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# City Planning and Infrastructure: Once and Future Partners

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## Abstract

Great cities are born of and give rise to great infrastructure. Historically, city planning has been deeply rooted in infrastructure and physical planning. One of its ontological bases has been to create urban place out of space through the intermediary of infrastructure. Currently, the links between infrastructure and city planning may be described as numerous but nonstrategic and noncomprehensive, even as the bond between infrastructure and cities remains tight. In part, this is because the planning profession has left key roles in infrastructure to other professions. This article chronicles the rises and falls in the fortunes of urban infrastructure in relation to city planning.

## Keywords

city planning, urban infrastructure, public works, planning history, urban development, capital facilities

Great cities are born of and give rise to great infrastructure. Seats of empire, such as Rome, Madrid, and London, owed their central standing to extensive infrastructure. These capitals could not govern the expanse of their dominions without superior transportation and communication systems to extend the reach and lucre of empire and the size of the capital administering it. The Roman Empire, for example, could not have existed in its grandeur without roads emanating to its peripheral outposts and aqueducts supplying Rome with water. Other public works critical to the rise of Rome include city walls, bridges, seaport, reservoirs, public baths and fountains, and civic architecture that consisted of amphitheaters, the coliseum, circuses, and plazas.<sup>1</sup> The saying “all roads lead to Rome” clearly asserts the centrality of infrastructure for Rome and its empire.

The Spanish Empire that reached its zenith after Columbus’s discovery largely owed its riches to its conquest of the Americas. The meticulous planning of their settlements in the Indies, as they were known, was made possible by the Spanish Law of the Indies, promulgated to ensure uniform settlement of the New World in the sixteenth century. While this law dealt with political administration, trade, and other affairs; a good portion was devoted to city layout and planning, especially infrastructure.<sup>2</sup> As the Archive of the Indies in Seville still attests

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today, administrative infrastructure was no small part of this operation, going hand in hand with physical infrastructure.

Today, global cities are indebted to their positions as command posts in the global economy to information, telecommunications, and transportation networks that concentrate knowledge, capital, and people. Old notions of empire and hierarchy have been pushed aside by a new order that shapes the symbiosis of corporate conglomerates with governments into networks, and posits world cities as nodes. The networking of society is in debt to the capital invested in networking infrastructures, which have recast relations among peoples, institutions, and places.<sup>3</sup> While social, political, administrative, and economic forces also have played key roles in the transformation of urban space, the transformation of social space in general and urban space in particular is partly due to the transformation of infrastructure, and the transformative power of infrastructure.<sup>4</sup> This transformative relationship between cities and infrastructure is not limited to seats of empire or global cities. It holds for cities and towns spanning the globe.

Of course, this relationship works both ways. Cities and their social, economic, and political functions also give rise to infrastructure, as infrastructure is needed to sustain growth. Water treatment, sewerage, and electric power, for example, are technologies born out of the stresses of rapid and large-scale urban growth. Compare, for example, the rate of growth of New York City before and after the Erie Canal in 1825 and Croton water system in 1842, or Paris before and after it developed its sewers in the 1830s. Cities and infrastructure have always been mutually interdependent and coevolutionary. In fact, cities could not exist without infrastructure.

Yet concentrated cities have numerous problems stemming from overcrowding and increased resource consumption, which furthermore imply equity and sustainability considerations. As cities have evolved from industrial to informational in a network society, we believe that cities require a new type of planning that provides guidance to metropolitan areas because of the substantial changes wrought by these transformations, and the essential need for responsive planning that takes into account these new realities.

This planning is founded, once again, on infrastructure, because of infrastructure's capacity to provide access to places and services, thus potentially lessening equity disparities, and its capacity to provide sustainable solutions, thus lowering nonrenewable resource depletion and environmental impacts at all scales. Infrastructure is a systemic integrator—across spatial scales, population groups, and disciplinary specializations—and as such is suitable for a renewed vision of comprehensive planning centered on equity and sustainability. This revived practice could un-splinter the city, and the practices that shape it.<sup>5</sup> Analyzing the changing relations between urban planning and infrastructure since the mid-nineteenth century can inform contemporary planning practice.

This analysis covers the United States and Europe, concentrating on the former. We focus on the industrial and late/postindustrial eras because of three reasons. First, the nature, scale, and location of industry were instrumental in changing the city as it concentrated peoples and their activities in greater numbers, recreating for the industrial era an intensified version of an essential urban condition.<sup>6</sup> Second, changes to urban form continued as new infrastructure and industrial needs promoted and allowed for the dispersal of populations beyond the city's earliest boundaries. Finally, because the extent and the speed that the network society spreads (globalization) are exerting a profound change on contemporary metropolises.<sup>7</sup> Our emphasis is not on infrastructure per se, as there are superb technological histories of infrastructure.<sup>8</sup> It is on the relationships among infrastructure, city development, and the urban planning professions.<sup>9</sup>

We believe that recovering infrastructure planning as a central concern of the planning profession, as the current leadership of the American Planning Association is keen on instituting, is an important step forward to continue the revival of American cities, to make metro areas more sustainable, and to put planning more squarely in the center of various policy arenas—energy, technology, sustainability, equity—not just urban ones.<sup>10</sup> This way, reinventing and rejuvenating the planning

profession accomplishes two critical tasks: to make planning more of a leadership profession and to make cities more sustainable. This transformation must include a decisive reengagement with infrastructure planning.

So doing responds to the call of historians for the practical import of history to contemporary practice. Carl Abbott and Sy Adler recognized the opportunities for making history a part of planning.<sup>11</sup> They understood that historical awareness helps the profession understand what it is doing in light of what it has done and hopes to do. Eugenie Birch advocated for historians to develop a planning history useful to present-day planning practice.<sup>12</sup> Moreover, this scholarship should address the complexity of cities and practice, including interdisciplinary collaboration. Scholars should strive to “produce insights of great value by employing interdisciplinary approaches.”<sup>13</sup> We seek to accomplish this by exploring the interdisciplinary interactions among the professions engaged in the activity of city planning.

## A Deeply Rooted Relationship

Historically, city planning has been deeply rooted in infrastructure. Early city planning, prior to the modern planning era ushered in by Georges Haussmann in Paris and Ildefons Cerdà in Barcelona in the middle of the nineteenth century, was limited to infrastructure planning, such as the layout of streets, squares, and open spaces, and the location of civic monuments, temples, and markets.<sup>14</sup> Since Cerdà’s and Haussmann’s time, the professions engaged in city planning have continued to consolidate around the physical elements of urban space, even as they expanded their scope beyond infrastructure.

As populations grew during the industrial era, masses of people found their way to the cities. Some nineteenth-century cities were growing so fast that they could hardly cope with the influx. Urban densities rocketed to levels not since experienced, at least in the United States. For example, in the Lower East Side of Manhattan, 540,000 residents crammed into an area of two square miles in 1910.<sup>15</sup> In daily life, streets were congested, housing was overcrowded, open space lacking, infectious disease common, and public health poor as a result of the lack of proper sanitation, ventilation, and other factors. Urban conditions for most deteriorated in proportion to the scale, density, and speed of population growth.

Infrastructure abetted industrial-scale urban growth in multiple ways. First, means of transport facilitated rural–urban and European–American migrations. Second, transportation infrastructures facilitated concentrated industrial activity. Rail, ports, canals, and turnpikes enabled the delivery of raw materials and growth-inducing trade. Next, the harnessing of electricity enabled industrial and residential uses to be located near each other. Finally, the impacts of growth—pollution, illness, and crowding—were alleviated somewhat by sanitary infrastructure—water, sewerage, and storm drains—thus reducing mortality rates and improving life expectancy.

Before the industrial age, cities that exceeded 50,000 inhabitants were rare exceptions.<sup>16</sup> Their small size let them fit into their environs more seamlessly, taxing nature less. Over time, the scale and density of industrial metropolises changed the relations between city and country.<sup>17</sup> As the metropolis exceeded the capacity of the natural ecosystems to support it, an ever-spreading web of infrastructure imported materials from further afield, with the effect of supplementing or supplanting natural systems with engineered ones.

Ongoing efforts to improve urban conditions comprise the history of city planning. Since the advent of the industrial era, historians have chronicled a series of reform movements that established the groundwork for contemporary planning practice.<sup>18</sup> It was partly, but far from exclusively, a history of the partnership between infrastructure development and city planning, a profession whose earliest incarnations, up to about 1910, largely dealt with city form. Today as before, the prospect of cities and of life in them is largely conditioned by infrastructure, and

the way we plan infrastructure will ultimately determine whether cities and our urban way of life will be sustainable.

*Infrastructure*, as used today, is a modern term. According to Konvitz, the word *infrastructure* “probably appeared for the first time in 1875, in French,” and originally referred to military works.<sup>19</sup> Infrastructure has acquired an expanded meaning, and now standard definitions typically refer to built facilities and networks—either above or below ground. This take includes publicly and privately owned providers of systems such as utilities (gas and electricity, water supply and sewerage, waste collection and disposal); public works (roads and bridges, dams and canals, ports and airports, subways and railways); community facilities (prisons, schools, parks, recreation, hospitals, libraries); and telecommunications (telephone, Internet, television, satellites, cable, broadband).<sup>20</sup> Early English uses of the term appeared between the first and second world wars. The word was not included in either *Webster’s Second International Dictionary* of 1934 or the first edition of the *Oxford English Dictionary (OED)*. The word is found in the 1976 supplement to the *OED* and in *Webster’s Third International Dictionary* of 1961.

## Nineteenth-Century Urban Reform Movements and Their Impact on Planning

The reform era, extending from around 1840 to approximately 1920, consisted of several periods, starting with sanitary reforms in urban England, Germany, and the United States. The first reform movement, improving sanitation, occurred between 1840 and 1890.<sup>21</sup> Sanitation reforms of that time operated on a miasma theory, whereby dirt and foul odors were disease bearing, and thus needed to be flushed away from the urban population in order to secure adequate public health.<sup>22</sup> In 1842 attorney Edwin Chadwick led the preparation of the groundbreaking “Report from the Poor Law Commissioners on an Inquiry into the Sanitary Condition of the Labouring Population of Great Britain,” which chronicled unsanitary conditions in urban England.<sup>23</sup> In the same time period, Chadwick introduced, to European cities, the water carriage system. These egg shaped “self-flushing mechanisms powered by water” would soon help rid cities of stagnate waste. Once coordinated at the city level, these mechanisms gave rise to the first sewer systems.<sup>24</sup>

In 1845, the first sanitary survey in the United States was completed in New York, directed by physician John Griscom and titled “The Sanitary Condition of the Laboring Population of New York.” It echoed Chadwick’s report, demonstrating its transatlantic influence. This survey entailed a systematic data collection effort that mapped every property to document contagious diseases.<sup>25</sup> Massachusetts followed in 1850 with a sanitary report written by Lemuel Shattuck, which spurred more systematic government action.<sup>26</sup> A survey was conducted in Memphis, Tennessee, in 1878 in response to yellow fever epidemics. An important difference between the Memphis survey and prior New York and Massachusetts surveys was that it was conducted by the newly constituted National Board of Health instead of a local citizens committee. Tennessee state authorities requested that the National Board prepare a plan for Memphis based on a survey, because they noted “proper sanitation . . . can only be accomplished through the means of a thoroughly systematized and comprehensive plan.”<sup>27</sup> As a result, Memphis provided a model for integrating the planning of streets, sewers, storm water drainage, water supply, building improvements, and administrative codes in a comprehensive manner. The practical outcome of the Memphis plan, outside the city of Memphis, was to install separate sanitary sewers in dozens of cities.<sup>28</sup> A key outcome of these advancements for the future planning profession was that they demonstrated conclusively the positive relationships among infrastructure, urban structure, and the health of urbanites. This cognizance became known as “townsite consciousness.”<sup>29</sup>

A second item addressed by the reform era was the deplorable condition of tenement housing. In 1857, the first official American inquiry into crowded tenement life was published.<sup>30</sup>

This report, titled *The Tenement House Problem*, was mandated by an 1856 New York state law. Its purpose, according to the law, was for members of the Association for Improving the Condition of the Poor (established in 1854) “to make an examination of the manner in which tenant houses are constructed in the city of New York.” The housing reform movement arose in response to this report, and it rallied support around the need to improve living conditions. The results of those examinations led to a series of laws, each building toward the landmark 1901 Tenement Housing Act that required sewer systems be included as part of private construction and connected to city sewage systems.

Parks and open space, also part of the reforms of this period, sought to cleanse city air and to provide land for public enjoyment. This period saw the creation of New York’s Central Park in 1857, followed by park and boulevard systems in Chicago, Boston, Philadelphia, Kansas City, Indianapolis, and numerous North American cities and towns.<sup>31</sup> In Boston, Frederick Law Olmsted Sr. designed the Fens, a linear park system or greenway that encompassed and enhanced a natural wetland, and in so doing exploited its “nature services” such as flood control. Over time, planning for single city parks expanded to the planning of metropolitan park systems, a movement that spread across the United States.<sup>32</sup>

Together, sanitation, housing, and park reforms exerted influences on the emergent field of city planning, whose origins were consolidated by none other than Frederick Law Olmsted. Known in that era for his and Calvert Vaux’s Central Park for New York City (1857), Olmsted had broader interests and activities. During the Civil War, Olmsted was director of the United States Sanitary Commission. Throughout his life and professional practice he strove to improve the health of cities and their inhabitants. A careful reading of his collected papers testifies that health was his driving concern.<sup>33</sup> Thus, Olmsted transformed the inherited American tradition of town planning through town layouts (streets and squares) to a more thorough practice that incorporated parks, parkways, landscaping, and sanitary infrastructure.<sup>34</sup> This can be seen clearly in his seminal 1868 plan for Riverside, Illinois, which included storm water drainage and sewerage. Spurred this way, the nascent city planning movement began to link town layout, sanitary reforms, and housing provision.<sup>35</sup>

The various urban reform movements of the late nineteenth and early twentieth centuries—Municipal Art, Civic Art, and City Beautiful—all benefited from the inspiration provided by the 1893 Columbian Exposition in Chicago. The exhibition was housed in the Great White City, which took its name from the uniform whiteness of all the façades and the millions of electric lights, which showered a brilliant light on the whitewashed plaster buildings.<sup>36</sup> Canals, streetcars, and water, sewerage, and electrical systems not only supported the fair’s operations but also were prominent exhibits. The fair showcased the integration of functional and aesthetic values in engineering, architecture, and civic design that went on to inspire a generation. Infrastructure and public space did the integrating.

These advances in the United States were not developed in a vacuum. They were often influenced by transatlantic innovations, as European cities were older, larger, and had longer traditions of dealing with urban problems, which occurred there first. Parallel to the American city beautiful movement were equivalents in Europe. One manifestation was found in the international expositions, which were held in leading capital and other cities throughout the continent, starting with the 1851 Crystal Palace Exhibition in London. These expositions and others showcased their city and provided a setting to display the latest wonders from around the globe.<sup>37</sup> Moreover, authors of American cities’ municipal art and city beautiful plans garnered their inspiration from cities such as London, Rome, and Paris.<sup>38</sup>

The origins of comprehensive city improvements through physical planning in industrial Europe are usually attributed to the works of Haussmann, Prefect of the Seine (administrative district that included Paris) from 1853 to 1870, and Cerdà, the Catalan civil engineer who laid out the



expansion of Barcelona in 1859. Infrastructure was their primary object of planning and means of its realization.

Hausmann was a skillful and willful administrator whose plan transformed Paris, chiefly by a modern network of wide streets and boulevards connecting key points such as rail stations and markets (Hausmann called them “nodes of relation”), through demolishing buildings to create open spaces, sanitary infrastructure, omnibuses, and gas lamp lighting. He also created two large public parks east and west of the city and built numerous community facilities: schools, hospitals, barracks, and prisons.<sup>39</sup> Perhaps most significant to the future planning profession was his view of the city. Based on planimetric and topographic surveys of the entire city, he conceived of intervening to create whole circulatory and respiratory systems that according to Choay, would “give unity to and to transform into an operative whole” his city.<sup>40</sup>

For his part, Cerdà was more daring than Hausmann. His surveys were more comprehensive, covering social, public health, housing, and physical environment conditions, in addition to the topographic work done by his Parisian contemporary.<sup>41</sup> He too based his plan on circulatory and respiratory systems, and outdistanced Hausmann by providing for multilevel transportation interchanges that foresaw mechanized urban mass transit, including rail. He conducted studies for the arrangements of housing and other buildings in blocks that integrated open public space into each block. His plan was an extension of the city outside the city walls, which were just torn down. It provided for other infrastructures as well: parks and plazas, sidewalks and gardens, roads and rails, water supply, sewerage, and storm drainage.<sup>42</sup> Thus with Hausmann’s, Cerdà’s, and Olmsted’s plans, and the sanitary idea of Chadwick and others, planning began to take shape, with a decidedly infrastructural vocation.

## The Progressive Era, City Beautiful, and City Planning

The culmination of these efforts occurred in the Progressive Era, which lasted from approximately 1890 to 1915. It was so called owing to the attempts to clean up political corruption, especially in local government. A distinguishing characteristic of the American progressive movement is that “middle-class and upper-middle-class people inspired and staffed [it].”<sup>43</sup> This contrasted with one European version, exemplified by L’Ecole Normale Supérieure de Administration of Paris, breeding ground of the elite that went on to staff national and provincial government in France and her colonies. In England, Oxford, and Cambridge groomed the elite for service to the Crown.

Planning historian Jon Peterson traced the birth of the “city planning” profession in America to the end of the progressive era: “the birth itself spanned almost precisely a ten-year period, from 1900 to 1910.”<sup>44</sup> He distinguished it from British planning of the era, which concentrated on “low-density suburban [housing] estates.”<sup>45</sup> Prior to 1890, according to Peterson, most city plans in the United States were new “townsite plans,” for completely new towns on virgin or at least undeveloped land.<sup>46</sup> Charleston (1672), Philadelphia (1682), Savannah (1733), Washington, DC (1791), and New York (1811) were the most well-known examples of city plans based on street grids laid out by surveyors and engineers. Paterson, New Jersey, stands apart in that it was established as America’s first planned industrial city, promoted by Alexander Hamilton, in the period 1791. In the start of the twentieth century, American city planning focused on the whole of existing large cities. Prior to the twentieth century, there was “special purpose planning” in the cities, what today is often called functional planning. The pre-progressive era’s special-purpose plans were mainly for parks, water supply, and sewerage infrastructure. The progressive era introduced the term *comprehensive* into systemwide special-purpose planning in the late nineteenth century.<sup>47</sup> Thus, we can trace two infrastructural roots of holistic city planning in the United States: street grids in town site planning and special-purpose planning.

Historian Stanley Schultz draws attention to these nineteenth-century antecedents to comprehensive city planning in the United States. They too were almost exclusively infrastructure-centered, and include water supply, parks, sewerage, streets, public transport, pipes for gas (street lamps), telegraph, telephone, and electric wires. As new technologies changed the city, they also changed the way the city was planned and managed.<sup>48</sup> While the professional activities Schultz studied certainly laid a solid basis for, and are now considered part of, the urban planning profession—prior to their crystallization in the first decade of the twentieth century in a comprehensive (meaning more than one function at a time, in addition to the city as a whole), systematic, and self-conscious fashion—they were practiced by a disparate assemblage of sanitary engineers, landscape architects, architects, surveyors, and municipal engineers.<sup>49</sup> Peterson refers to these as “antecedents of city planning.”<sup>50</sup> Nonetheless, American cities prospered by the infusion of these new networked infrastructure systems and the urban possibilities that they engendered.

In the United States, the link between urban prosperity and planned infrastructure was never more placed into relief than in Chicago’s Columbian Exposition of 1893. It intensified the desire of cities small and large to improve themselves, in large measure through physical appearance. Excitement about the Exposition sparked many comprehensive planning efforts, then termed civic art or civic aesthetics, not the least of which was the 1901 McMillan Plan for Washington, D.C., the “inception” and “icon” of city planning.<sup>51</sup> The McMillan Plan’s contribution to the City Beautiful movement was “palpable and immediate, in both the architectural and popular press.”<sup>52</sup> This plan directed the disposition and improvement of public spaces, especially parks and the Mall. It relocated rail lines and established the location of the Pennsylvania Railroad’s new Union Station just northeast of the Capitol. In sum, an infrastructure plan clothed in the finery of City Beautiful civic design. The McMillan Plan inaugurated the dizzying decade in which city planning emerged as a new profession, distinct from its predecessors engineering, architecture, landscape architecture, and surveying.

This new comprehensive planning placed function alongside beauty for coequal consideration. In 1909 the Commercial Club of Chicago released Burnham and Bennett’s *Plan of Chicago*.<sup>53</sup> The Chicago plan, like McMillan’s before it, was a landmark. The Chicago plan described existing conditions and provided the vision for specific solutions designed to overcome existing problems as they pertain to infrastructure: transportation, streets, waterfront, parks, public buildings, and open spaces. While Burnham and Bennett’s Plan was not merely an infrastructure plan, it did place its “emphasis on infrastructure.”<sup>54</sup> Its solutions were attained by means of urban design, and today it is largely remembered by its famous illustrations. Furthermore, it expanded the scope of city planning so as to consider the placement and function of infrastructure beyond the local (municipal) scale. In comparison, many plans of both periods included only certain infrastructures, and other infrastructures such as energy, heat, power, water, and waste disposal got scant attention.<sup>55</sup> Nonetheless, infrastructure, as the term is used today, played a larger role in the 1909 Chicago plan than is typically acknowledged, even in generous accounts that correctly identified its remarkably broad program, and that of the City Beautiful movement as well.

Just as importantly, it was the newly minted profession of city planning that prepared the city plans and conducted infrastructure planning. As Peterson takes pains to elaborate in his magisterial text, “At no time during 1905–1909, in fact, did engineers or engineering societies in any city initiate comprehensive plans, despite their expertise in street construction, bridge design, railroad grade crossings, and harbor improvements. Soon after the American planning movement achieved national organization in 1909, its leadership would bemoan the underrepresentation of this sizable and strategic element within their ranks.”<sup>56</sup>

Other landmark planning texts were produced during this time. All demonstrated the prominence of growth-shaping or growth-inducing infrastructure planning in practice and in the classroom. In 1916, engineer-planner Nelson Lewis wrote *Planning the Modern City*. It identifies six principal

elements of a city plan: transportation systems, public facilities, the street system, parks and recreation, location of public buildings, and patterns of land use.<sup>57</sup> In the same year, John Nolen edited *City Planning*. This book explained the principles of and justifications for preparing a general plan. To Nolen and his contributing authors, the principal elements of a city plan were composed of infrastructure: streets, public buildings, recreation facilities, parks, water supply, waterways, railroads, and transportation and railways. Only five chapters of eighteen were allocated to administrative issues such as legislation and financing.<sup>58</sup> The two seminal texts, written by two seminal figures, placed infrastructure at the center of the newly consolidated profession of city planning.

What the City Beautiful movement did was not only energize planning and foment its professionalization but it expanded planning's scope beyond infrastructure and hygiene. It seemed to say that infrastructure was never enough.<sup>59</sup> While it stemmed from infrastructure, as city planning matured, it became aligned with leading institutions in the economy and society. As it did so, it shifted its scope to political, administrative, and legal concerns. It began to plan and govern urban space. Historian Christine Boyer noted, "Out of the complex of infrastructural and service needs, city planning from its inception became a many-faceted process." She goes on to observe in her Foucauldian- and Marxian-inspired analysis that "above all else, disciplinary space is cellular; its purpose is to be able to separate or break up confusing overlaps." Planning's distance from infrastructure started to grow just as it begun to consolidate as a profession. In planning's place stepped state-appointed Public Utilities or Public Service Commissions that took control of infrastructure from the cities.<sup>60</sup> This evolution of urban planning took place immediately before, during, and after World War I.

## City Functional to the Mid-Twentieth Century

By 1920, city plans were becoming less occupied with aesthetics and more concerned with administration, the control of private property by zoning, and coping with the widespread use of the motor car. New York City's 1916 Zoning Code was popularized by Hugh Ferriss's powerful renderings of building setbacks and by a clearly written legal code in support of the renderings. The diffusion of the New York code to towns and cities nationwide led to the rapid adoption of zoning as the principal municipal tool to accomplish planning, supplanting the comprehensive plans drawn by civic designers. As a result of the zoning revolution, land use zones prescribed by ordinance supplanted physical urban form and infrastructure location and design as the objects of planning. This transition echoed a change in urban settlement patterns spurred by the popularization of automobile travel, made affordable by Henry Ford's Model T, and the availability of cheap gasoline to power them. Increases in car ownership and income, a growing highway and street network, and streetcar and commuter rail lines permitted those who could to move out to the suburbs.<sup>61</sup>

At this time, new institutional considerations caused infrastructure-sensitive physical planning to recede, especially at the municipal level. Legally binding master plans administered by newly formed planning commissions altered how planning was done and who did it. Before, it was architects, landscape architects, and engineers. Now, lawyers and new professionals called city planners took on these tasks. Because of changing urban dynamics and changes in the planning profession, both Lewis and Nolen updated their seminal texts. Lewis's revised *Planning the Modern City* recognized the increasing role of municipal administration, yet nonetheless maintained four physical elements of a city plan: the transportation system, streets, park and open spaces for recreation, and public buildings.<sup>62</sup> Nolen also kept his sights on physical (infrastructural) planning while expanding the book's scope to include zoning and a revised chapter on planning legislation.<sup>63</sup>



In the 1930s, the city planning profession in the United States confronted changing economic and social conditions by creating new ideas and new tools. The development of institutional capacity at all levels of government (National Planning Board, state planning boards, municipal planning and zoning commissions), along with a wider range of legal instruments were accomplishments that helped city planning's professional standing. Abetted by their growing numbers, planners developed expertise through specialization. Scientific projections of future population growth, slum clearance, and public housing were some of the key advances. Regional, state, and national planning further articulated professional aspirations throughout government and society. Infrastructure planning receded at the local level, yet was central to regional and state plans.<sup>64</sup>

The preparation of metropolitan and regional plans recognized that urban growth occurred in suburban sprawl as well as downtown concentration, and the interrelations of the two required coordinated planning for more than just the central city. Inspired by the Scottish biologist and regionalist Patrick Geddes, planners on both sides of the Atlantic produced regional plans. The *Plan for New York and Its Environs*, prepared in the 1920s, for example, was essentially a regional design that used regional infrastructure systems as a framework. Another example is the Tennessee Valley Authority (TVA), a federal agency created in the 1930s to build dams, reservoirs, hydroelectric plants, munitions factories, and supportive public facilities in a multistate Tennessee River region in the Southeast. Intended as a regional development strategy for one of the chronically poorest regions in the nation, the TVA was an icon of New Deal planning.<sup>65</sup> Widely influential, both stand as convincing evidence of the link between planning and infrastructure at the metropolitan and regional scales.

The National Planning Board, created in 1933 and operating through 1943 under other names such as the National Resources Committee and the National Resources Planning Board (NRPB), coordinated federal planning for public works and national resources. It conducted long-range studies in support of its planning and stimulated local, regional, and especially state planning. Forty-five of forty-eight states adopted state planning boards in the 1930s.<sup>66</sup> Hundreds of major public works projects were built by the Public Works Administration, the Works Progress Administration, the Civilian Conservation Corps, and the TVA still grace communities throughout the United States. After 1939, at the dawn of World War II, the NRPB withdrew from public works planning and supporting state planning boards, most of which were dissolved or left idle, in favor of special duties related to the national defense.<sup>67</sup> Nonetheless, one prime legacy of the NPB is the link between public works and comprehensive planning, fortified by a degree of multijurisdictional coordination perhaps not since experienced.<sup>68</sup>

A number of texts were written in this same decade that endeavored to reset the direction of the planning profession. Typical was planning consultant Earl Mills, a contributing author to volume 2 of *The Planner's Journal*, who averred that the profession faced a fork in the road: to plan or replan. Nonetheless, each choice maintained that planning deals with the physical form of the city.<sup>69</sup> His prescription for an adequate city plan entailed population studies, land use and zoning, water and sewage facilities, a major thoroughfare plan, transit and transportation, parks, recreation areas, schools, civic art, and housing. Via Mills's text, population study and land use continued to assert themselves on the North American planning scene alongside of infrastructure and zoning.

Lawyer-planner Edward Bassett, a zoning pioneer, contributed his insights on the future direction of planning in his book *The Master Plan*. There he identified seven elements of community land planning: streets, parks, sites for public buildings, public reservations, zoning districts, routes for public utilities, and pierhead and bulkhead lines. His text signaled a move away from civic design, as he chose public building *sites* instead of public buildings because he believed the latter belonged to the domain of architecture rather than community planning.<sup>70</sup> Clearly, in these texts, some types of infrastructure were still a component of planning and the comprehensive plan,

although the shift to zoning, land use, and population forecasting was taking hold and in some cases superseding infrastructure and public works planning.

In 1941, the predecessor to the International City Management Association, the Institute for Training in Municipal Administration, issued the first edition of *Local Planning Administration*.<sup>71</sup> This text “set forth the basic principles of intelligent community planning,” of which only five of fourteen pertained to infrastructure. Following the progress of mainstream North American planning by examining the second edition in 1948 and the third edition in 1959 of *Local Planning Administration*, one can detect a continuing shift away from physical planning, the comprehensive plan, and infrastructure, to zoning and other forms of administration, along with new tools such as urban renewal and public housing. Infrastructure, while it continued to be included, steadily declined in importance. The sea of change in the profession from shaping urban form to exercising bureaucratic functions was apparent in the table of contents. The choice of publisher, an administrative association, in lieu of the American Institute of Planners, was also indicative.

Foreshadowing the ICMA “Green Book” was Robert Walker’s 1941 *The Planning Function in Urban Government*. Echoing the green book was Harold Lewis’s 1949 *Planning the Modern City*. The latter, written by the son of Nelson Lewis, also identified planning with administrative and governmental activities as much as with urban infrastructure. Infrastructure, under which he included transportation, public facilities, street system, park and recreation, and the location of public buildings, was classified in the realm of engineering, and not planning.<sup>72</sup> Robert Walker’s book, widely used as an authoritative text, ventured even further into the administrative arena.<sup>73</sup>

Parallel shifts were spearheaded by Stuart Chapin’s landmark *Land Use Planning*. “It changed the way planning was practiced in the United States, by shifting the core of planning from design to land use. This meant a move away from Olmsted’s ‘complex unity’ of the city to land units segmented into categories [zones]. . . . Even as the book acknowledged that land use planning was one part of comprehensive planning, it nevertheless stressed quantitative analysis over design synthesis. . . . In part its success derived from the fact that a land use basis (as opposed to a whole-city basis) fit more neatly into the way North American institutions dealt with real property (deeds, laws, zoning). . . . With the land use control model, planning employed a divide and conquer mentality decidedly distinct from the order and build mindset of previous physical plans.”<sup>74</sup> At this point, we can add that around this time emerged a more widespread recognition that politics often trumped even the best plans. To counter politics, planners shored up the administrative and institutional sides of planning, which also began to overshadow design. These four books signaled changes on the professional horizon.

### *City Grass-Rooted Questions the Comprehensive Planning Ideal*

The 1950s and the 1960s saw the interstate highway system begin its assault on city centers, with highway engineers mastering the drawing boards. It was left to activists, civic groups, and other scholars to critique the way infrastructure planning was done, particularly in relation to low-income communities.<sup>75</sup> Activists opposed destruction of viable urban neighborhoods by ribbons of concrete and maze-like multilevel interchanges whose principal design criterion was free traffic flow.

Celebrated city planners and writer-activists such as Paul Davidoff, Jane Jacobs, and Chester Hartman played vital roles in “freeway revolts” in Philadelphia, New York, and San Francisco of the 1950s and 1960s, which spread to other cities. In the main, however, the planning profession stood aside as transportation specialists aided by a range of federal and market subsidies and incentives redrew metropolitan maps in favor of the suburbs.<sup>76</sup> It would be somewhat of an exaggeration to say that the general silence of urban planners vis-à-vis infrastructure amid the postwar urban freeway construction din was deafening. Instead, some activist voices in the

urban planning chorus served, in part, to critique infrastructure planning done by others, particularly in relation to low-income communities.<sup>77</sup> It took planning decades to recover from the antiurban renewal and breakdown of the comprehensive planning ideal critiques of this period.<sup>78</sup>

The turbulent decade of the 1960s ushered in a profound reconsideration of urban planning's scope and mission. Emboldened by Jacobs's call to pay greater attention to the fine-grained details of city living, especially in the neighborhoods, planners began to fight the increasing hold that transportation engineers and urban renewal experts exerted on urban development.<sup>79</sup> The planning profession was impelled by Davidoff's inspiring article "Advocacy and Pluralism in Planning" to give voice to the underrepresented and advocate on their behalf in the planning arena.<sup>80</sup> Cities reached near the top of the U.S. domestic policy agenda, placed in the limelight by segregation, riots, decay, depopulation, and pollution. The Department of Housing and Urban Development, established in 1965, applied federal muscle to the urban agenda. Infrastructure was not included as a main part of the new department's mission. Instead, federal responsibility for infrastructure was and continues to be scattered among numerous departments and agencies.

This accelerated the shift of planning from infrastructure, and moved it toward urban redevelopment, community planning, citizen participation and empowerment, and housing. A wave of new city planning programs inundated American universities in the sixties and early seventies, sparked by the renewed interest in working with the community residents to solve city problems. Social planning, advocacy planning, equity planning, policy planning, and other monikers denoted two shifts in planning. One was to critique infrastructure planning and physical planning from a social equity, local, and place-based perspective. The second was to continue the gradual shift away from physical form that had dominated planning in the United States.

Another seismic shift of the sixties, the environmental movement, was to have a similar effect on the planning profession. Although many were called to planning, particularly environmental planning, by such seminal texts as Ian McHarg's *Design With Nature*, efforts to improve the environment relied on natural methods.<sup>81</sup> Environmental infrastructure became the near-exclusive province of civil engineers, landscape architects, and new specialists, such as environmental engineers and planners.

*The Urban General Plan* by Berkeley professor and former San Francisco city planning director Jack Kent, along with Goodman and Freund's *Principles and Practice of Urban Planning* and University of North Carolina faculty member Chapin's second edition of *Urban Land Use Planning* all contained ample evidence that planning was retreating from infrastructure.<sup>82</sup> This trend away from infrastructure continued, as evinced by texts that have guided mainstream U.S. practice the most, especially the ICMA's *Practice of Local Government Planning*.

### A Strange Estrangement

As we begin the twenty-first century, the relation between infrastructure and city planning may in a limited sense be described as estranged, in the literal meaning of the term—to be kept apart from its accustomed place, or withheld from one's perception or knowledge.<sup>83</sup> This is so even as the bond between infrastructure and cities is as tight as ever. The vital importance of infrastructure to cities has been repeatedly affirmed in case studies of cities and general treatises and histories.<sup>84</sup> Yet in practice and in the academy, the planning profession as institutionalized in the APA and the AICP and their predecessors, has gone through continuous changes vis-à-vis its approach to infrastructure. This situation has been noted, and the relative lack of attention to infrastructure in recent decades has led it to be called "the Cinderella of urban studies."<sup>85</sup> Outlining this relationship, and the changing fortunes of planning and cities, reveals tendencies that have import for planning practice and education today.

In the United States, contemporary planners' infrastructure activities include site planning, annexation, capital improvements planning and budgeting, transportation planning, special-purpose planning, and episodic and reactive land development review functions. In these activities, city planners typically coordinate meetings with developers, designers, and other interested parties. Additional activities may include assessing impact fees, ensuring the adequacy of easements, and applying design guidelines to projects. Planners may also be responsible for conducting infrastructure and environmental assessments, the latter of which often includes infrastructure.<sup>86</sup> Two observations can be made about this impressive array of activities related to infrastructure. First, entire networks or systems are rarely the primary concern, except perhaps at the metropolitan scale (MPOs and COGs for specific functional systems) or state and national scales (if the state has serious state or regional planning, such as Florida and New Jersey). Usually, planners consider infrastructure at the site, district, or neighborhood scale—in an incremental rather than comprehensive manner. Second, many of these activities are reactive to development proposals and not anticipative of new growth or dynamic urban conditions. They skirt the long-term and strategic functions that entire infrastructure networks exert in the urban environment. City planning also tends to elide the interrelations among infrastructure systems, multimodal and multisystem synergies, sharing of rights of way, and their interactions with urban fabric and function. Reinserting these exculpated yet critical aspects of infrastructure would further strengthen planning practices.

A selective review of contemporary municipal general plans in the United States and Canada reveals a similar level of disengagement. These ten plans, in San Francisco, San Jose, Calgary, Edmonton, Portland Oregon (two plans), Dallas, Miami, Phoenix, and Toronto, adopted in recent years, centered their interests on demographics, land use, economic development, social concerns, urban design, and overall quality of life. A content analysis of these plans reveals their principal concerns as those just listed.<sup>87</sup> Infrastructure occupied scant portions of their texts; an average of 11.3 percent of the pages for the ten plans were devoted to infrastructure. A typical one, the award-winning San Jose 2020 General Plan, dedicated 10 of 245 pages to infrastructure, including transportation. None of its seven "major strategies" dealt with infrastructure. San Francisco had the most content related to infrastructure, nearly one half. Yet two other plans had less than 5 percent each. Furthermore, this degree of attention is evident in the plans of cities and towns of all sizes.<sup>88</sup>

Further evidence of decentering planning from infrastructure is in the standard reference of local urban planning in the United States, the International City Management Association "Green Book," titled *The Practice of Local Government Planning*.<sup>89</sup> It does not have a single chapter dedicated to infrastructure, utilities, capital facilities, or public works. Another leading text, *Urban Land Use Planning*, now in its fifth edition and fifth decade, allocates one chapter to infrastructure.<sup>90</sup>

As a consequence of the profession's partial disengagement, infrastructure planning is left to utility providers, school districts, city engineering or public works departments, parks departments, and street departments. While planning agencies often coordinate with infrastructure organizations, and while infrastructure entities may have city planners or land use planners on their staffs, the degree and effectiveness of coordination among them varies widely, depending on a host of institutional, political, cultural, educational, and historical factors. Another aspect of the distance of infrastructure from the core of urban planning is that some of it is increasingly being done by the private sector, chiefly with new telecommunications infrastructures that are having a massive effect on urban development.

This follows a long history in the United States of urban development spurred by entrepreneurs using infrastructure. For the most part, American cities gained streetcars, gas light, electricity, telephones, telegraphs, and water supply from private companies operating under municipal franchises. More recent utilities such as cable TV, mobile phones, computer networks, and other

telecommunications infrastructures also are not being planned by professional city planners. These new utilities are following in the same patterns of regulated, privately owned utility companies of the past. In both old and new utilities, engineers, accountants, politicians, and entrepreneurs play a large role in planning and management—not city planners.

Where comprehensive planning does engage infrastructure more completely and strategically is at larger scales, notably the metropolitan, regional, and state scales. For example, the New York Regional Plan Association's Regional Plan of 1996, the Portland Metro's Metropolitan Plan of 1995, the San Diego Association of Government's Regional Comprehensive Plan of 2004 (especially the "Integrated Regional Infrastructure" chapter), the City of San Antonio's Southside San Antonio subregional plan of 2003, and the New Jersey State Plan of 2001 all are based on the governance of growth-shaping infrastructure.

Infrastructure as a basis of planning at larger than the city scale is especially noticeable in Europe, where it is termed *spatial planning*, and in East and Southeast Asia, where architect-planners and engineer-planners set their sights on shaping urban form via infrastructure. In Europe, as the mode of planning has transformed from blueprint to strategy, especially at regional and European scales, infrastructure is used as the strategic kingpin to intra- and interconnect metropolitan regions.<sup>91</sup> The recent metropolitan plans for Paris, Madrid, Milan, Berlin, Brussels, Barcelona, Beijing, Shanghai, and numerous other cities stress infrastructure as a principal factor shaping settlements.<sup>92</sup> While our focus is on the United States, this admittedly limited selection does suggest that American planning can learn from international practices that link infrastructure to planning.

This introductory and selective scan of infrastructure and city planning highlights as much diversity as it does identify common trends. To better understand how we arrived at this position today, the following sections illustrate key historical tendencies of urban development, infrastructure, and city planning. Beginning with the mid-nineteenth-century sanitary reforms in England and continuing to the present, the article draws mainly on seminal texts and histories, themselves relying on primary sources.

### *What Caused the Estrangement of Infrastructure from Planning?*

This overview of the history of the development of city planning in the United States reveals the changing relationship of infrastructure to planning. Our analysis of American planning history suggests that cities, city planning, and infrastructure have had strong reciprocal interdependence. Since the industrial era, after being based initially on the twin pillars of sanitary reform via infrastructure provision and poverty alleviation through housing reform, planning evolved to assume more functions, such as civic beautification, land use and development control via zoning and other legal provisions, regional and state planning, economic and community development, and environmental protection.<sup>93</sup> We should take care to note the distinction between physical form as a basis of planning and infrastructure as a basis of planning. While there are obvious links between the two, they had different origins and differing impacts on the planning profession. The limits of the physical planning approach, especially its tendency to leave out some aspects of infrastructure, were in part what gave way to the expansion of planning into social, legal, institutional, and other arenas. City planning has never been exclusively about physical planning or infrastructure, not even in European or Asian countries where technically trained architect-planners and engineer-planners practice. It has always been a means to achieve broader social and economic and political goals, and those means have included infrastructure and physical planning. Notwithstanding, our analysis suggests that the stronger the interrelation between city planning and infrastructure has been, the more the professional activity of city planning and its pre-1900 antecedents—and the cities themselves—have benefitted.



This preemption of the planning profession's scope is termed an estrangement. While never a complete rupture, for us estrangement refers to the uneasy relationship between planners and engineers, as well as between planners and public finance and administration professionals, in part because of the differences in training that they receive. These other professions have partially usurped planning's advocacy and management for infrastructure.<sup>94</sup> Engineers, with a mathematically oriented systems approach to problem solving, speak a language distant from the combination of legalese, social survey, policy making, consensus building, and urban design that planners have evolved. Public finance and administration, sharing some commonalities with planning such as policy and law, stresses management, accountability, budgets, accounting, finance, and politics. The beginning of their separation can be traced to twin sources. First is the specialization of the professions into increasingly discipline-specific technical areas of expertise from the nineteenth century onwards.<sup>95</sup> Second, after the City Beautiful movement in the United States, planning had gradually and steadily shifted from urban physical form to legal, social, and administrative concerns. This incremental and gradual shift spanned generations and cast a long shadow on contemporary planning practice that has not satisfactorily been resolved on a long-term basis. We hasten to add that American Planning Association leadership, dovetailing with the advent of the new presidential administration, is actively and swiftly seeking to redress this concern.<sup>96</sup>

## **Whither Infrastructure?**

Planning for infrastructure has always been essential to the well-being and prosperity of cities and their inhabitants. Today, as argued in this article, the planning profession's interest in infrastructure has declined somewhat in deference to specialists, such as engineers, other public work officials, public administrators, and financiers. While this is true, particularly when compared to the inception of professional city planning in the United States one century ago, it is only part of the story.

As the pace of technological innovation accelerates, new and enhanced technologies place extraordinary demands on society to integrate them into the complex webs of life, not the least of which are the urban complexes made possible by infrastructure networks. These new technologies have required extensive planning. We believe cities require an entirely new type of planning because of the substantial changes wrought by telecommunications technologies and the global economy. Relevant to these contemporary concerns are planning approaches that consider the networked nature of cities and society.<sup>97</sup>

Furthermore, earlier infrastructure technologies have caused impacts that are just now being felt or they have produced long-standing impacts that continue to accumulate and fester. Most energy-producing infrastructure falls into this category, particularly those using nonrenewable energy sources; as does private-automobile infrastructure, with its seemingly insatiable appetite for gasoline, asphalt, and concrete. Water supply, wastewater, and storm water infrastructures relying on old technologies such as dams, sewers, concrete drainage channels, and storm sewers respectively, also have extensive financial and environmental costs and impacts that are not being managed in a sustainable manner.<sup>98</sup>

Compounding the combined forces of global technological change and the impacts of both old and new technologies is the decline of the public sector, especially its exercise over the planning and construction of infrastructure. The corrosion of a belief that government can do good for the public has permeated international institutions as well as national, regional, and local governments. The welfare states in Europe and North America have eliminated government programs, or deregulated, privatized, or decentralized them. As one corollary of the growth of the private sector, most data are confirming that social and economic inequities continue to escalate, and environmental degradation and resource depletion accelerates, albeit with some improvements.

In light of these challenges, effective management of expensive capital investments—the important yet deteriorating stocks of public infrastructure—now more than ever requires extensive coordination and planning, which has not gone unnoticed by scholarly observers and critical international institutions.<sup>99</sup>

The wise planning and employment of infrastructure can aid in the solving of vexing problems, including sustainable urban development and redevelopment, attaining social and economic equity through access to facilities, and the preservation of rural and natural environments. We do not claim that only planners possess these qualities, nor are we arrogating a scope of activities that would amount to professional imperialism. Planners, engineers, and other professionals all have acknowledged that these issues cannot be addressed by any single profession acting alone. As long as a century ago, British planning pioneer Patrick Abercrombie called for cooperation among areas of planning.<sup>100</sup> In *that* golden age of planning, engineers, landscape architects, and architects *were* urban planners, and routinely collaborated to solve problems and set new agendas for our professions. Shortly thereafter, however, Alfred Bettman's address to the 1935 Public Work's Congress in the United States, "City Planner and City Engineer Relationships," decried the inefficiency of infrastructure provision when coordination did not prevail.<sup>101</sup> We add that professionals, however united collectively, must act in concert with society and its leaders to secure lasting improvements.

In times of distress, such as the Great Depression of the 1930s, World War II and its aftermath, and the current financial, economic, and ecological crises, societal leaders have returned to the comforting harbor of infrastructure as a planned remedy, via such programs as the New Deal, the Marshall Plan, and the current economic stimulus package, which includes spending on energy, transportation, and water systems. In times of plenty, urban planners have also turned to infrastructure, as we have seen in the United States in the 1920s (streets and highways to support the automobile), the 1950s and 1960s (interstate highways and water projects in the West), and the 1990s (Internet and other telecommunications). In times of excessive plentitude, some countries have undertaken imperial expansion, tangibly enabled via infrastructure. Here we have classic Rome, sixteenth-century Spain, nineteenth-century England, and twentieth-century United States. These expansions have also been abetted by administrative infrastructures to support the widening of the physical web, such as the United Nations, the World Bank, and the International Monetary Fund after World War II in this century, and the Law of the Indies and the Archive of the Indies to support imperial Spain's conquests and colonizations. Advanced societies have repeatedly turned to the twin pillars of physical and administrative infrastructures to accomplish their aims, and have always done so using advance planning and strategic foresight.

The historical evidence of the twentieth century further suggests that societies oscillate between the poles of relying on infrastructure between times of distress and times of prosperity, on the one hand, in which societies invest heavily in infrastructure, and the times of relative normalcy, on the other hand, where public works tend to be neglected, again relative to the exuberance of abundance. These swings between infra-*philia* and infra-*phobia* are also evidenced in city planning, as this article has strived to show. If city planners are to attempt to achieve a balanced approach to cities and their planning, in which infrastructure planning integrated more fully with city planning, then one path can mediate the extreme swings between infra-*philia* and infra-*phobia* by a constant emphasis on planning and investing in infrastructure. Urban planners have much to contribute in this realm, including the use of a life-cycle approach to infrastructure that keeps infrastructure situated squarely in institutional and political agendas on a routine basis, instead of reacting to crises or fueling booms.

As systems theorists, ecologists, ethnographers, city planners, and others who have studied whole systems suggest, system "characteristics derive from the system."<sup>102</sup> This is so because parts of a system interact to endow a degree of integrity and functionality that is greater than the

sum of its parts. Separating components from a system, such as infrastructure from a city and its planning, weakens the whole. This article suggests a renewed link between infrastructure and urban planning in the professions and the academy. Strengthening the infrastructure–urban planning link is a critical task in order to make city regions more sustainable.

In a rejuvenated profession of city planning that fully integrates infrastructure, a city planner could rephrase a leading city engineer of a century ago by substituting her profession: “The office of the municipal engineer is of the greatest importance to the community. . . . In fact, the city government of today is in a large measure a matter of municipal engineering, and the character of the city engineer’s department is a safe index to the intelligence shown in the development of a municipality.”<sup>103</sup>

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61. Sam Bass Warner Jr., *Streetcar Suburbs: The Process of Growth in Boston, 1870-1900* (Cambridge, MA: Harvard University Press, 1962; reprint Cambridge, MA: Harvard university Press, 1978); Kenneth Jackson, *The Crabgrass Frontier: The Suburbanization of the United States* (New York: Oxford University Press, 1985).
62. Harold Lewis, *The Planning of the Modern City*, Vols. 1 and 2 (New York: John Wiley, 1949).
63. John Nolen, *City Planning: A Series of Papers Presenting the Essential Elements of a City Plan*, 2nd ed. (New York: Appleton, 1929).
64. Harvey Perloff, *Education for Planning: City, State and Regional* (Baltimore, MD: Johns Hopkins University Press, 1957).
65. Phillip Selznick, *TVA and the Grassroots: A Study in the Sociology of Formal Organization* (Berkeley: University of California Press, 1949).
66. Peterson, *The Birth of City Planning in the United States*, 322.
67. Marion Clawson, *New Deal Planning: The National Resources Planning Board* (Baltimore, MD: Johns Hopkins University Press, 1981).
68. Once again, similar activities were undertaken in the United Kingdom. Thomas Adams prepared eight advisory regional plans between 1924 and 1932, and introduced the American idea of a parkway into metropolitan design in his work around the city of London. Patrick Abercrombie, prior to leading the development of the Greater London Plan of 1944 and the Clyde Valley Plan of 1946 for the Glasgow urban region of Scotland, produced a series of advisory regional plans in the twenties. (See Hall, *Cities of Tomorrow*.) They were regional designs that guided the physical form of the region, and the location and size of new or expanded settlements. Infrastructure was to do the shaping.
69. Earl Mills, "Elements of an adequate comprehensive city planning program," *Planner's Journal* 2 (1936): 150-54.
70. Edward M. Bassett, *The Master Plan: With a Discussion of the Theory of Community Land Planning Legislation* (New York: Russell Sage Foundation, 1938).
71. Ladislav Segoe, ed., *Local Planning Administration* (Chicago: The Institute for Training in Municipal Administration, 1941).
72. Lewis, *Planning the Modern City* (New York: John Wiley & Sons, 1949).
73. Robert Walker, *The Planning Function in Urban Government* (Chicago: University of Chicago Press, 1941).
74. Michael Neuman, "Does Planning Need the Plan?" *Journal of the American Planning Association* 64, no. 2 (1998): 208-220.
75. Cliff Ellis, "Professional Conflict over Urban Form: the Case of Urban Freeways, 1930-1970," in *Planning the Twentieth-Century American City*, 262-79.
76. Adam Rome, *The Bulldozer in the Countryside: Suburban Sprawl and the Rise of American Environmentalism* (Cambridge, UK: Cambridge University Press, 2001); Jackson, *Crabgrass Frontier*; Chester Hartman, *The Transformation of San Francisco* (Totowa: Rowman and Allenheld, 1984).

77. Cliff Ellis (1996) chronicles the influence of highway engineers in American city infrastructure planning. "Municipal engineers in Chicago and Detroit produced plans for express highways as early as the 1920s." Furthermore, "the federal government entered the urban freeway debates forcefully only during the 1930s," with two influential documents prepared by highway engineers in the Bureau of Public Roads: *Toll Roads and Free Roads* (1939) and *Inter-regional Highways* (1944), the latter serving as a blueprint for the 1956 Interstate and Defense Highway Act.
78. Alan Altshuler, *The City Planning Process: A Political Analysis* (Ithaca, NY: Cornell University Press, 1965); Martin Anderson, *The Federal Bulldozer: A Critical Analysis of Urban Renewal 1949-1962* (Cambridge, MA: MIT Press, 1965); Aaron Wildavsky, "If Planning Is Everything, Maybe It's Nothing," *Policy Sciences* 4 (1973): 127-53.
79. Jane Jacobs, *The Death and Life of Great American Cities* (New York: Random House, 1961). Also, it should be noted that urban renewal did include a large dose of infrastructure provision, although this has been overlooked by some commentators.
80. Paul Davidoff, "Advocacy and Pluralism in Planning" *Journal of the American Institute of Planners* 31 (1965): 103-115.
81. Ian McHarg, *Design with Nature* (New York: American Museum of Natural History, 1969).
82. T. J. Kent, *The Urban General Plan* (San Francisco: Chandler, 1964); William Goodman and Eric Freund, *Principles and Practice of Urban Planning*, 4th ed. (Washington, DC: International City Managers' Association for the Institute for Training in Municipal Administration, 1968); Stuart Chapin Jr., *Urban Land Use Planning* (Urbana: University of Illinois Press, 1957; reprint, Urbana: University of Illinois Press, 1965): 965.
83. We do not interpret estrangement to mean complete divorce or separation. See the *Shorter Oxford English Dictionary*, 6th ed. (Oxford, UK: Oxford University Press).
84. Bonnie Lindstrom, "Public Works and Land Use: The Importance of Infrastructure in Chicago's Metropolitan Development, 1830-1970," in *Suburban Sprawl: Private Decisions and Public Policy*, ed. William Weiwei and Joseph Persky (Armonk, NY: M. E. Sharpe, 2002); Steven Erie, "Los Angeles as a Developmental State," in *From Chicago to L.A.: Making Sense of Urban Theory*, ed. Michael Dear (Thousand Oaks: Sage, 2002), 133-59; William Cronon, *Nature's Metropolis*; Harold Plat, *City Building in the New South: The Growth of Public Services in Houston* (Philadelphia: Temple University Press, 1983); Melosi, *The Sanitary City*; David Perry, ed., *Building the Public City* (Beverly Hills, CA: Sage, 1995); Benevolo, *The History of the City*; Lewis Mumford, *The City in History*.
85. Graham and Marvin, *Splintering Urbanism*, 18.
86. A review of the PAS Reports and books on the American Planning Association's Web site reveals numerous documents pertaining to these infrastructure efforts. They also underscore the two observations that follow.
87. Search terms we used in the content analysis of the plans were *infrastructure, capital facilities, community facilities, public facilities, public works, utilities, transportation, circulation, wastewater, water supply, open space, parks, and recreation* and other directly related systems. We examined the entire text of the following city plans: City of San Jose Planning Department, *San Jose 2020 General Plan* (San Jose, CA: City of San Jose Planning Department, 1994); City of Edmonton, *Capital City Downtown Plan* (Edmonton, Alberta, Canada: City of Edmonton, 1997); Portland Metropolitan Council, *Metro 2040 Growth Concept* (Portland, OR: Portland Metropolitan Council, 1994); Portland Metropolitan Council, *Urban Growth Management Functional Plan* (Portland, OR: Portland Metropolitan Council, 2007); City of Dallas, *Forward Dallas! Comprehensive Plan* (Dallas, TX: City of Dallas, 2006); City of Calgary, *Imagine Calgary Plan* (Calgary, Alberta, Canada: City of Calgary, 2007); Ontario Municipal Board, *Toronto Official Plan* (Toronto, Ontario: Ontario Municipal Board, 2007); San Francisco Planning Department, *San Francisco General Plan* (San Francisco, CA: San Francisco Planning Department, 1996-2009); City of Miami Planning Department, *Miami 21 Code* (Miami, FL: City of Miami Planning Department, 2009); City of Phoenix, *General Plan for Phoenix* (Phoenix, AZ: City of Phoenix, 2001).

88. Rolf Pendall, "Municipal Plans, State Mandates, and Property Rights," *Journal of Planning Education and Research*, 1 no. 2 (2001): 154-65; Rolf Pendall, Robert Puentes, and Jonathan Martin, *Review of the Land Use Regulations in the Nation's 50 Largest Metropolitan Areas* (Washington, DC: Brookings, 2006); Phillip Berke, David Godschalk, and Edward Kaiser, *Urban Land Use Planning*, 5th ed. (Urbana: University of Illinois Press, 2005).
89. Charles Hoch, Frank S. So, and Linda C. Dalton, *The Practice of Local Government Planning* (Washington, DC: International City Management Association, 2000).
90. Berke, Godschalk, and Kaiser, *Urban Land Use Planning*.
91. Koos Bosma and Helma Hellinga, *Mastering the City: North-European City Planning 1900-2000*. (Rotterdam: NAI Publishers; The Hague: EFL Publications, 1997), 2 vols.; Andreas Faludi and Bas Waterhout, *The Making of the European Spatial Development Perspective: No Masterplan* (London: Routledge, 2002).
92. The lead author has been to these cities and examined their plans.
93. Housing, while a strong planning root in Europe, is not as much a root in the United States. A debated puzzle in American planning history is why housing played a lesser role (Gail Radford, 1996. *Modern Housing for America: Policy Struggles in the New Deal Era*. Chicago, IL: University of Chicago Press.). We thank an anonymous reviewer for this insight.
94. American Water Works Association (AWWA), *Water Infrastructure at a Turning Point: The Road to Sustainable Asset Management* (Washington, DC: AWWA, 2006); Neil Grigg, *The Sanitary Condition of the Laboring Population of New York* (Boca Raton, FL: CRC Press, 2002); Institute of Transportation Engineers (ITE), *Transportation Planning Handbook*, 3rd ed. (Washington, DC: ITE, 2009); John Vogt, *Capital Budgeting and Finance: A Guide for Local Governments* (Washington, DC: International City Management Association, 2004). This shift goes back a long time. William Wilson's and Martin Melosi's meticulous analyses indicated that "beginning in the nineteenth century, municipal engineers deliberately preempted several planning areas, especially those involving sanitation, street grading and surfacing, drainage, and the oversight of [capital] improvement construction" (Wilson, *The City Beautiful Movement*, 285; see also Melosi, *The Sanitary City*).
95. Robert Wiebe, *A Search for Order, 1877-1920* (New York: Hill and Wang, 1967).
96. Paul Farmer, "Change," 3-4; American Planning Association (APA), *National Infrastructure Investment Task Force* (Chicago, IL: APA).
97. Gabriel Dupuy, *L'urbanisme des réseaux: theories et methods* (Paris: A. Colon, 1991); Graham and Marvin, *Splintering Urbanism*. Richard Hanley, *Moving People, Goods and Information in the 21st Century* (London: Routledge, 2004); Oliver Coutard, Richard Hanley, and Rae Zimmerman, eds., *Sustaining Urban Networks* (London: Routledge, 2005); Rae Zimmerman and Thomas Horan, eds., *Digital Infrastructures: Enabling Civil and Environmental Systems through Information Technology* (London: Routledge, 2004).
98. UNCHS Habitat, *Cities in a Globalizing World*; Peter Hall and Ulrich Pfeiffer, *Urban Future 21: A Global Agenda for Twenty-first Century Cities* (London: E& FN Spon, 2000); World Bank, *World Development Report*.
99. Hall and Pfeiffer, *Urban Future 21*; K. Bernhart and S. McNeil, "Infrastructure and Public Works Education: One Size Does Not Fit All," *Public Works Management and Policy* 5, no. 4 (2001): 318-28; UNCHS, *Cities in a Globalizing World*; World Bank, *World Development Report: Infrastructure for Development* (London: Earthscan, 2001).
100. Patrick Abercrombie, "Town Planning in Greater London: The Necessity for Cooperation," *Town Planning Review* 2 (1911): 261-80.
101. Alfred Bettman, *City and Regional Planning Papers* (Cambridge, MA: Harvard University Press, 1946).
102. Thomas Hughes, "The Social Construction of Technological Systems," in *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*, ed. Wiebe E. Bijker, Thomas P. Hughes, and Trevor J. Pinch (Cambridge, MA: MIT Press, 1987), 52.
103. Albert Noyes, "Organization and Management of a City Engineer's Office" (1894), p. 544 in Schultz, *Constructing Urban Culture*, 189f13).

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