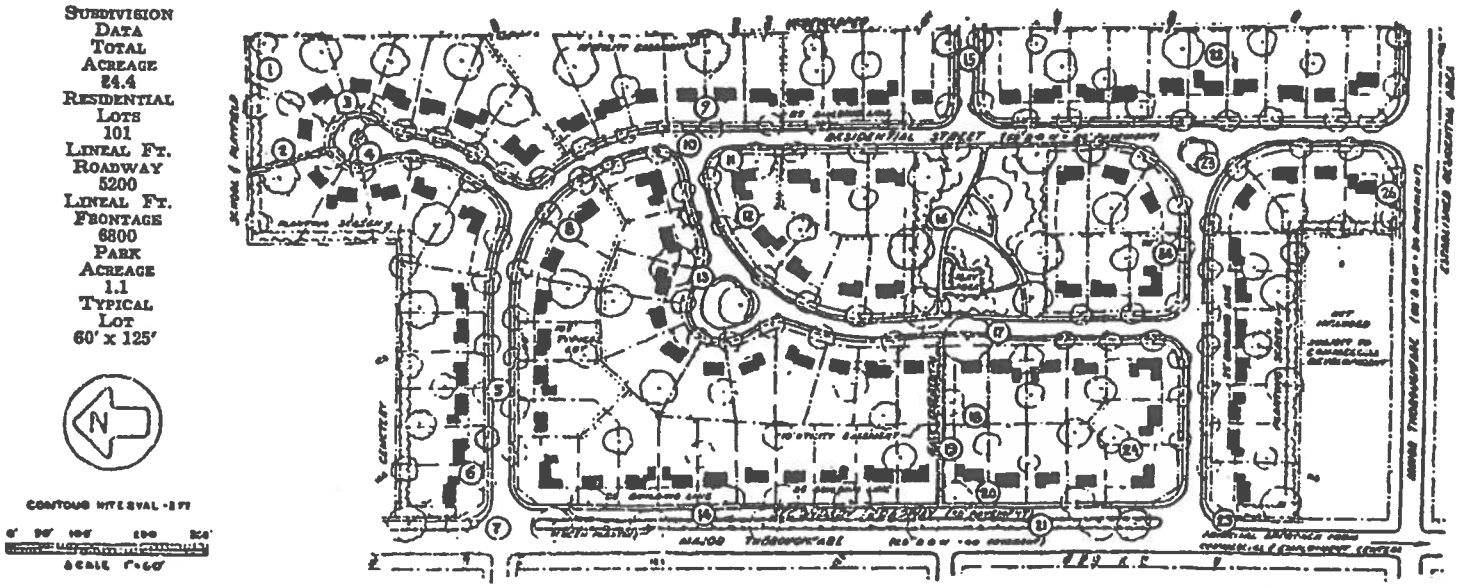
construction cost is thereby reduced as 18 feet of paving is sufficient with a minimum 30 foot radius turn-around.

• Minimum set backs for houses should be set at 15 feet.

• Permanent trees should be planted 40 feet apart on either side of the street, either halfway between the sidewalk and the curb or on the outer side of the sidewalk and the property line.

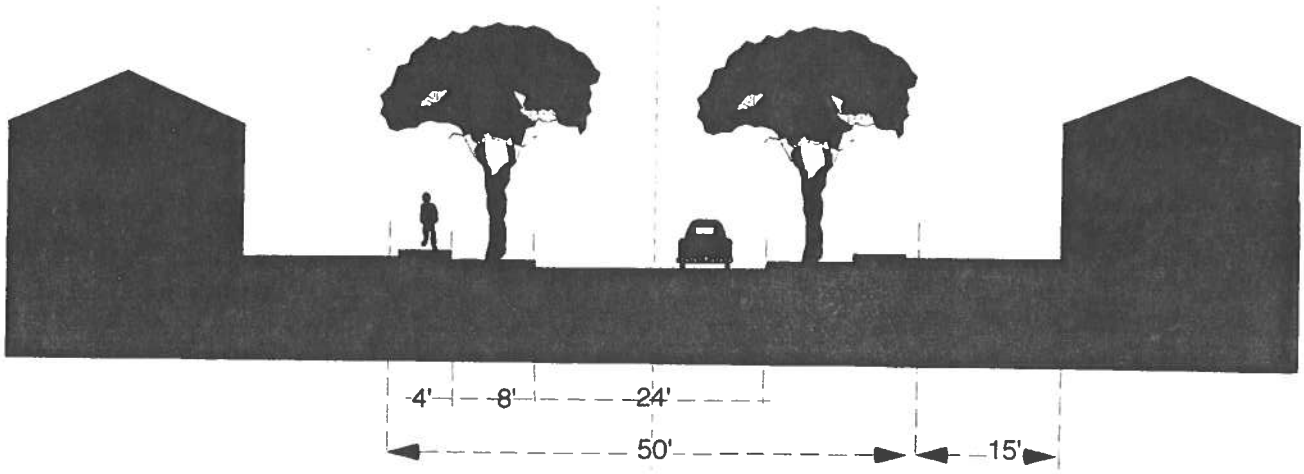
• Front yards should avoid excessive planting in order to give a more pleasing unified effect along the street (Fig. 14).

Subsequent publications by the FHA adhered to the established standards of 1936 and 1937. Modifications of street layouts and width did not change until 1941 when the minimum width of residential street pavement was increased from 24 feet to 26 feet and concrete curb construction was recommended.[73] In 1938 the FHA Technical and Land Planning divisions initiated a free review program by which prospective developers could submit preliminary plans to be examined. The review procedure and required forms were included in most of the Administration's publications. The Publication stated: "The FHA is interested in cooperating with real estate developers, builders, and their technical consultants in obtaining high standards of land development. The opportunity is

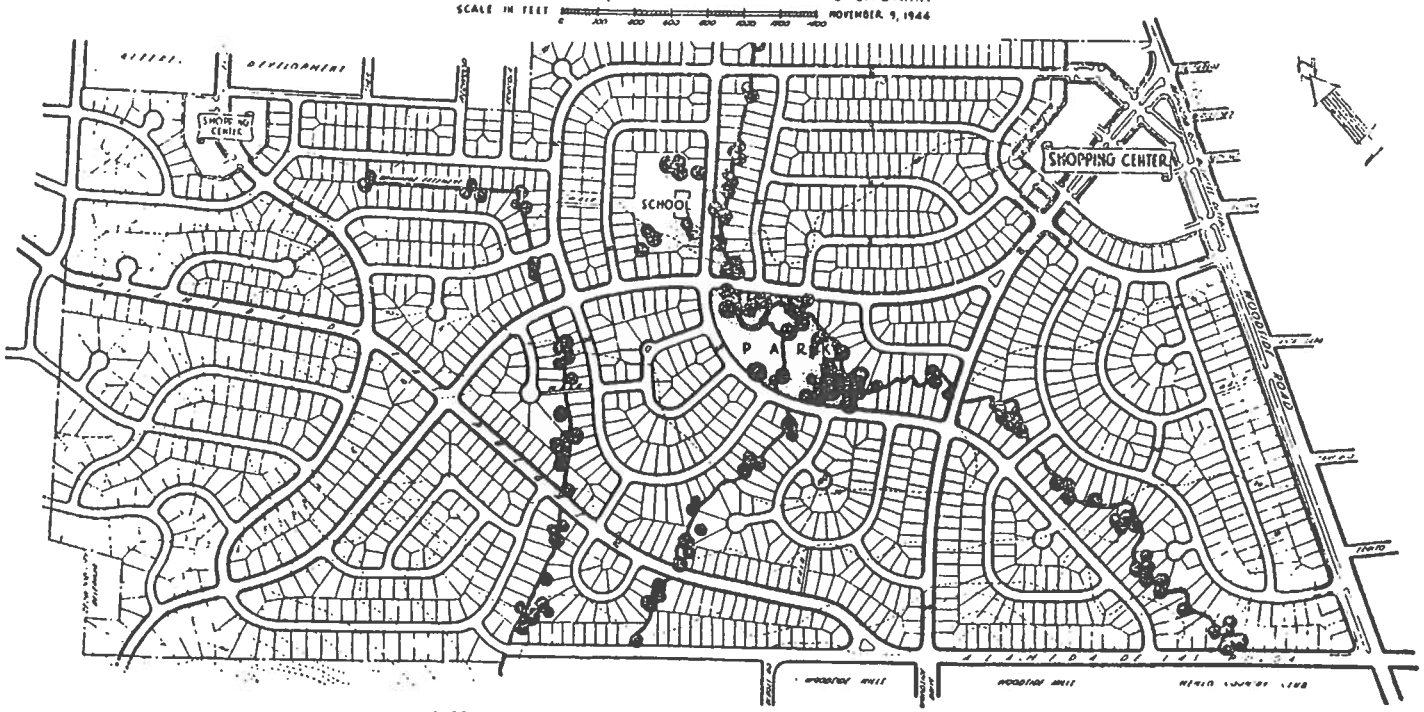


1. 15 foot easement for planting screen to provide protection from non-residential use.
2. 10 foot walk easement gives access to school.
3. Cul-de-sac utilizes odd parcel of land to advantage.
4. Turn-around right-of-way 100 feet in diameter.
5. Street trees planted approximately 50' apart where no trees exist.
6. Additional building set-back improves subdivision entrance.
7. Street intersections at right angles reduce hazards.
8. Lot side-line centered on street end to avoid car lights shining into residences.
9. Residences opposite street end set back farther to reduce glare from car lights.
10. Three-way intersections reduce hazards.
11. Property lines on 30' radii at corners.
12. Lot side-lines perpendicular to street right-of-way lines.
13. "Eyebrow" provides frontage for additional lots in deeper portion of block.
14. Secondary roadway eliminates hazard of entering major thoroughfare from individual driveways.
15. Provision for access to land now undeveloped.
16. Neighborhood park located near center of tract. Adjacent lots wider to allow for 15 foot protective side line set back.
17. Pavement shifted within right-of-way to preserve existing trees.
18. Above ground utilities in rear line easements.
19. 10 foot walk easement provides access to park. Adjacent lots wider to allow for 15 foot protective side line set back.
20. Variation of building line along straight street creates interest.
21. Screen planting gives protection from noise and lights on thoroughfare.
22. Lots backing to uncontrolled land given greater depth for additional protection.
23. Low planting at street intersections permits clear vision.
24. Wider corner lot permits equal building set back on each street.
25. Platting of block end to avoid siding properties to residences across street.
26. Lots sided to boundary street where land use across street is non-conforming.

14. FHA recommended subdivision layout.(FHA)



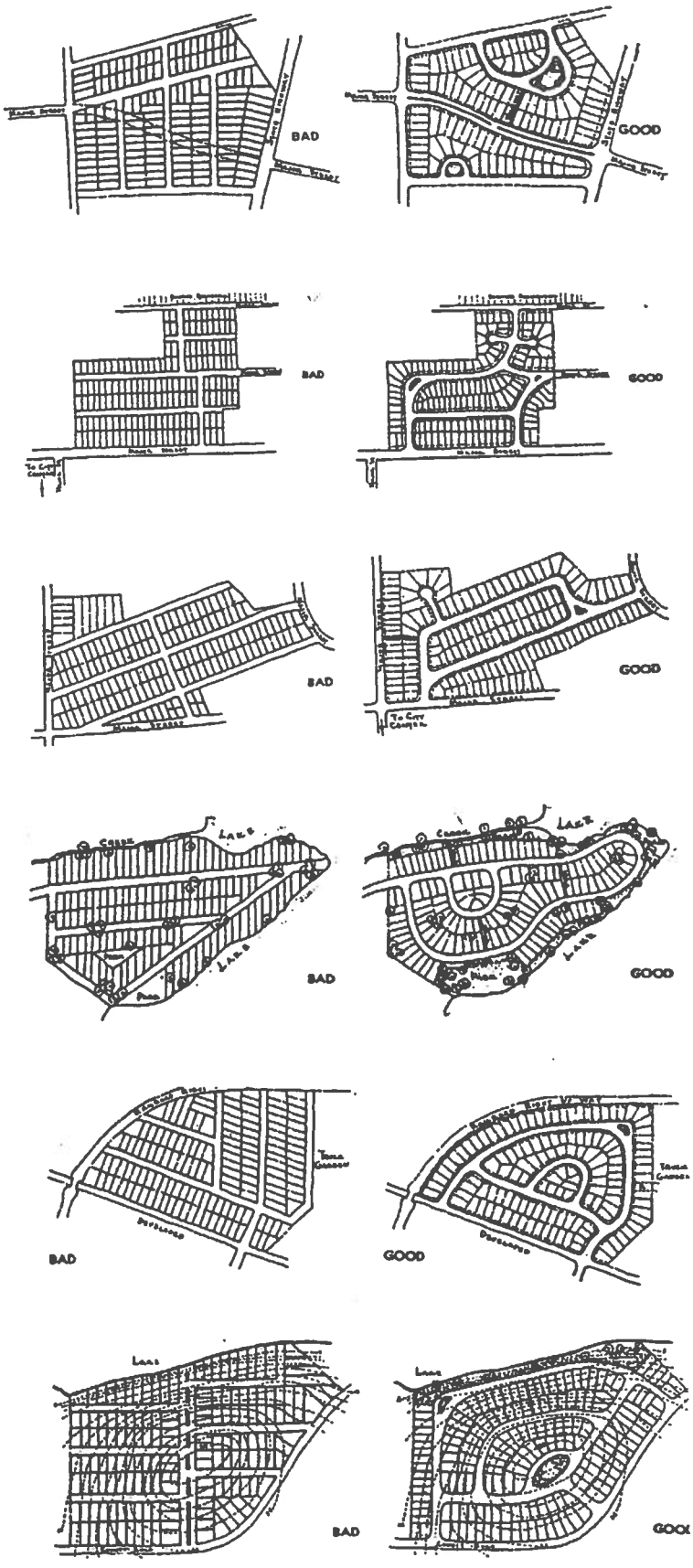
SUGGESTED SUBDIVISION PLAN FOR
° WOODSIDE ACRES °
REDWOOD CITY, SAN MATEO COUNTY CALIFORNIA
SCALE IN FEET NOVEMBER 9, 1944



14b. FHA recommended and constructed street layouts. (ULI, 1947)

welcomed to analyze proposed subdivisions and to make suggestions which, in our opinion, if followed, will create more marketable, attractive, and stable residential properties." FHA consultants would then analyze plans and suggest layouts that would conform to FHA guidelines for securing an insured mortgage. It was a powerful control tool and naturally, almost all subdivision developers submitted their plans for review as a safe prelude for 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'. The extent of such authority was stated by the FHA administrator, James Moffett, in 1935 when in a confidential meeting he told his advisory board to "make it conditional that these mortgages must be insured under the Housing Act, and through that we could control over-building insertions, which would undermine values, or through political pull, building in isolated spots, where it was not a good investment. You could also control the population trend, the neighborhood standards, and material and everything else through the President."[74] FHA minimum standards and design regulations had set the ground work for modern subdivision practice. They shaped the practices employed by the Federal Public Housing Authority and its wartime housing projects, provided the basis for the Second World War suburbanization drive, and established the foundation for local government subdivision regulations (Fig. 15).



15. FHA recommended subdivision layouts. (FHA)

Plat Approval and the Local Authority. By 1941 thirty-two States had passed legislation granting power of subdivision control through the establishment of local planning commissions. Through an exercise of legislative "police power" by the state, the right of a landowner to sell property could be withheld until approved by a designated authority that was mandated to "promote the community health, safety, morals, and general welfare."[75] Local planning commissions, once authorized and empowered by the community, adopted rules and regulations governing subdivision procedures within their jurisdictions. Most of these regulations were adopted from the Federal Government's established criteria, in particular those of the FHA. In a nation-wide comprehensive survey of more than two hundred cities done by the Public Administration Service in 1941, a similar trend of requirements and standards was presented. All of the cities and counties surveyed required that proposed subdivision streets conform to the street plan of the community, particularly with regard to major streets. The majority of cities established the functions of minor subdivision streets as providing access, light, and air to abutting property. Layouts were encouraged to provide discontinuity and the elimination of through traffic.

An interesting shift is seen with regard to dead-end streets. While early in the century developers often independently constructed dead-end streets with no regard to general circulation planning, thus making it a problematic street configuration, in the 1940s properly located and designed dead-end streets were seen as desirable streets on which to live. The width of minor streets and dead-end streets varied between 22 to 40 feet for roadway width and 50 to 60 feet for right-of-way. Prevailing minimum measurements for planting strips was recommended at 6 feet, minimum sidewalk width at 4 feet, and curb radii at 20 to 25 feet. The survey showed that 160 cities from a total of 213 required a right-of-way of 50 to 60 feet, with two cities requiring only 33 feet (North Adams, Massachusetts and Bronxville, New York) and one city, an 80 foot width (Great Falls, Montana). Traffic lane widths for minor streets were generally recommended at 9 feet and parking lanes at 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 is recommended in outlying residential streets but was not always necessary in the inner ones.

During the late 1930s and early 1940s almost all cities required the planting of street trees with a deviation from older practices: "While it has been customary in the past to plant street trees between the street curb and the pedestrian walk, an alternate procedure is now recommended as preferable in some cases. Trees planted along the street curb increase the severity of motor accidents and in turn are easily subjected to traffic injury; they interfere with and are injured by telephone wires and other utilities, the limited soil and water supply at the pavement edge restrain the tree growth and increase replacement costs; and except on very wide streets, curb planted trees crowd in upon the traveled way. To plant street trees on the property side of pedestrian walks, away from the pavement and traffic, seems more desirable, particularly on residential streets."[76]

Subdivision regulations as exercised by a local planning agency provided an effective tool for the accomplishment of the community master plan. Within each locality one might expect a unique and diverse set of guidelines corresponding to the character of the area to be developed. Indeed local planning administrative acts often stated that: " Good subdivision design cannot be standardized and applied universally to all tracts, but only basic principles and minimum standards of design can be formulated."77 Diversity of design and freedom of choice was advocated for the design of residential streets: "In the development of residential neighborhoods, whether for the rich or for the poor, we usually need, in short, to get away from the stereotyped and formal. Our main traffic lines have freed our minor streets from the rules, restrictions, and system which traffic imposes on our main traffic thoroughfares; and the regulations determining the space which must be left open between the fronts of the opposite houses has given us the liberty to leave as much of this space in private, and as little in public ownership as may be convenient. We can have a sidewalk or omit a sidewalk, just as is best fitted to the conditions of the particular street; we can have a footway instead of a street if we prefer, or a road without a footway if that is better."78 Bridging the gap between a principle and a standard to obtain diversity and adaptation to local conditions have remained unattained. Thus, most local agencies ended up adopting a nationally prevailing set of recommended subdivision standards and requirements as put forward by the FHA.

The builders' community, which supported a comprehensive national set of regulations as manifested by the FHA standards, was indeed apprehensive about local agencies' guidelines. Local policies were seen as unpredictable, hard to plan for, costlier and less supportive of development. To help counter such measures and help the home builders and real estate community, a few private organizations were formed, the most influential of which was the Urban Land Institute. Organized in 1939 as an independent non-profit research organization in the field of urban planning and land development, it was sponsored by the National Association of Real Estate board which acted as a consultant to the National Association of Home Builders. Its major emphasis was to provide information to developers and home builders in the process of community development. The organization advocated the FHA approach to subdivision layout and adopted many of its recommendations. It tried to lobby against the individual approach to subdivision stating that: "The ultra-modernist and the seeker for radical unorthodox, or socialized departures in this field will not find them here. What he will find will be considered recommendations of methods and procedures which have stood the test of sound land planning and engineering design, of the financial risks involved, and, most important, ideas which have the acceptance of the American home-buying public which is traditionally moderate in its selection of a home."79 Yet, ULI publications also pointed to inconsistencies in local agency requirements and often asked for reconsideration in order to facilitate construction and lower expenditure. As such it has often acted as a catalyst for change within a structural planning framework. As most local streets and their utilities would be located, financed and constructed by the subdivider of

land whose main aim was profit, ULI often pointed out that: "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."[80]

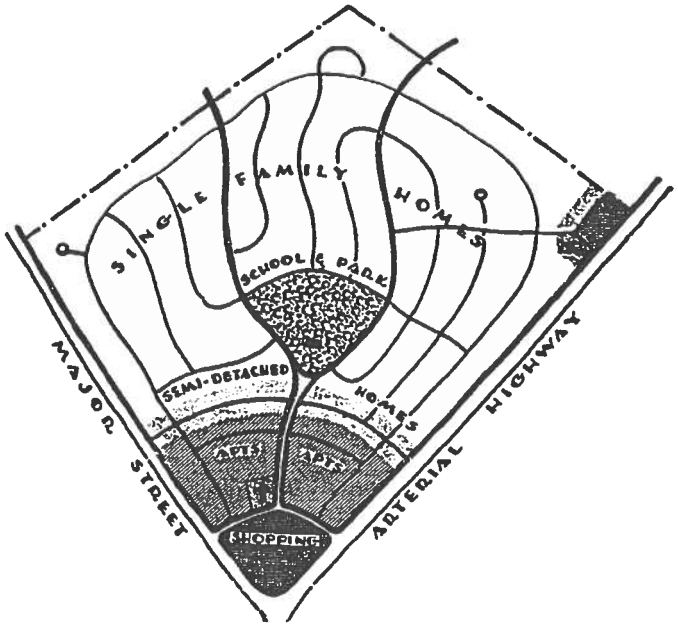
ULI's desire to cut construction costs and to lessen the burden on the developers was reflected in its recommendations for minor streets in detached residential streets published in 1947:

- Right-of-Way: maximum 50 feet.
- Pavement Width: maximum 26 feet.
- Sidewalks: "Sidewalks tend to encourage use of the street for play rather than off-street areas such as the rear yard or play ground. In general, the Council recommends a sidewalk on at least one side of the street." Sidewalks are recommended to be 4 feet wide with regular curb and 3 feet 6 inches with rolled curbs.
- 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 to be used mainly with vertical curbs as a way to overcome the curb cuts and the gradient of the driveway. A Minimum of 8 feet on both sides of the street is recommended for tree planting (Fig. 16).

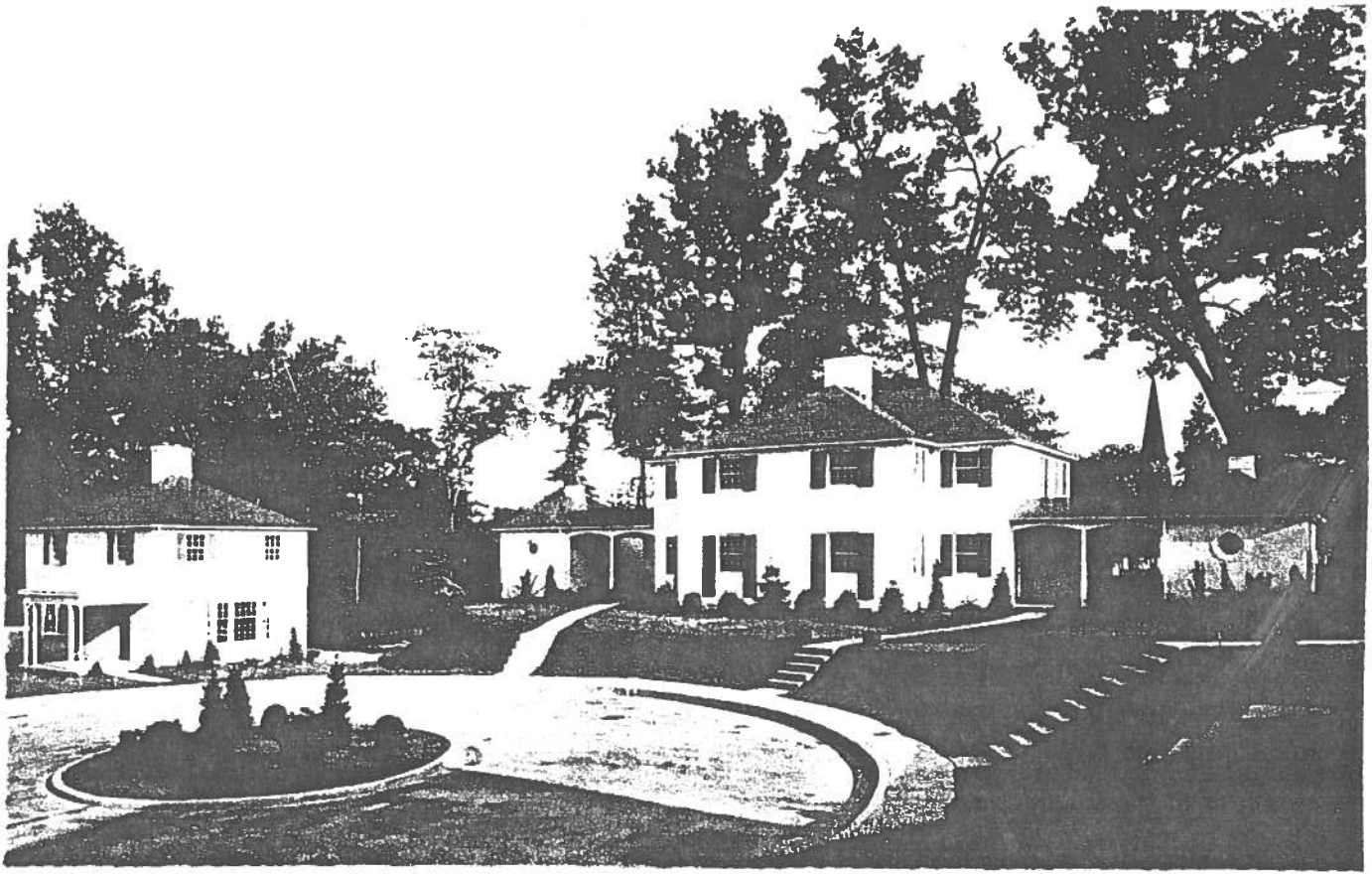
ULI's publication of *Residential Streets* in 1974 and 1990 continued the organization's policy of advocating lower standards for local streets and a renewed emphasis on accommodating other street usages beside just vehicular access.

Another organization closely related to ULI was the National Association of Home Builders. NAHB was strongly opposed to 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?" It then continues to give the apparent reasons as:

1. A lack of understanding of the relationship between street location, alignment width, and street use.
2. Adherence to an obsolete theory that every street should be designed to become a traffic street.
3. Insistence on continous alignment of minor streets.
4. The overlooking of economic aspects and the cost of constructing, maintaining, and repairing from 38% to 54% more roadway



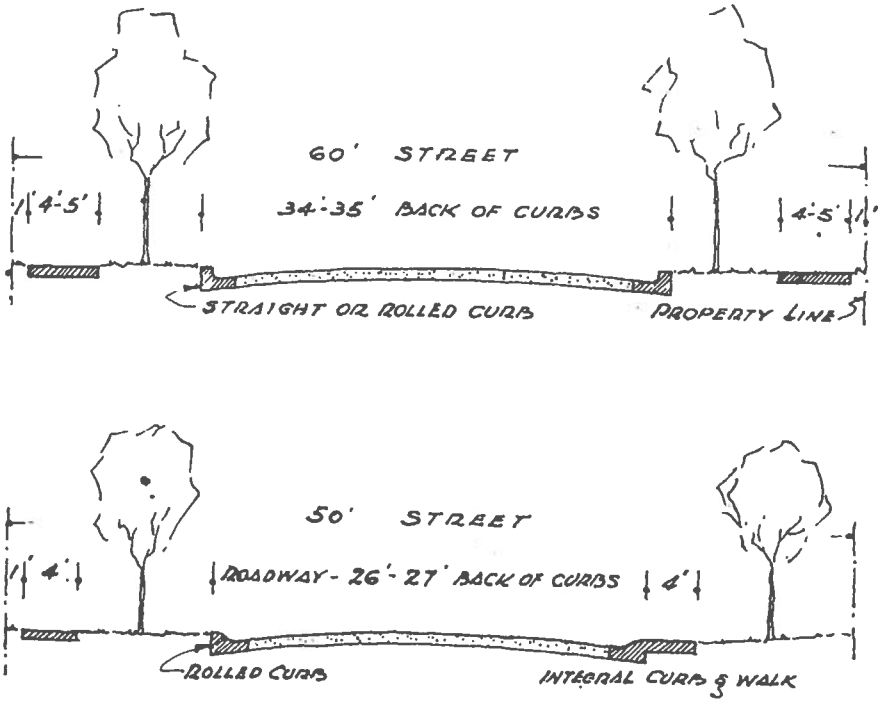
16. ULI recommended subdivision layout along the Neighborhood Unit Principle. (ULI. 1947)



DESIGN OF LOCAL RESIDENTIAL STREETS

Speed: Based on maximum of 25 m.p.h. in accord with Uniform Vehicle Code recommendation. Recommendations will be reasonably satisfactory if some speeds exceed 25 m.p.h. a little.

	Single-family Units	Multi-family Units
Street Width:	50 feet	60 feet
Pavement Width:	26 feet	32 feet
Curbs:	Straight curb recommended	Same
Sidewalks		
Width:	4 feet minimum	Same
Set-Back:	3 feet minimum if no trees, 7 feet minimum with trees	Same
Horizontal Alignment:	200 feet minimum sight distance	Same
Vertical Alignment:	6-8 per cent maximum grade desirable 3-4 per cent per 100 feet maximum rate of change	Same
Cul-de-sac:	400-500 feet maximum length	Same
Turn-arounds:	40 feet minimum curb radius without parking	Same
	50 feet minimum curb radius with parking	Same
Pavement Surface:	Non-skid with strength to carry traffic load.	Same



16b. ULI recommended residential street standards. (ULI, 1947)

surface than is needed.[81]

Stressing the needs for reconsideration by the building industry was often met with reluctance by local planning agencies. The fear of creating substandard street layouts and the rise in vehicular ownership promoted a technocratic structural approach to subdivision design.

4. Technocracy and Engineering, 1950-1985

The role of the automobile. After World War I the 2 million motor vehicles of 1915 grew to almost 10 million in 1920, all attempting to use an inadequate road system. The impact of the automobile at that time necessitated a comprehensive rethinking of transportation network policy. Although local states and government were expanding their road network, a coherent national road system had to be developed, one that would be coordinated financially and technically. This could only be achieved by federal action. In 1921 the Federal Highway Act was passed to provide for federal aid to construct "such projects as will expedite the completion of an adequate and connected system of highways, interstate in character"[82] The Act was the first recognition in American transportation policy of the desirability to provide for a functional specialization for motor vehicle routes and their control by a central authority. Such emphasis provided the basis for a hierarchical road system and the first official categorization of roads and streets, in particular the separation of arterial through-traffic networks from local ones. Federal monetary aid had also generated the largest road improvement program in the nation. During the depression years in particular, federal aid was extended to include urban and rural road systems. By 1938 total road and street improvements reached a total of 600,000 miles as compared with only 80,000 miles for highway construction.[83]

The change in policy and the improvement of road systems necessitated the emergence of a new profession. Traffic engineering at that time was not a recognized discipline and was not part of an established practice. In fact between 1920 and 1930 it failed to even be recognized as a specialized sector within the American Society of Civil Engineers.[84] Except among a few engineers there was little available knowledge of the fundamental differences between road construction techniques and transportation planning. Many of these early professionals were civil or electrical engineers, self taught in transportation planning and construction.[85] Road designers in the 1920s had to work within an emerging field of knowledge and concepts, often developing them through actual application.

The Institute of Transportation Engineers. The need for specialization in traffic engineering as a result of rapidly changing transportation needs prompted the formation of the transportation engineering profession in 1930 through the national Institute of Transportation Engineers and a specialized education program at Yale University. The new profession was founded on: "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."[86] In 1939, ITE was approached for the first time by the federal government, the National Conservation Bureau, and the American Association of Highway Officials to suggest traffic engineering guidelines and standards in the form of an engineering handbook and related technical publications. In 1942 the Traffic Engineering Handbook was first published and provided the basis for the profession and its practice.

Most of these early publications were concerned with high speed and efficient road networks, rather than local residential networks. In the 1940s 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-car traffic. Street parking on urban streets was recommended at 13 to 15 feet. Justification for these dimensions often stated that: "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."[87]

Wider lanes and cross sections were thought to improve safety and efficient movement in the traffic engineering profession. The safety problems associated with through traffic in residential streets was not addressed by traffic engineers until the mid-1950s. At that time the emphasis shifted to prevention of through traffic by means of a hierarchical street network. Yet the cross sections of residential streets and their geometrical configurations remained unchanged. One of the first engineering studies on residential subdivision street safety was conducted in Los Angeles between 1951 and 1956. The study aimed at finding the rates of accidents in a gridiron type development as compared with the prevailing FHA limited access and curvilinear pattern. The study included eighty-six residential subdivision tracts with a total developed area of 4,320 acres, representing a population of 53,000 persons, 108 miles of residential streets, and 660 intersections. The study showed that the distribution of accidents was substantially higher with grid-based subdivisions. The total accident rate for all gridiron subdivisions was 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. In terms of accident frequency 50 percent of all intersections in the gridiron pattern had at least one accident during the five year period. In contrast, only 8.8 percent of the intersections in the limited-access patterns had accidents during that period. This was significant since there were 65 percent more intersections in the limited-access tracts than in the gridiron 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.[88] (Fig. 17).

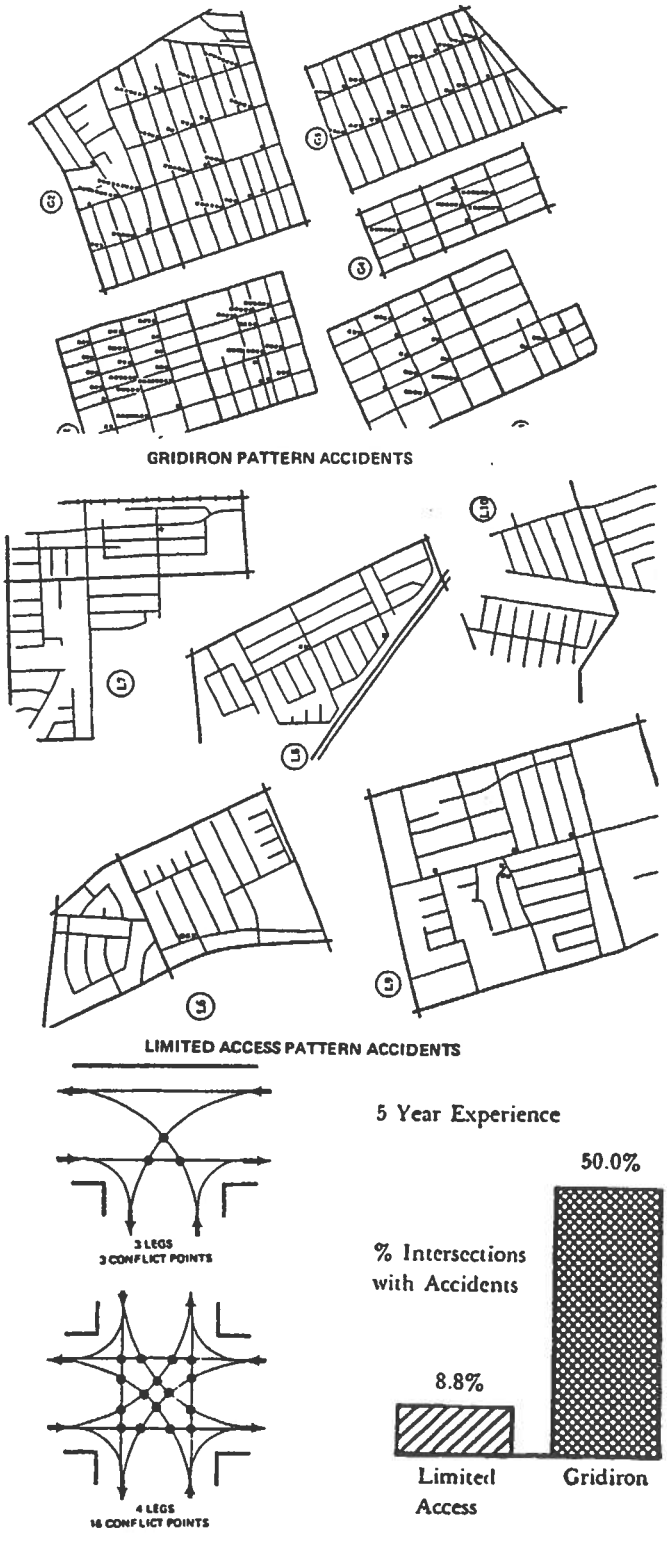
Expanding on these findings, ITE decided to devise a technical publication that would establish an engineering format for the widely used form of subdivision layout. In 1961 Harold Marks, the author of the Los Angeles

study, presented a proposal for *Geometrics of Local and Collector Streets* to the 31st Annual Meeting of Traffic Engineers. The proposal called for a clear classification of streets. It stated that: "One of the problems associated with the classification of streets is the lack of uniformity that presently prevails." It emphasized the need to adopt a residential system that would incorporate the following:

1. Limited access to the perimeter highway.
2. Discontinous local streets to discourage through traffic.
3. Design patterns with curvilinear alignment, cul-de-sacs, short street runs, and elbow turns.
4. A clear distinction between access streets and neighborhood collectors in section width.
5. Numerous three-leg T intersections.
6. Local street widths are recommended to have a 40 - 60 foot right-of-way with 26 - 36 foot pavement.[89]

In 1965, ITE published *Recommended Practice For Subdivision Streets.* The publication stated that: "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." Other principles included:

- Circulation systems should be safe and efficient.
- Street systems should be designed in their entirety rather than piecemeal.
- Through traffic on local streets should be minimized.



17. Limited access and gridiron street pattern accident distribution diagram. (Los -Angeles Study 1951-1956) (Marks)

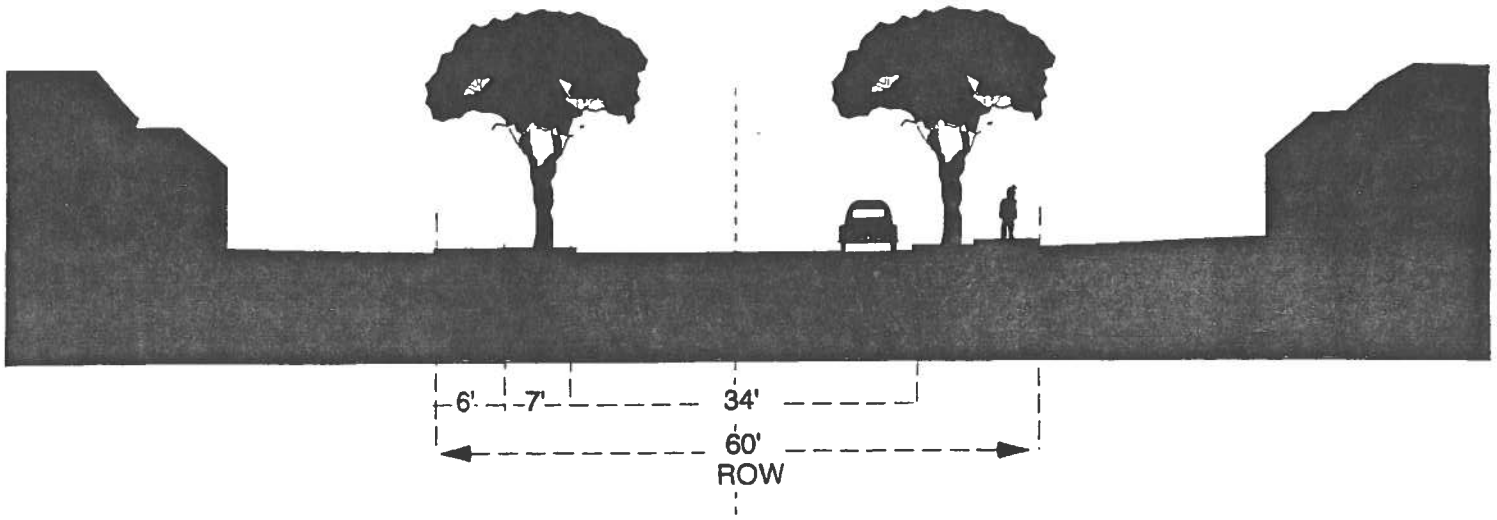
- Local street systems should be designed for a low volume of traffic.
- Local streets should be designed to discourage excessive speed through the use of curvilinear patterns and discontinuities.
- Pedestrian-vehicular conflict points should be minimized.
- A minimum amount of space should be devoted to streets.
- There should be minimal intersections with preference for T-type intersections rather than cross type.
- Local streets should be related to topography.

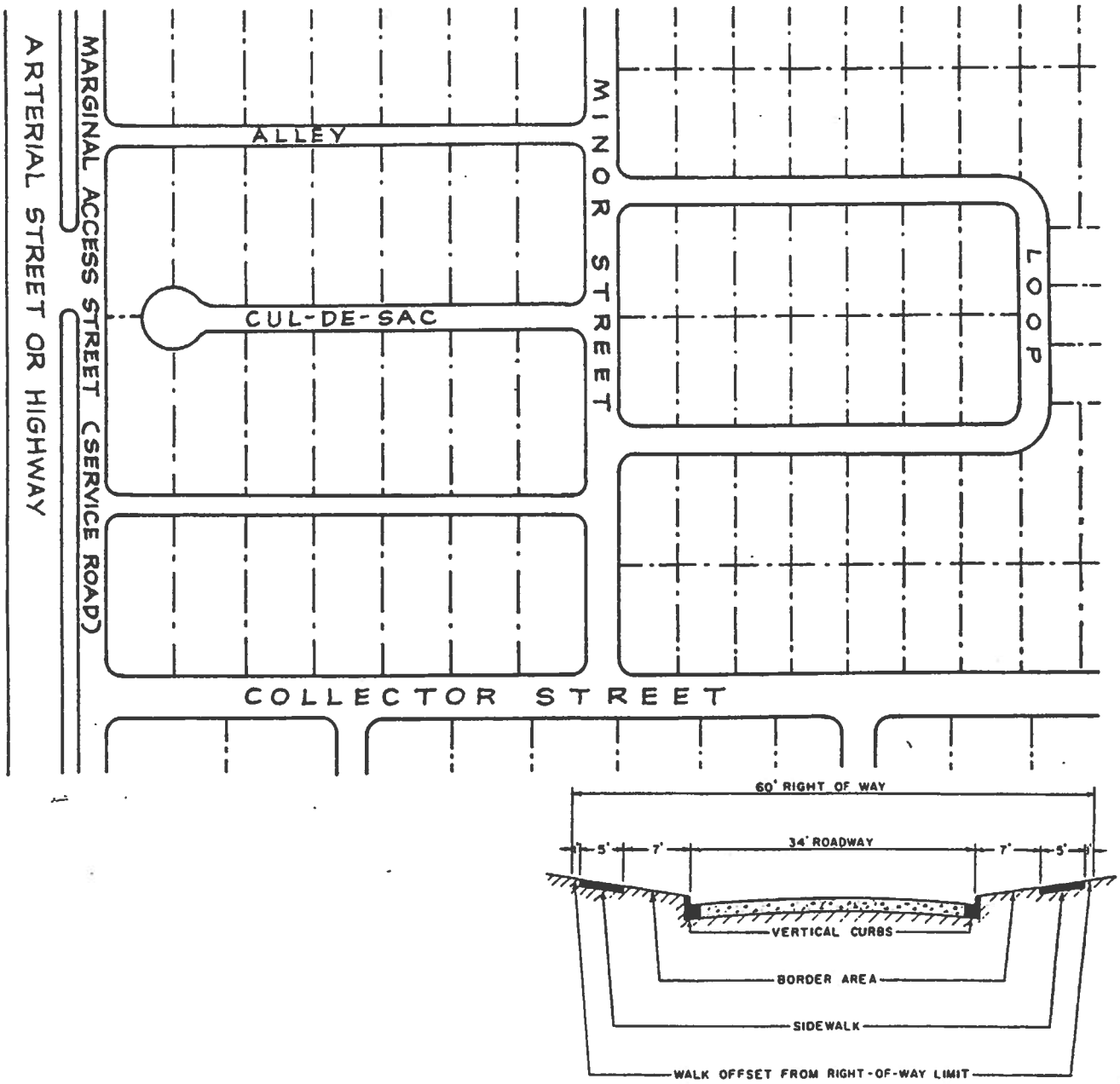
After stating the principles the publication proposed a set of standards for geometrical configurations. These standards were mainly aimed at creating efficient vehicular movement and illustrate the conflict between the declaration of flexible principles and a set of rigid standards. On one hand ITE stated that: "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, expermentation and improvments in residential design" and on the other hand it prescribed charts and measurement to be followed:

- Right-of-way: minimum 60 feet.
- Pavement width: 32 to 34 feet.
- Curb: Vertical curb with gutter. (Rolled curbs were not recommended.)
- Sidewalks: At both sides, minimum width 5 feet.
- Planting Strip: 6 - 7 feet sloping towards street.
- Grade: Minimum 4%, Maximum 15%.
- Cul-de-sac: Maximum length 1000 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). (Fig.18).

In 1984 *Recommended Guidelines for Subdivision Streets* was published, yet the ITE standards and geometrical configurations remained practically unchanged from the 1964 version. In 1991 ITE's Technical Council Committee published another version, *Guidelines for Residential Subdivision Street Design.* The principle changes in this publication were a decrease of planting strip width to a minimum of 5 feet, and the extension of cul-de-sac length from 700 feet to 1000 feet with an increased end radius of 60 feet.

ITE standards have been widely used as a basis for subdivision regulation by local agencies and public works departments.[90] It established a professional framework and a source of reference that could be claimed as scientific based on empirical research. It provided a solution that was deemed as absolute and indisputable, and created a state in which there was little room for innovations and new design approaches.





18. ITE typical cross sections and recommended street layout.(ITE)

5. A Return to Former Values, 1985-

In 1927, while designing Radburn, Clarence Stein called for a "revolution in planning". He challenged existing practices that were geared toward facilitating the automobile and proposed a "radical revision of relation of houses, roads, paths, gardens, parks, blocks, and local neighborhoods."[91] Yet, Stein's call for change has remained practically unanswered. Sixty years later a few designers and planners are still searching for modifications for subdivision layouts. Peter Calthorpe (1988) states: "The current round of suburban growth is generating a crisis of many dimensions: mounting traffic congestion, increasingly unaffordable housing, receding open spaces, and stressful social patterns."[92] Andres Duany (1989) sees the current fragmented and unsatisfying suburbs of today as the products of "zoning and subdivision ordinances zealously administered by thousands of planning departments." Ordinances that "dictate only four criteria for urbanism: the free and rapid flow of traffic, parking in quantity, the rigorous separation of uses, and a relatively low density of building".[93] The ideas of Calthorpe and Duany have been categorized as "Traditional Neighborhood Development" and "Neotraditional Neighborhood Design". These terms echo the traditional pattern of walkable, mixed-use neighborhoods and suggest a return to the Unwin and Parker Garden City ideal.

Neotraditional Neighborhood Design. In an effort achieve these ideals, Duany has established a set of specific traditional neighborhood ordinances and codes. These codes encompass several categories such as: land use, land allocation, lots, buildings, and streets. The residential street components include the following physical attributes:

- Dense network of connected streets.
- Reduced or non-existent street hierarchy.
- Small blocks. (max. 2000 feet).
- Street cross section -- max. 40 feet (two 10 foot traffic lanes with on-street parallel parking on one side).
- Sidewalk width -- minimum 4 feet.
- The use of alleys to provide service and utility easements.
- Trees planted in right-of-way.
- Building setbacks between 15 and 35 feet.

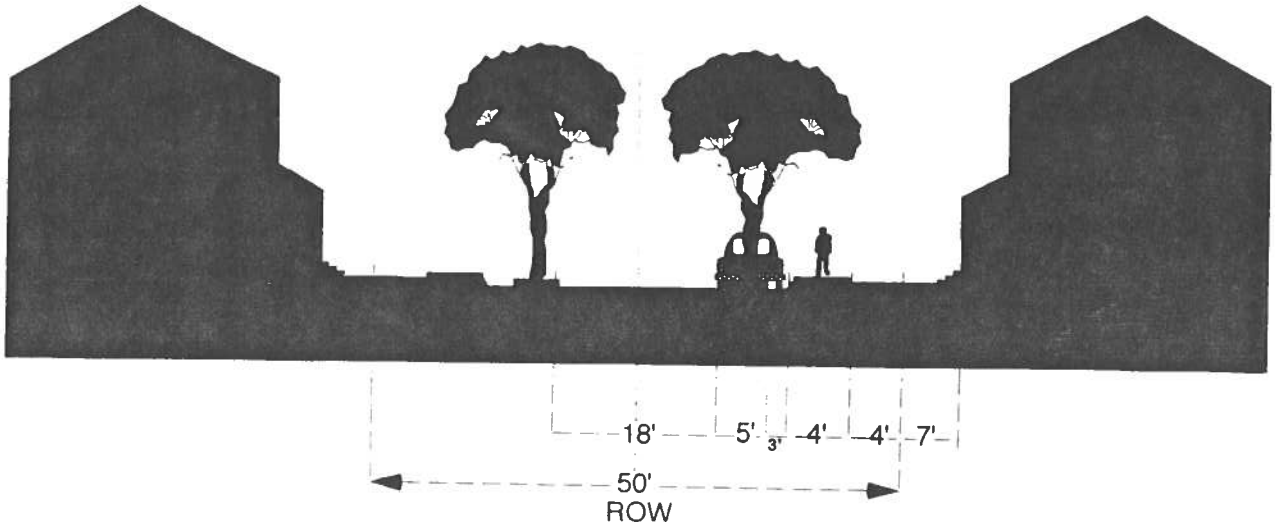
Social Advantages:

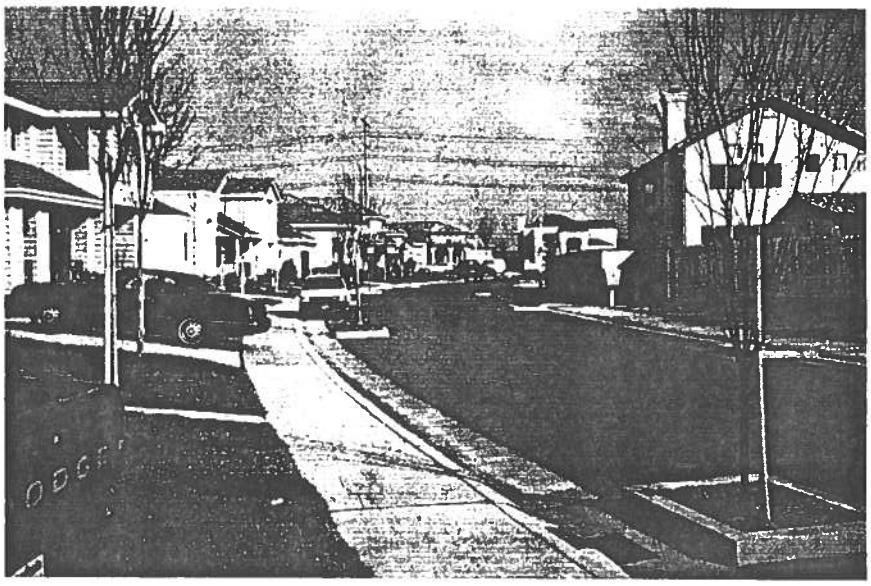
- Increase accessibility due to interconnected street network.
- Encouragement of pedestrianism and social integration by de-emphasizing auto use, (through a reduction in road performance standards).
- Encouraging social integration by increasing street's function as public domain.
- Increased in personal time due to a reduced number and length of vehicle trips as well as reduced traffic congestion.
- Promotion of security through neighborliness.
- Efficient use of land and fuel.[94]

Like Duany, Calthorpe's design guidelines call for a street system which is clear , formalized and interconnected. Street patterns should:

- Be simple.
- Avoid winding roads.
- Avoid cul-de-sacs and dead end streets.
- Be linked and direct.[95] (Fig. 19).

The advocacy of direct street patterns underscores the historical debate between the





19. Residential streets in a neo-traditional community. Laguna-West, CA 1993.

grid system and the curvilinear discontinued system. Neo-traditional concepts put forward by Calthorpe and Duany rely on the garden city ideal as represented by Unwin and his American counterparts, Perry and Stein. Yet these latter designers were strongly opposed to the grid system as part of a residential development. Lewis Mumford claimed that: "With a T-square and a triangle, finally, the municipal engineer could, without the slightest training as either an architect or a sociologist 'plan' a metropolis, with its standard lots, its standard blocks, its standard street widths, in short, with its standardized comparable, and replaceable parts. The new gridiron plans were spectacular in their inefficiency and waste. By usually failing to discriminate sufficiently between main arteries and residential streets, the first were not made wide enough while the second were usually too wide for purely neighborhood functions . . . as for its contribution to the permanent social functions of the city, the anonymous gridiron plan proved empty."[96] Other critics suggested that the grid network system consumes more open space, is less supportive of an independent pedestrian network, and is less environmentally sensitive.[97]

The rise of neo-traditional design concepts has prompted few transportation related studies by the traffic engineering profession. As none of the neo-traditional communities are fully operational, computer modeling has been used to examine the assertion that a neotraditional street network will reduce travel distance and time and lessen automobile dependency. These studies suggest that a neotraditional street network will indeed function more efficiently than a conventional suburban network through an increase in route choice. The employment of multiple routes and intersections will provide more connections and avoid loading traffic on one street in particular. Although such a street system has a potential for easing congestion on main streets, it will also add through traffic on residential streets. The increase of traffic to residential streets might prove to be an obstacle to increasing pedestranization and social interaction in neighborhoods.[98] To accommodate increased traffic, neotraditional designers are suggesting changes to existing street cross section standards. In the Laguna West development designed by Calthorpe, street trees on residential streets are planted within the parking strip to narrow the visual corridor, to slow traffic and to create a pedestrian scaled space.

The neo-traditional concept is in its early beginnings. Yet, this new trend addresses and challenges current established standards and regulations. It provides an alternative to existing subdivision practices and rejuvinates an important debate on the future of residential development.

Traffic Calming and Integration. One of the more intriguing street design innovations of the last twenty years has been the implementation of the integration concept in European residential streets. The idea was to allow pedestrians and vehicles to mix safely in the street. By redesigning the physical aspects of the street, a reclamation of the pedestrian social and physical public domain was achieved. This 'emancipation' of the pedestrian environment was done with full integration of vehicular traffic and thus it was not an anti-car policy. The concept gained popularity

and has been applied in a few countries, most notably in the Netherlands where it was first developed and executed. Yet its philosophical roots lay in a report published in England in 1963 by Colin Buchanan and the 'Traffic in Towns' team. In 1959 the Ministry of Transportation commissioned Buchanan to investigate the issue of "improving urban transport." This was to be done "both in terms of reducing congestion and to come to terms with the car." Buchanan, being both a road engineer and an architect, brought to the team an innovative edge. He was able to see the conflict between providing for easy traffic flow and the destruction of the residential and architectural fabric of the street. For the prevailing philosophy of the late 1950s and early 1960s this was a unique approach. The team came up with a technique for evaluating and reconstructing the urban traffic system. They suggested the creation of specific zones called *environmental areas* or *urban rooms*. These zones would be of a different character from typical roads and the level of traffic would vary according to their function. Roads would not only be evaluated by their capacity for carrying traffic, but also in terms of environmental capacity. This notion of environmental capacity would then be used as a measuring device for standards and limitations.[99] Some of these environmental areas would be subjected to complete segregation between traffic and pedestrians, while others would be a mixture of pedestrians and vehicles. In the latter it was not seen as harmful to the traffic flow if the vehicles were to reduce their speed and volume.

The concept of 'traffic integration' and 'traffic calming' in the environmental capacity zones introduced in the report was considered unfavorable and was misunderstood by British policy makers. The ideas seemed counterproductive to the economic and development policies of the time that favored economic growth through the building of motorways, reforming the railway system, and road improvements. It was not until the late 1970s that the report surfaced again and achieved its major impact.[100] Britain's decision to combine two departments — the Ministry of Transport and the Ministry of Housing and Local Government — into the new Department of the Environment was the first attempt to address both land-use issues and transport planning as a single entity, yet physical changes were slow to appear.

Interestingly, the *Traffic in Towns* report had a much greater impact in Europe. It was adopted by German and Dutch planners to such an extent that many still refer to Buchanan as the "father of traffic calming." Niek De Boer, Professor of Urban Planning at the University of Emmen in the Netherlands, was inspired by Buchanan's theoretical ideas. Searching for applicable venues for the theory, he decided to concentrate on the physical design of streets. Trying to overcome the contradiction between children playing and car use, he saw in Buchanan's concept of coexistence a possible solution. He then designed cul-de-sac streets in such a form that motorists would feel as if they were driving in a "garden" setting. Drivers would then be forced to take consideration of other road users. De Boer renamed these streets, *woonerf*, or 'residential yards'. At the same time (1974), the Municipality of Delft was considering re-designing and upgrading road surfaces in inner city locations. They decided to take up De Boer's

ideas and implement them in some of the lower-income neighborhoods where more child play areas were urgently needed and available play sites were nonexistent. With resident participation a physical design was formed that integrated sidewalks and roadways into one surface, creating an impression of a "yard". This was further enhanced by trees, benches, and small frontal gardens.

The Delft experience was a success. The woonerf concept became accepted all over the Netherlands and was soon adopted in Germany (1976), England (1977), Sweden and Denmark (1977), France (1979), Japan (1979), Israel (1981) and Switzerland (1982). Unfortunately, the woonerf has remained a novelty in North America. Although the system was introduced and written about in Donald Appleyard's widely acclaimed book *Livable Streets* (1981), and in ITE's *Residential Street Design and Traffic Control* (1989), it has not yet gained the acceptance of the legislative and planning agencies. Public agencies have seen no need to initiate such a concept and developers preferred the "sure approved plan" over any new concept that might tangle their project in a bureaucratic web.

Unified Street System, The Shared Street (Woonerf). *Unified street system*, is a global term that encompasses the basic ideas represented by the original Woonerf. Varied terms are used in other countries: Woonerf (woonerven) — Residential Yard (Netherlands); Wohnstraßen — Living Street (Germany); Shared Street or Mixed Court — (England); Community Doro — Community Street (Japan) and Rehov Meshulav — Integrated Street (Israel). Clearly, seen through these terms, the underling concept of this street system is one of integration with an emphasis on the community and the residential user. Thus, pedestrians, children at play, bicyclists, parked cars, and moving cars all share the street space. Even though it seems these uses conflict with each other, the physical design is such that drivers are transposed into an inferior position. Such conditions are much safer for the pedestrian than in common street layouts. Studies in Germany, Denmark, and Israel show a decline in the number of accidents by more than 20 percent and a decline in the number of severe accidents by more than 50 percent compared with traditional streets, and that the groups that benefit the most are pedestrians, children and two-wheeled drivers.[101] The street layout establishes a pedestrian orientation by giving pedestrians primary rights and making the driver feel like an intruder. The motorist recognizes the probability of sudden conflicts and exercises particular caution. (Fig. 20).

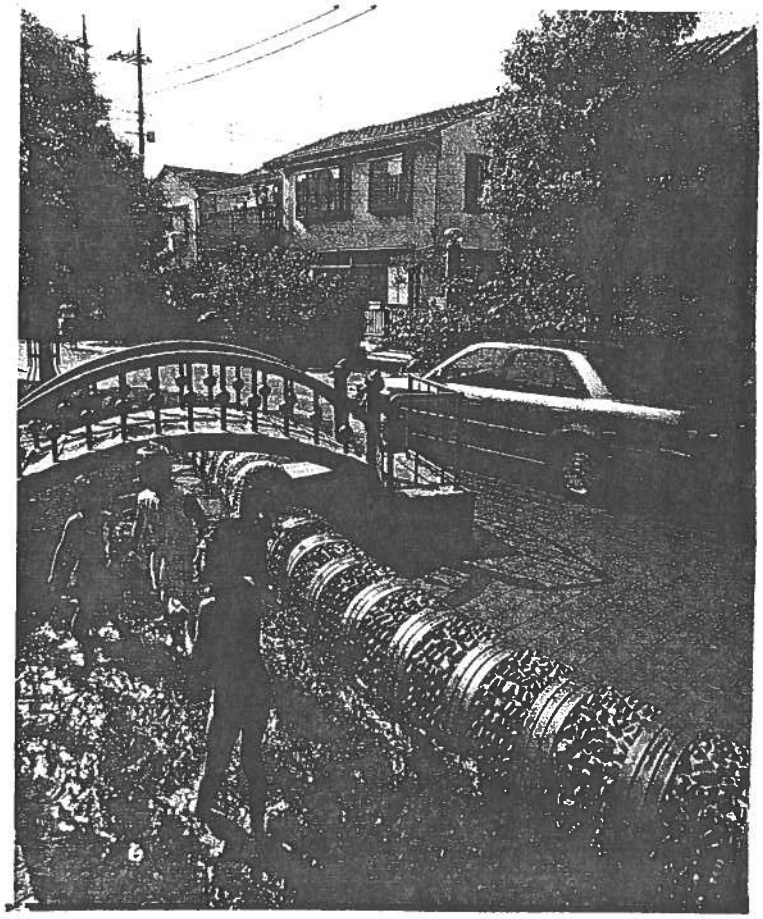
The unified street system concept is fully adaptable to any setting and could take various physical shapes. In the twenty-five years of its physical development the following design characteristics are typical:

1. Clearly marked entrances.
2. Physically shared space by pedestrians and cars.
3. Unified street pavement (preferably with the elimination of curbs).
4. Car speed and movement is restricted by physical barriers, deviation, bending, undulation, and slalom layout.
5. Retention of residents' auto access to front of dwellings.
6. Extensive landscaping.

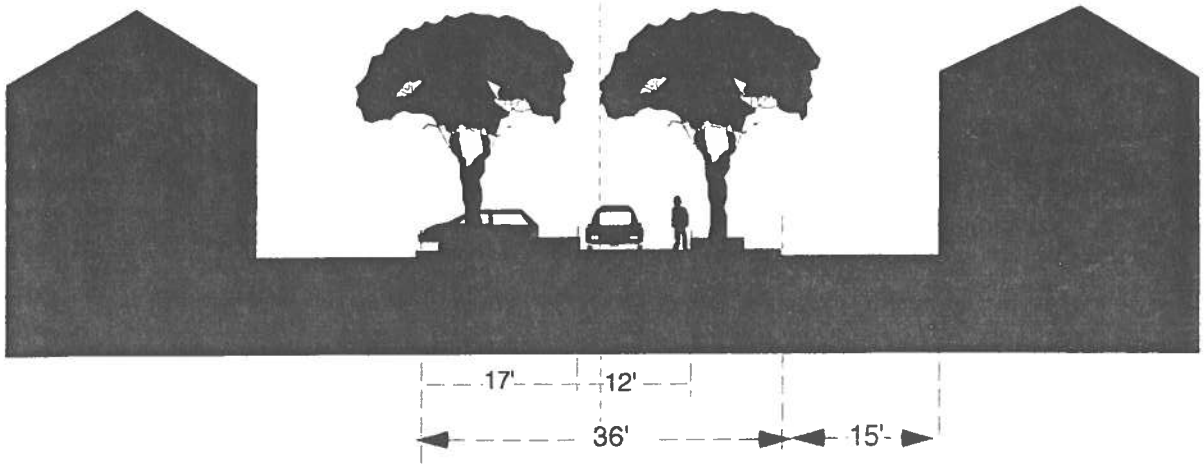
7. Street furnishings.

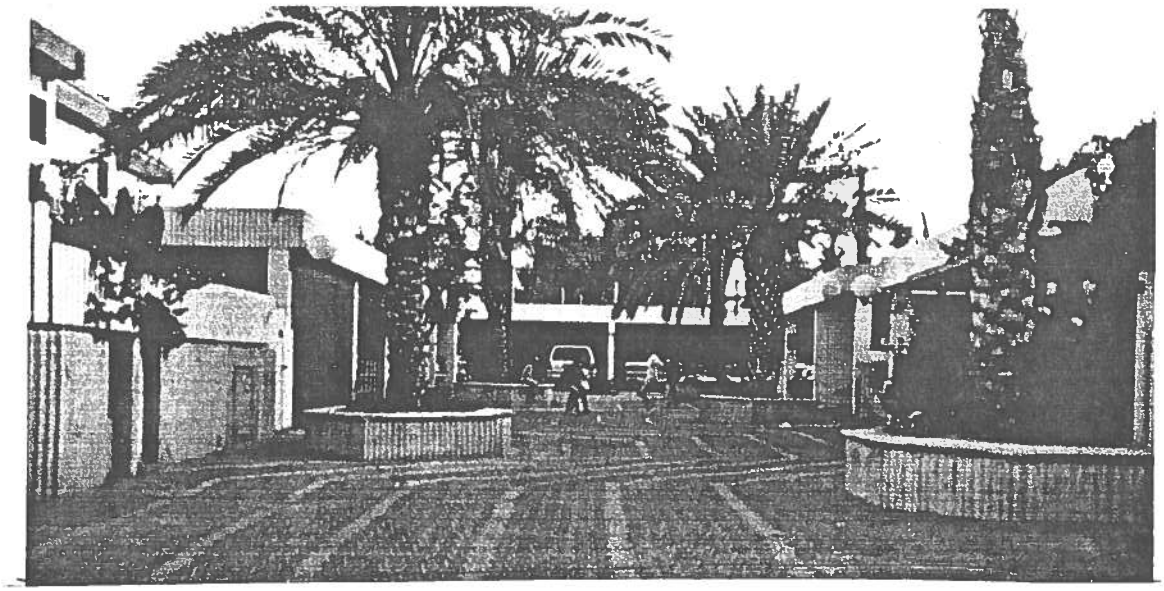
Uniform paving of the entire right-of-way is a common design feature. Elimination of curb and grade changes provides one surface, which enhances the sense of one continuous space. Such features have a powerful effect on drivers. Without the entrenched familiarity of two curb lines and an asphalt runway, a driver's psychology is affected and deceleration occurs. Even when a curb is needed for drainage purposes, it is common practice to use the same paving material for the entire space. Further, driver inhibition is achieved by directional changes of the route and the placement of planting beds. The driver has to negotiate and pass through narrow sections of roadway. These narrow sections are just over 11 feet wide allowing the passage of one car at a time in a two-way traffic situation (width might vary to allow clear passage for local service vehicles). The vehicle lane shifts from side to side every 125 feet, restraining speed buildup. Planting beds are usually low (12 inches high) and are made of materials that allow large vehicles, such as a hook-and-ladder fire truck, to drive over them in case of an emergency. They do not hinder the opening of car doors and can provide informal seating.

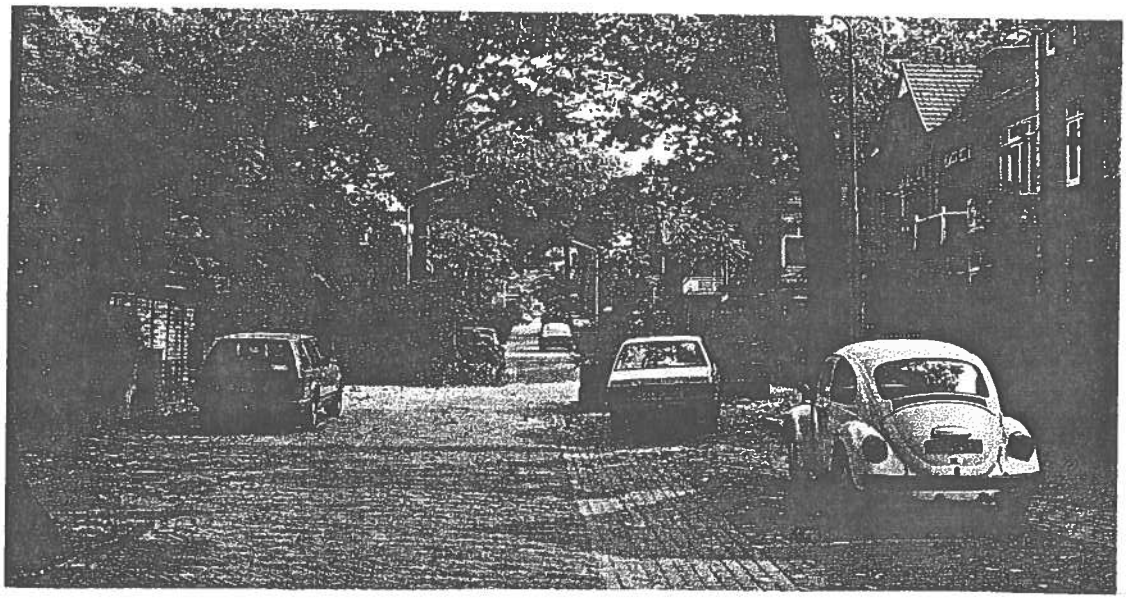
Parking design follows a variety of patterns. In some configurations spaces are clustered together in groups of no more than six spaces and are at a right angle to traffic. This layout demands more attention from the driver and can be better used by children when the spaces are empty. Other patterns provide parking spaces near the unit entrance. Such schemes correspond to the residents' desire to park their vehicles as close as possible to their dwellings. Parking is not a hindrance to the street's aesthetic quality. In many contemporary designs parking spaces are not clearly marked. The early practices of marking parking through signs and paving have been replaced by use of physical elements such as planting beds, street furniture, and trees. While visually the street is perceived as one coherent unit, the underlying physical structure influences driver conduct as to driving and parking. (Fig. 21).



20. Shared street-- 'Community Street', Tokyo, Japan. (Toyota)



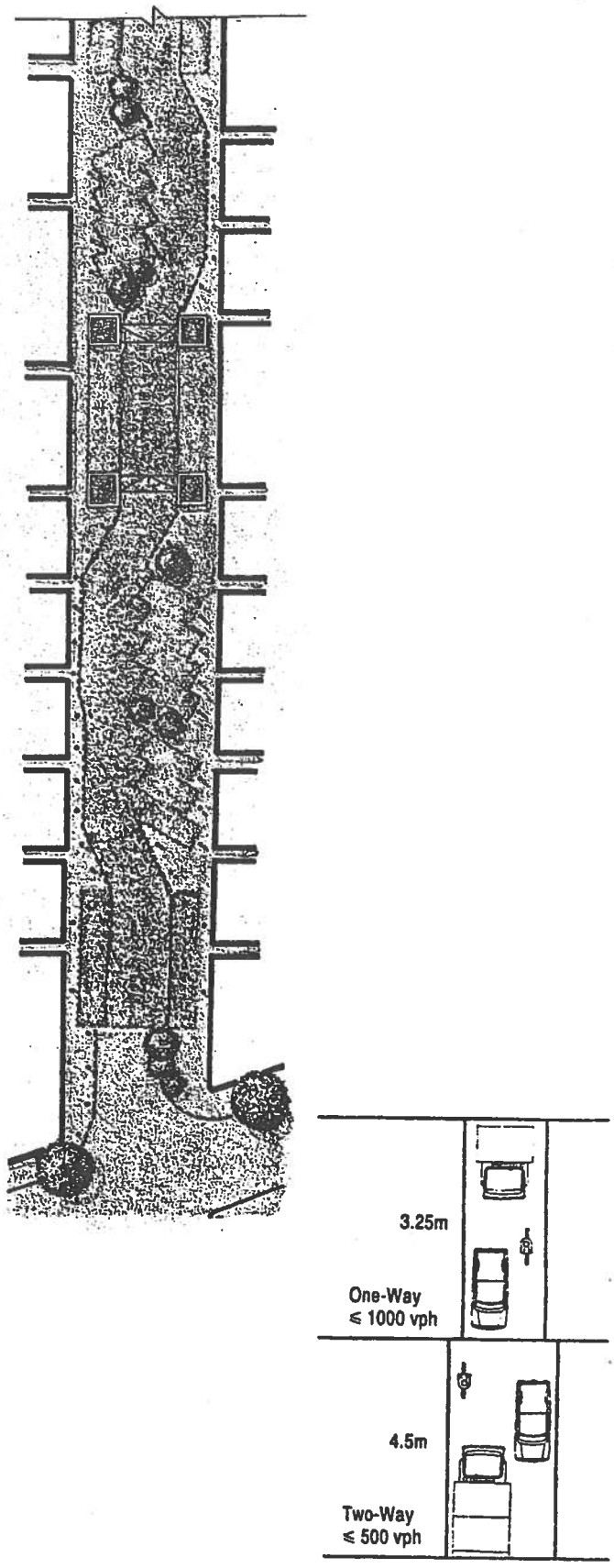




20b. Typical scenes and cross-section of shared streets.

Although most of these physical characteristics describe a linear street layout, the unified street principles can be applied to any configuration. With the adaptation of the system to new housing developments, other forms and designs have emerged. In 1974 the concept of shared surface was introduced in Britain for new developments. Clusters of houses were to be accessed by pedestrians and drivers through a shared undemarcated surface. Such an arrangement was seen as enabling designers to develop new urban forms more favorable to the residents. Favorable reaction from local communities resulted in publication of a set of guidelines for shared surface design in 1977 by the British Department of the Environment and the Department of Transportation. Recently, new town developments in Japan and Israel have incorporated the unified street concept as a basic design layout. In these developments most residential streets are shared spaces branching off a main collector.

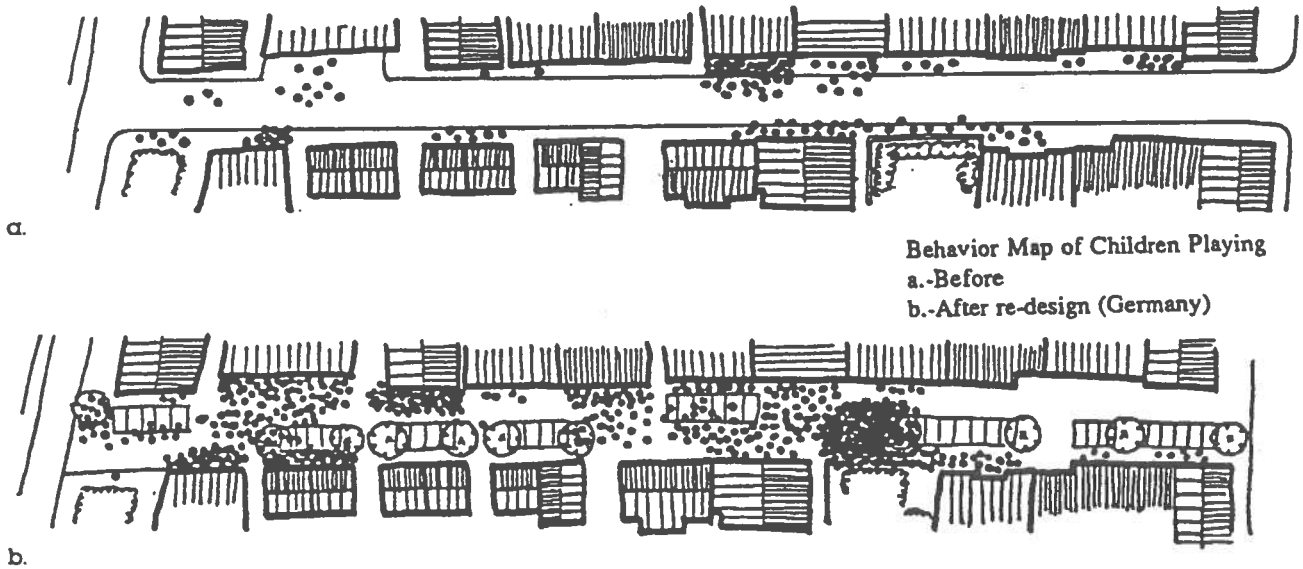
Shared streets establish a social character and make the street public territory as it was prior to mass automobile ownership. Shared streets are more than transportation channels, they are places suited for pedestrian interaction, where people choose to socialize on the street for a longer period of time. Shared streets are especially supportive of children's activity. They provide behavioral and play options and increase social contact within a safe home base territory. Readiness of residents to take care of the public domain is often observed. Residents view the street as an extension of their personal space and will often maintain and re-landscape the planting beds adjacent to their dwellings. An increased length of stay on the street increases



21. Typical linear layout and lane width of shared streets. (Devon)

the chances for social interaction. This is predominantly observed through children's play interaction which increased 20 percent in converted streets, according to a study of two woonerven in Germany by Eubank (1987). Her observations indicate that the street redesign led to a greater and more diverse use by children. Not only did more unsupervised children stay longer, but play became more complex. Increases were noted in games requiring more space and in the use of bicycles and toy vehicles. Most notable was the shift in play location from narrow street sidewalks to the woonerven's entire width, including the former traffic lane.[102] (Fig. 22).

The shared street concept and its design implementation are an example of a deviation from the typical structural standardization of urban street design. It is the result of a more receptive and flexible design approval procedure which does not adhere to prescriptive solutions. Its success lies in the creation of a workable compromise between conflicting interests both within its physical domain and the planning structure that generated it. As such it provides an example of a street design that follows what Thomas Adams called in 1934 "guidance rather than law".



22. Children's play locations on a regular street and after its re-design to a shared street. (Germany) (Eubank)

Conclusion

Design standards have a long history and have been used to improve varied environmental qualities including safety, efficiency, health, privacy, and appearance. While standards can be useful in preventing the worst conditions, they can also stifle creativity and can inhibit adaptation to local situations. Once established they become too easy to use and, as we have seen in the case of street standards, have become deeply embedded in engineering and design practice, as well as in the legal and even financial structures that support development. The results are all too visible in look-alike developments that are unresponsive to their users and to their geographic context. While the original motivations for establishing standards were valid, over time they have become rigid and overscaled. What began as visionary design often evolved into a technocratic, over-engineered approach. The original purpose has been lost and the standards are often counter-productive, resulting in developments that are dehumanizing and wasteful of land and other resources.

The construction of streets in subdivisions is a mandatory procedure of providing legal and physical access to residential units within the community. Through the years the design and layout of these streets in the United States has been increasingly regulated. The assumed failure of streets to provide adequate accessibility due to an increase in mobility and car ownership has produced standards that are often in excess of real traffic requirements. The residential street network has been based on engineering research primarily oriented to large scale streets and highways. Standards have often been mechanically adopted by local governments without considering the character of each project. In addition, fear of liability has embedded these standards in codes as justifiable absolutes. As a result, new standards or modifications have been very slow to develop. Although some attempts have been made to introduce different approaches to road layouts, actual guidelines have not changed. Commonly, local or state standards are adopted from federal and professional standards. Since higher governmental agencies have not advocated changes, lower level agencies are reluctant to do so. Local authorities see the federal guidelines as a rule flatly recognized by all road-related groups and agencies that clears them from responsibility. Consequently, local planning processes and resident involvement rarely challenge existing street standards. Unconventional suggestions face a nearly impossible task to gain approval. These standards impede any innovative approaches for suburban layout, and they pose a rigid conservative framework that results in an unchanging suburban environment. Current problems in subdivision street design may be attributed to such single-minded focus on traffic control and the lack of integration between concerns for functional accessibility and livability.

It is now time to go back and 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 need to look at streets as complex community settings that serve a variety of needs -- not merely channels for moving traffic and emergency vehicles. They are also environments used for walking, bicycling, for children to play in, and people to socialize in. They are the staging space for community interaction and neighbor-

hood development. As such their design also requires an understanding of social behavior, architectural and urban design, and general planning.

We now need to approach street design and planning in an interdisciplinary way. Urban designers, planners, and engineers need to work together in developing new and revised standards that are more responsive to the diverse users of streets and that are more adaptable and responsive to varied social and geographic settings. The creation of street design standards should be an evolutionary process that incorporates multi-disciplinary cooperation and results in flexible design guidelines suited to the context. Rather than rigid engineering standards, the possibility of performance standards that can respond to varied user needs and place values while providing basic needs for safety should be studied. The development of explicit yet variable standards for residential street design can offer new possibilities for subdivision street design that might induce users to alter their travel behavior, their choice of routes, and their modes of transportation. Investigation of design prototypes and planning processes that have successfully changed street standards abroad can suggest different approaches for modifying guidelines in the United States. A renewed effort to establish such guidelines through technical and official publications would provide a basis for change and a legal backing for local planning agencies.[103] At the same time, interim provisions should be made to allow for alternative subdivision layouts that challenge existing standards and focus on 'habitat,' as well as movement.

NOTES

1 Raymond Unwin, *Town Planning in Practice* (London: Adelphi Terrace, 1909), pp. 299-301.

2 Institute of Transportation Engineers, *Recommended Guidelines for Subdivision Streets* (ITE, Washington, DC: 1984), section 2.03.03, pp. 5-6.

3 Sim Van der Ryn et al, *Sustainable Communities* (San Francisco: Sierra Club Books, 1986) p. 38.

4 Measurements taken from a contemporary suburban subdivision plan, Hercules, California.

5 See Michael Renner, *Rethinking the Role of the Automobile*, World Watch Institute, Paper 84 (Washington, DC: 1988) and Mark Hanson, "Automobile Subsidies and Land Use," *Journal of the American Planning Association*, vol. 58, 1992, p. 66.

6 Robert Cervero, "Jobs Housing Balance and Regional Mobility," *Journal of the American Planning Association*, vol.55, 1989, p.137.

7 *The Second National Conference on City Planning and the Problem of Congestion*, Proceedings, May 1910, Rochester, New York, (Cambridge, MA: Harvard University Press, 1910) pp. 22-23.

8 Urban Land Institute, *Residential Streets*, (Washington, DC: ULI Publications, March 1990) p. 20.

9 Richard Unterman in "Design Standards for Streets and Roads," in *Public Streets for Public Use*, Anne Vernez Moudon, ed. (New York: Van Nostrand, 1987) writes that the liability issue surfaced in the early 1960s when motorists who were injured in accidents went to court if they believed the roads were inadequately designed. The public agency could clear itself from blame if the road was up to federal or professional engineering standards. In the case of the Town of Belmont, Loudon County, Virginia, proposed substandard residential streets were rejected by the Virginia Department of Transportation. Lloyd W. Bookout in "Neotraditional Town Planning," *Urban Land*, April 1992) writes: "The project's street standards violated the rather inflexible requirements of the Virginia Department of Transportation (VDOT). While state transportation officials were sympathetic to many of the planning and design objectives, they were more concerned about liability. VDOT feared accident victims would file suits against the state for permitting substandard street design."

10 For example, the 3R projects in the California were developed in accordance with the Federal Highway Work Administration, Transportation Research Board, and American Association of State Highway and Transportation Officials minimum standards requirements. *Minimum standards for Geometric Design of Federal-Aid Resurfacing, Restoration, and Rehabilitation Projects on Local Streets and Roads*, (Sacramento: Caltrans, Division of Local Programs, Office of Local Streets and Roads, Oct. 1988).

11 Planner Lane Kending from Loudon County Virginia remarked on the Belmont project: "The real problem with implementing many of these ideas, is the lenders, most of whom do not really understand the development business and insist that the same mistakes be repeated time and time again." (Bookout, April 1992). In the Laguna West project in Sacramento designer Peter Calthorpe had to revise his commercial center to a more conventional layout with more parking spaces and more visibility for the parking area from the main roadway (Bookout, 1992, and an interview with Architect Rick Williams from Calthorpe Associates, March 1992)

12 "Roads and Highways," *Encyclopedia Britannica*, 1983 ed.

13 *A history of Technology*, Volume IV, Chap. 17 (Oxford: Oxford University Press, 1958).

14 Albert C. Rose, *Historic American Roads*, (New York: Crown Publishers, 1976). For full discussion of American road building history see: Christy Borth, *Mankind on the Move*, (Washington, DC: Automotive Safety Foundation, 1969) and John B. Rae, *The Road and Car in American Life*, (Cambridge: MIT Press, 1971).

15 In Walter L. Creese, *The Search for Environment*, (New Haven: Yale Univ. Press,

1966) p. 69.

16 Creese, p. 76.

17 Creese, p. 76.

18 Robert Fishman, *Bourgeois Utopias: The Rise and Fall of Suburbia,* (New York: Basic Books Inc., 1987).

19 Lawrence J. Stone, *The Family, Sex and Marriage in England 1500-1800,* (New York: Harper & Row, 1977), parts 4 and 7.

20 Fishman, p. 26.

21 A. J. Downing, *Architecture of Country Houses,* (New York: D. Appleton & Company, 1850), preface.

22 Olmsted, Vaux, and Co., *Preliminary Report Upon the Proposed Suburban Village of Riverside,* (New York, 1868), reprinted in S.B. Sutton, *Civilizing American Cities: A Selection of Frederick Law Olmsted's Writings,* (Cambridge, MA: MIT Press, 1971) p. 292.

23 Quoted in K. Jackson, *Crabgrass Frontier,* p. 75.

24 Olmsted, Vaux, and Co. p. 292.

25 Olmsted, Vaux, and Co. p. 300

26 Olmsted, Vaux, and Co. p. 302

27 M. Moore, "Sanitary Oversight of Dwellings," *Charities Review,* 4, No. 8 (1895). Quoted in Christine Boyer, *Dreaming the Rational City,* (Cambridge, MA: MIT Press, 1983) p. 18.

28 Frederick Howe, "The Garden Cities of England," *Scribner's Magazine,* July 1912. Quoted in Boyer, p. 41.

29 Carol Aronovici, "Suburban Development," *Annuals of American Academy of Political and Social Science,* vol.51, Jan. 1914, p.238. Cited in Boyer, p. 42.

30 Creese, p. 79.

31 Creese, p. 82.

32 Creese, p. 89.

33 Raymond Unwin, *Town Planning in Practice,* (London: Fisher Unwin, 1909) p. 393.

34 Unwin, p.126.

35 Ebenezer Howard, *Garden Cities of To-Morrow,* (Cambridge, MA: MIT Press, 1965) p. 48.

36 Howard, (Introduction by F.J. Osborn) p. 26.

37 Unwin, p. 299.

38 For instance, in 1858 a steam powered stone crusher was invented by Eli Whitney Blake and was first employed in Central Park in New York City and for road improvements in Hartford, Connecticut in 1860. In 1869 the first steam powered road roller was imported from England and used in New York's Central Park, at the corner of 115 th Street and 6 th Avenue. In 1878 Amzi Barber paved the first asphalt road in Washington, DC.

39 John B. Rae, *The Road and Car in American Life,* (Cambridge, MA: MIT Press, 1971).

40 Rose, p. 73

41 Rose, pp. 75-76, cites the following:
(1) First State - Aid Road NJ, 1892: "The state-aid road law provides for the appointment of Township committees who should annually inspect the roads of their townships, and adopt a systematic plan for improving the highways; they should have power to employ an engineer or any competent person for advice, plans and estimates . . . it is estimated that at least 27,000 tons of water fall annually on one mile of road, and the necessity of a well-rounded road-bed, with open side ditches from outlet to outlet, is an important feature."
(2) The Status of The Office of Road Inquiry, 1893: "To enable the Secretary of Agriculture to make inquiries in regard to the system of road management throughout the United states, to make investigations in regard to the best method of road making, and to enable him to assist the agriculture college and experiment stations in disseminating information on this subject."

42 Rae, pp. 32 & 50, cites the following:
(1) The 1904 road census showed 2,151,570 miles of roads in the US, of which only 7% were classified as "improved" or surfaced with stone or gravel. The remaining 93% were dirt roads.
(2) In 1900 there were eight thousand motor vehicles in the US, in 1920, eight million motor vehicles, and in 1930, twenty three million.

43 Rose, p. 90.

44 Cited in Neil Postman, *Technopoly,* (New York: Alfred A. Knopf, 1992) p. 51.

45 Mel Scott, *American City Planning Since 1890,* (Berkeley, CA: University of California Press, 1971) pp. 166-7.

46 Edward Devine, "Social Ideals in the Present American Program of Voluntary Philanthropy," *American Sociological Society,* 7,

1912. Cited in Boyer, p. 60.

47 Ann Christensen, "The American Garden City," Diss. University of Minnesota 1978, p. 95.

48 Boyer, p. 144

49 Lewis Mumford, "The Intolerable City; Must it Keep Growing," *Harper's Monthly,* 152 (1926), p. 287.

50 Mumford, p. 287.

51 Clarence Stein, *Toward New Towns for America,* (Cambridge, MA: MIT Press, 1957) p. 23.

52 Stein, p. 41.

53 Stein, p. 40.

54 Stein, p. 47.

55 Stein, p. 44.

56 Clarence Arthur Perry, *The Neighborhood Unit,* (New York: Regional Plan of New York and its Environs, 1929) Regional Plan Associations p. 34.

57 As noted before, in the 1920s regional and metropolitan concerns resulted in extensive large scale planning efforts from coast to coast. The Boston Metropolitan Planning Commission was established in 1923. The Los Angeles county Regional Planning Commission, was established at the same time and focused on the needs for highways, water conservation, sanitation, zoning and parks. In New York five regional planning bodies were established: The Niagara Frontier Planning Board, The Onondaga County Regional Planning Board, the Capitol District Regional Planning Association, the Central Hudson Valley Regional Planning Association, and the Regional Plan of New York and its Environs. (Scott, 1971)

58 David Johnson, "The Emergence of Metropolitan Regionalism: An Analysis of the Regional Plan of New York," Diss. Cornell University, 1974. Cited in Boyer, p. 184.

59 *Regional Plan of New York and Its Environs, 1929,* Monograph I, chapter II and Monograph III, chapters III - IV.

60 Clarence Arthur Perry, *Housing For The Machine Age,* (New York: Russell Sage, 1939) pp. 26-30.

61 In Boyer, p. 210.

62 For the findings of the President's Conference see: John Gries and James Ford (ed.), *Planning for Residential Districts, Report on the President's Conference on Home Building and Home Ownership,* (Washington, DC: National Capital Press, 1932) p. 71.

63 *The FHA Story, 1934-1959,* (Washington, DC: FHA Publications, 1959).

64 *Slums, Large Scale Housing and Decentralization,* Proc. "The President's Conference on Home Building and Home Ownership." (Washington, DC: National Capital Press, 1932).

65 Franklin D. Roosevelt, "Back to the Land," *Review of Reviews,* vol. 84, Oct. 1931. Cited in Boyer, p.213.

66 Cited in Rae, p. 225.

67 Stein, pp. 119-124

68 *The Regional Plan of the Philadelphia Tri-State District,* (Philadelphia: Regional Planning Federation of the Philadelphia Tri-State District, 1932) p. 1.

69 *Regional Plan of New York and its Environs, 1929,* Volume VII, p. 18.

70 *The FHA Story,* pp. 12-16.

71 Marc A. Weiss, *The Rise of the Community Builders,* (New York: Columbia University Press, 1987) p. 152.

72 These standards and the succeeding ones are based on the following major FHA standards setting publications: *Subdivision Development,* Circular No.5, January 10, 1935 ; *Planning Neighborhoods for Small Houses,* Technical Bulletin No. 5, July 1, 1936; *Subdivision Standards,* Circular No. 5, May 1, 1937 (Revised August 15, 1938 and September 1, 1939); *Planning Profitable Neighborhoods,* Technical Bulletin No. 7, 1938; *Principles of Planning Small Houses,* Technical Bulletin No. 4, July 1, 1940 (updated issue of the 1936 publication, revised June 1, 1946); *Successful Subdivision,* Land Planning Bulletin No. 1, March, 1941; *Neighborhood Standards for California,* February 1953.

73 Three types of concrete curbs were proposed: (1) A 12" high battered curb, (2) A 12" high curb and gutter, (3) A 12" high rolled curb and gutter.

74 *FHA Confidential Report of Housing Advisory Council,* (Washington, DC: January 21, 1935), in Weiss, p. 153.

75 Harold W. Lautner, *Subdivision Regulation, An Analysis of Land Subdivision*

Control Practices, (Chicago: Public Administration Service, 1941) p. 1.

76 Lautner, p. 113.

77 *Local Planning Administration,* (Chicago: International City Managers Association, Municipal Management Series, 1941) p. 256.

78 Lautner, p. 117.

79 Urban Land Institute, *The Community Builders Handbook,* (Washington, DC: ULI, 1947) Foreword, p. 7.

80 ULI, p.62.

81 National Association of Home Builders, *Home Builders Manual for Land Development,* (Washington, DC: NAHB, 1950) pp. 114-118.

82 Rae, p. 38.

83 Rae, p. 74.

84 "Institute of Transportation Engineers: A Retrospective," *ITE Journal,* vol. 50, no. 8, August 1980 p.11.

85 Ibid.

86 Theodore Matson and Wilbur Smith, *Traffic Engineering,* (New York: McGraw-Hill, 1955) p. 3.

87 Ibid., p. 410.

88 Harold Marks, "Subdividing for Traffic Safety," *Traffic Quarterly,* vol. 11, no.3, July 1957, pp. 308-325.

89 Harold Marks, "Geometrics of Local and Collector Streets", ITE Proceedings of, 31st Annual Meeting, Washington DC: August 1961 pp. 105-116.

90 A comparison of subdivision regulations in the San Francisco Bay Area shows that the following places also based their standards on ITE publications: Berkeley, Concord, Danville, Hercules, Pleasanton, Pinole, and San Mateo.

91 Stein, p. 42.

92 Peter Calthorpe, "Pedestrian Pockets," in *The Pedestrian Pocket Book: A New Suburban Design Strategy,* ed. Kelbough Dough (New York, NY: Priceton Arcitectural Press), p. 3.

93 Andres Duany, Elizabeth Plater-Zyberk, Chester E. Chellman, " New Town Ordinances and Codes," in *Architectural Design,* 59, 5-6 p. 71.

94 Ibid, pp. 72-75

95 Calthorpe Associates and Mintier Associates. "Transit-Oriented Development Design Guidelines". Prepared for Sacramento County Planning and Community Development Department. Sacramento Ca. 1990, p. 48.

96 Mumford, *The City in History,* p.422.

97 For example see: "The Holly Grid: A Skeptic's View." by Sam H. Kaplan in *Planning* 56, 11, 1990. pp.10-11.

98 For example see the following studies: "Traditional Neighborhood Development: Will the Traffic Work?" by W. Kulash, Presented at the *Eleventh International Pedestrian Conference.* Bellevue, Washington. (1990) and *A Comparative Assessment of Travel Characteristics for Neo-Traditional Developments* by Michael G. McNally and Sherry Ryan, (Irvine, CA: Institute of Transportation Studies, University of California, Irvine, 1992).

99 Colin Buchanan, *Traffic in Towns,* (London: Penguin Books, 1964).

100 Carman Hass, *The Pedestrian and City Traffic,* (London: Belhaven Press, 1990).

101 Germany: Warner Brilion and Harald Blanke, *Traffic Safety Effects from Traffic Calming,* Proceedings of, the Conference on Road Safety and Traffic Environment in Europe, Gothenbarg, Sweden: Sept. 1990 pp. 135-148. Denmark: Ulla Engel, *Effects of Speed Reducing Measures in Danish Residential Areas,* ibid., pp. 95-135. Israel: Abishai Polus, *Evaluation of the Characteristics of Shared Streets,* Transportation Research Institute, Report No. 85-72. (Haifa: TRI, 1985). For other results see "Speed Management Through Traffic Engineering," *Accident Analysis and Prevention,* vol. 24, no. 1., Feb. 1992.

102 For Germany see a study by Brenda Eubank, "A Closer Look at the Users of Woonerven," in: *Public Streets for Public Use,* (New York: Van Nostrand, 1987) pp. 63-79. For Japan see Kiyoshi Ichikawa, "Living Environment and Design of Woonerf", in *International Association of Traffic and Safety Sciences,* vol. 8, (1984), pp. 40-51.

103 Current literature on tort liability for local roads suggests that courts have usually ruled in favor of local jurisdictions that have

lower design standards for local roads, as long as they were set in writing. See, C.R. Mercier, "Low Volume Roads: Closure and Alternative Uses," *Transportation Research Record,* no. 898, 1983, pp. 110-115. and C.R. Mercier, "Cases for Variable Design Standards for Secondary Roads," *Journal of Transportation Engineering,* 113, no. 2 (1987), p. 181.

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Appendices

A. Chronology of Events in the Development of Street Standards

1816 First American State Board of Public Works, established.
1823 First American Macadam road constructed(VA).
1823 Park Village (Regent's Park, London) John Nash, Architec t.
1837 Victoria Park (Manchester).
1857 Llewellyn Park (NJ).
1858 Blake's "stone Breaker" machine.
1869 The steam road roller used (NY).
1869 Riverside (IL) Olmsted & Vaux, Architects.
1875 Public Health Act The "Bye Law" street, (England).
1875 Bedford Park (London).
1889 Sand clay roads (SC).
1889 *Der Stadebau* by Camillo Sitte.
1892 State aid roads (NJ).
1893 First brick rural road (Ohio).
1893 Office of Road Inquiry, Dept. of Agriculture, established.
1897 First object-lesson road constructed (NJ).
1898 *Tomorrow : a Peaceful Path to Real Reform* , Ebenezer Howard.
1901 Erswick (York, England) Parker & Unwin, Architects.
1902 *Garden Cities of Tomorrow* , Ebenezer Howard.
1903 Letchworth (England) Parker & Unwin, Architects.
1905 Hampsted Gardens (England) Parker & Unwin, Architects.
1905 Office of Public Roads, established.
1905 Coal Tar experiments (TN).
1906 Bituminous Macadam road (RI).
1909 Concrete road (MI).
1909 *Town Planning in Practice* by Raymond Unwin.
1916 *City Planning of Streets and Lots* , by C. Mulford.
1916 Federal Aid Highway Act.
1918 First federal aid road completed (CA).
1920 National highway and road research program, established.
1927 Radburn (NJ.) Clarence Stein, Architect.
1929 *The Neighborhood Unit* , by Clarence Perry and Thomas Adams.
1930 Institute of Transportation Engineers, established.
1932 The President's Conference on Home building and Home Ownership.
1934 *Residential Areas* , Harvard City Planning Studies Publications, By Thomas Adams.
1935 *Subdivision Development*, FHA (National Housing Act).
1936 *Planning Neighborhoods for Small houses* , FHA.
1938 *Subdivision Standards* , FHA.
1938 *Planning Profitable Neighborhoods* FHA.
1939 Public Roads Administration, Federal Works Agency, established.
1939 *Standards for Modern Housing* , Public Health Association.
1939 *Practical Standards for Modern Housing,* National Association of Housing Officials.
1941 *Successful Subdivisions,* FHA.
1947 *The Community Builders Handbook,* Community Builders Council & ULI.
1947 *A checklist for the Review of Local Subdivision Controls,* US. National Housing Agency.
1948 *Planning the Neighborhood.* American Public Health Association.
1949 Federal Highway Administration, established.
1952 *Land Subdivision Regulations,* Housing and Home Finance Agency.
1953 *Neighborhood Standards* FHA.

1954 *A Policy on Geometric Design of Rural Highways,* American Association of State Highway Officials.

1957 *Subdividing for Traffic Safety* , Harold Marks, Eno Foundation.

1960 *Suggested Land Subdivision Regulations,* US. Housing and Home Finance Agency.

1961 *Geometric sof Local & Collector Streets* , ITE.

1961 *New Approaches to Residential Land Development,* Urban Land Institute.

1961 *Building Traffic Safety into Residential Developments,* Urban Land Institute 1962 *Adopted Standards,* League of California Cities.

1962 *Parking Dimension s,* Automobile Manufacturers Association.

1965 *Traffic Engineers Handbook,* Institute of Traffic Engineers.

1968 National Committee on Uniform Traffic Laws and Ordinance.

1969 *Recommended Practices for Subdivision Streets* Institute of Traffic Engineers.

1970 *Design Guide for Local Roads and Streets,* American Association of State Highway Officials.

1974 First Woonerf constructed in The Natherlands.

1974 *Residential Streets,* Urban Land Institute.

1980 *Fire Safety Guides For Residential Development,* California Department of Forestry.

1987 Seaside, (Florida). A neo-traditional neighborhood development. Andres Duany Architec t.

1988 *Minimum Standards for Geometrical Design of Federal Aid Restoration and Rehabilitation Projects on Local Streets and Roads,* Caltrans.

1989 *Residential Street Design and Traffic Control,* Institute of Transportation Engineers.

1989 *Traditional Neighborhood Development Ordinance,* Foundation for Traditional Neighborhoods.

1990 Laguna West (CA). A neo-traditional development. Peter Calthorp, Architect.

B. Chronology and Categories

Year	Administrative Act	Construction Technique	Design Prototype	Conceptual Framework	Normative Specification
1816	First American State Board of Public Work				
1823		First American MacAdam Road (VA)	Park Village London (John Nash)		
1837			Victoria Park Manchester		
1857			Llewellyn Park (NJ)		
1858		Blake's Stone Breaker			
1869		Steam Road Roller (NY)	Riverside (IL) (Olmsted)		
1875	Public Health "Bye Law" St. (England)		Bedford Park (London)		
1889	Sand Clay Roads (SC)			*Der Stadtebau* (Camillo Sitte)	
1892	State Aid Road (NJ)				
1893	Office of Road Inquiry (Dept. of Agriculture)	First Brick Rural Road (Ohio)			
1897	First Object-Lesson Road (NJ)				
1898				*Tommorow A Peaceful Path to Real Reform* (Ebenezer Howard)	
1901			Earswick (York- Eng.) (Unwin)		
1902				*Garden Cities of Tommorow* (Ebenezer Howard)	
1903			Letchworth (England) (Unwin)		
1905	Office of Public Roads	Coal Tar Experiments (TN)	Hampsted Gardens (England)		
1906		Bituminous Macadam Road (RI)			

Year	Administrative Act	Construction Technique	Design Prototype	Conceptual Framework	Normative Specification
1909		Concrete Road (Mich)		First American National Conference on City Planning *Town Planning in Practice (R. Unwin)	
1916	Federal Aid Highway Act			City Planning of Street and Lots (C. Mulford)	
1918	* First Federal Aid Road (CA) * Bureau of Public Roads				
1920	Highway Research Bord				
1927			Radburn (NJ)		
1929				*The Neighbor-hood Unit* (NY Regional Plan-Perry)	
1932	The President's Conference on Home Building and Home Ownership			*Planning for Residential Districts* -The City Planning Committee	
1933	National Planning Board				
1934	National Housing Act -FHA			*Harvard Univ. City Planning Studies-* (Thomas Adams)	
1935					*Subdivision Development* (FHA)
1936					*Planning Neighborhood for Small Houses* (FHA)
1938					* *Subdivision Standards* * *Planning Profitable Neighborhood* (FHA)
1941					*Successful Subdivisions* (FHA)

Year	Administrative Act	Construction Technique	Design Prototype	Conceptual Framework	Normative Specification
1947					**The Community Builder Handbook* (ULI) **A Check List for the Review of Local Subdevision Controls* (NHA)
1948					*Planning the Neighborhood* (American Public Health Association.)
1949	Federal Highway Administration				
1952					**Land Subdivision Regulation* (Housing & Home Finance Agency)
1953					*Neighborhood Standards* (FHA)
1954					*A policy on Geometric Design of Rural Highways* (AASHO)
1956					**A Policy on Design Standards* (AASHO)
1957					*Subdividing for Traffic Safety*-ITE
1961					**Building Traffic Safety into Residential Development* (ULI) **Geometrics of Local & Collector Streets* (ITE)

Year	Administrative Act	Construction Technique	Design Prototype	Conceptual Framwork	Normative Specification
1962					*Parking Dimensions* (Automobile Manufacturers Association)
1963				*Traffic in Towns* (C. Buchanan)	
1965					*Traffic Engineers Handbook* (ITE)
1967	National Committee on Uniform Traffic Laws & Ordinance				*Recommended Practice for Subdivision Streets* (ITE)
1970					*Design Guidelines for Local Roads & Streets* (AASHO)
1974					*Residential Streets* (ULI)
1980					*Fire Safety Guides for Residential Developments* (CA Dept. of Forestry)
1981				*Livable Streets*) (Appleyard)	
1984					*Guidelines for Subdivision Streets* (ITE)
1988					*Minimum Standards for Federal Aid Restoration and Rehabilitation of Local Streets* (CalTrans)
1989					*Residential Street Design & Traffic Control* (ITE)

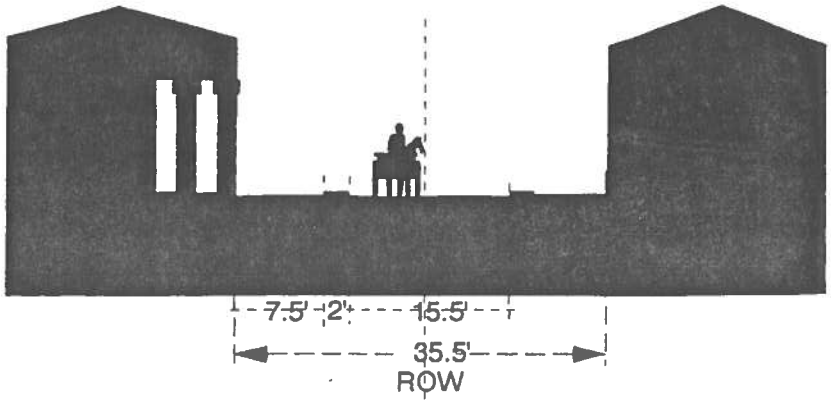
C. Chronology and Physical Attributes of Streets

Year-Publication	R.O.W	Pavement	Setback	Sidewalk	Planting Strip	Parking Lane	Curb	Trees
1823-	50	30	Varies	10	None		None	Yes
Park Village -London								
1837-	50		20		None		None	Yes
Victoria Park -England								
1868-	55		30	6	6		None	Yes
Riverside - Ill.								
1870-	75		50	5	7.5		Wood & Concrete	Yes
Garden City- LI								
1875-	40	26	12	7				Yes
Bedford Park- England								
1905-	20	16	20		2		None	Yes
Hampstead Garden-England								
1927-	30	18	15	6			None	Yes
Radburn NJ								
1929-	60	20	30	10	15		Vertical	Yes
The Neighborhood Unit								
1932-	60	24		5	5			Yes
Planning for Residential districts								
1934-	50	24		5	5		Vertical	Yes
Residential Neighborhoods.								
1935-	50	24	15	4	8	8	Rolling or Vertical	Yes
Subdivision Development. FHA								
1936-	50	24	15	4	8	8	Rolling or Vertical	Yes (@40')
Planning Neighborhoods. FHA								
1938-	50	24	15	4	8	8	Rolling or Vertical	Yes
Subdivision Standards FHA								
1940-	50	24	24	4	8	8	Rolling or Vertical	Yes
FHA Standards								
1947-	50	22		4		7		
Subdivision control NHA								

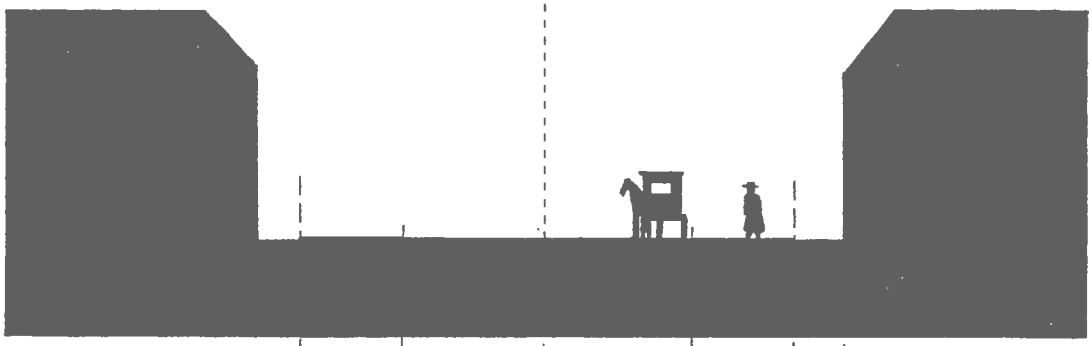
Chronology and Physical Attributes

Year-Publication	R.O.W	Pavement	Setback	Sidewalk	Planting Strip	Parking Lane	Curb	Trees
1947-	50	26		4	8		Rolling	Yes
Community Handbook-ULI								
1948-		26		4		8		Yes
Planning Neighb. Public Health								
1949-	50	26		4	6		Vertical	
Traffic Safety								
1950-	50	26		4	7		Vertical	Yes
Home Builder Manual NAHB								
1961-	40	26		4	3	8		
Geometrics of Local Street. ITE								
1967-	60	36		5	6	8	Vertical	
Recommended Practice ITE								
1974-	52	36		4	3	8	Rolling	Yes
Residential Streets ULI								
1984-	60	36		5	6	8	Vertical	
Subdivision Streets ITE								
1989-	60	36		5	6	8	Vertical	
Residential Street design ITE								
1991-	50	24	7	4	4	8	Rolling	In pavement
Laguna West(Neotraditional)								

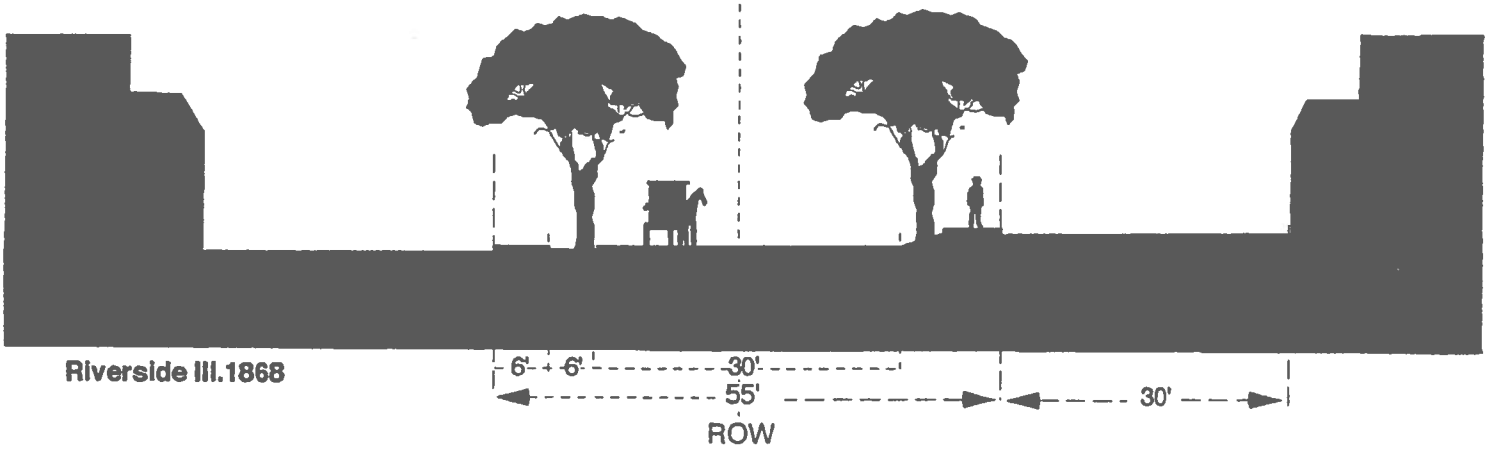
D. Cross Sections



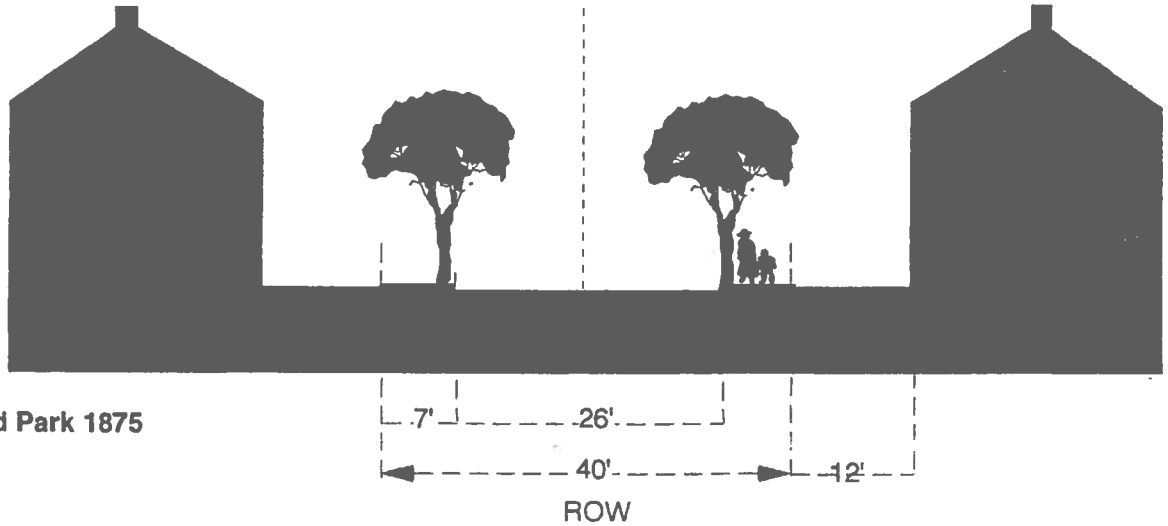
Roman Road (79 A.D)



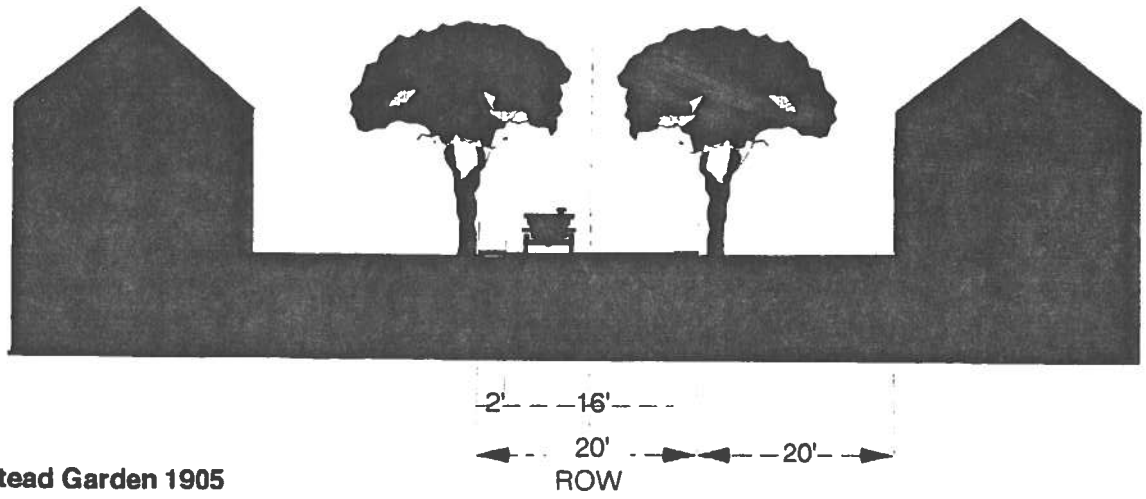
Park Village 1823



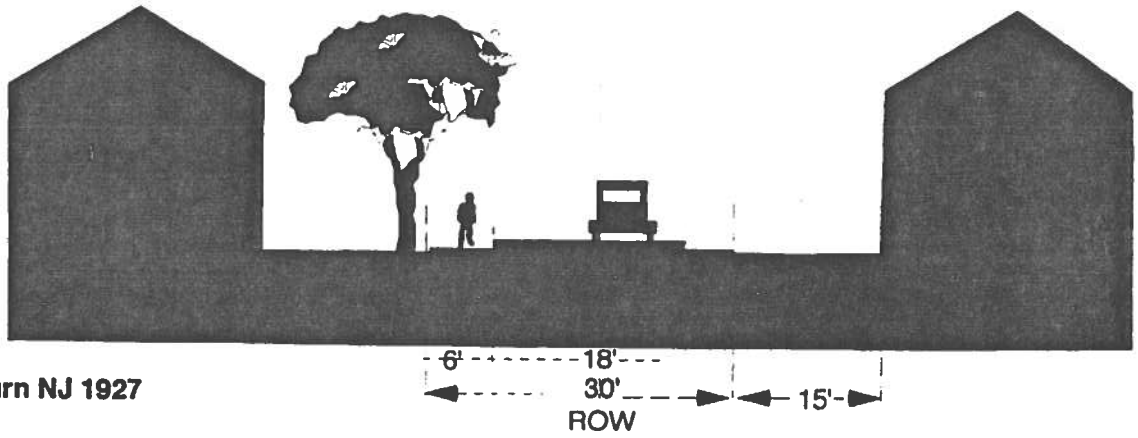
Riverside Ill.1868



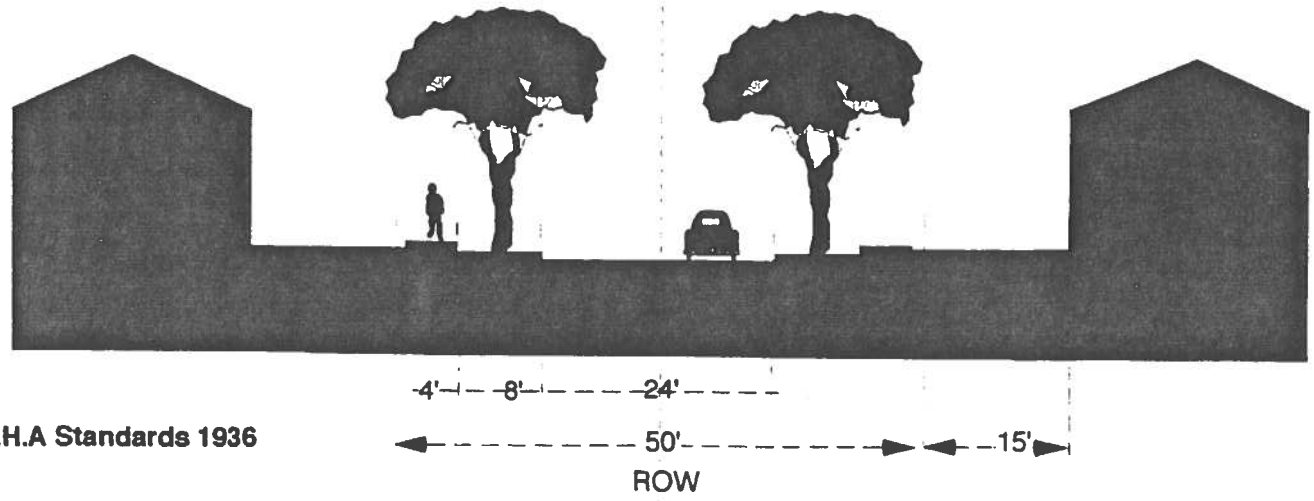
Bedford Park 1875



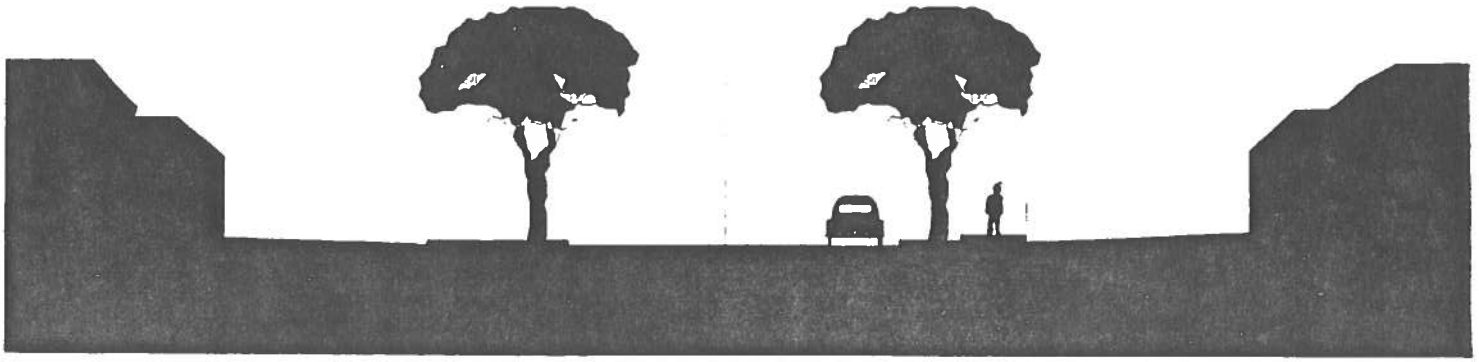
Hampstead Garden 1905



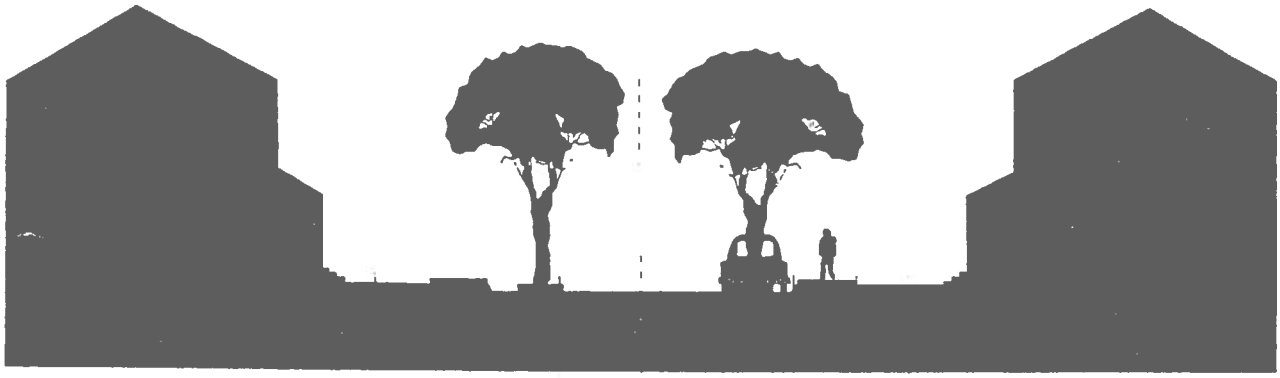
Radburn NJ 1927



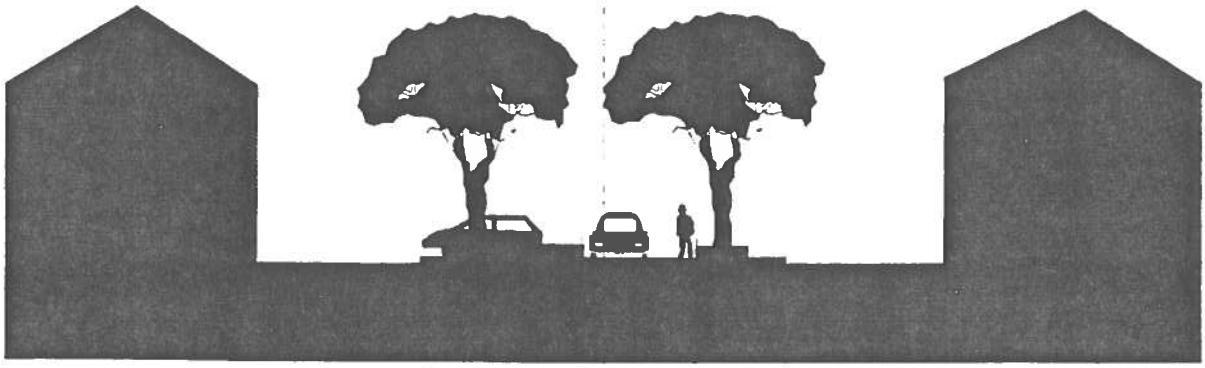
F.H.A Standards 1936



Typical Cross Section
According to ITE Standards- 1965



Laguna West- Ca.- 1991
(Neotraditional Community)



Shared Street- Woonerf