THE PROBLEMS AND PROCESS OF INFRASTRUCTURAL IMPROVEMENT IN 19th CENTURY CITIES: A CONCEPTUAL FRAMEWORK AND CASES

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On October 8, 1871, a terrible fire ravaged the city of Chicago, reducing nearly four square miles of densely built up land to rubble. It took several days for the shock to wear off. Once it did, however, the destruction inspired a chorus of demands that Chicagoans take advantage of the disaster by rebuilding the burnt district better than before. Among the improvements people wanted were changes in the infrastructures that provided public services.[1]

Chicagoans clamored especially strenuously for improved water services. The fire had burnt the roof off the water works, shutting it down. So the most immediate need was to get the water works back in operation, a task that took two weeks. Even before this repair could be finished, however, the newspapers, the Fire Department, local engineers, and other concerned citizens were calling for a more far-reaching renovation of the water system as a whole. They demanded that the city establish a new network of water mains, fire reservoirs and wells, and mechanical Holly pumping works to supplement and enhance the inadequate water supplies and pressures provided by the existing, gravity-based, stand-pipe water system for fire fighting purposes. They also urged the city to increase substantially the number of fire hydrants in the inner city.[2]

The fire also inspired many demands for the modernization, physical expansion, and spatial reorganization of Chicago's railroad infrastructures. Railroad company executives and other business leaders called on the city to create new railroad rights of way to enable the companies that had been

sharing rights of way with other companies to establish separate ways, as well as to permit new railroads to enter the city. They also called for the construction of a lakefront union depot to centralize and rationalize the railroads' geographically far-flung, badly organized track and terminal facilities. At the same time, property owners, residents, and other critics of the industry demanded that the city force the companies to viaduct their hazardous grade crossings and otherwise limit the dirt, noise, and traffic problems their trains caused.[3]

The need for these improvements was clear. The Fire Department had been calling for renovations in the water system for several years. More to the point, the great fire had dramatized the deficiencies of the water system by burning down everything within a nearly four square mile section of the city.

The rail system was in equally bad shape. Over two hundred heavily laden trains chugged in and out of the city every day along tracks operated by twenty-five different lines. They were the economic wonder of the Middle West. As extensive as the track and terminal facilities already were, however, they were already to small to handle adequately all the business they had to carry. Worse, the haphazard geographical layout of the terminals made transferring freight and passengers from one line to another frustratingly complicated, time consuming, and expensive. The steady streams of trains also blocked street traffic; and worse, they often injured and even killed passersby in addition to threatening those they did not actually harm with the prospect of possibly imminent loss of life or limb. The trains also created serious noise and smoke problems, that, in combination with the street problems, blighted entire neighborhoods and helped turn them into slums.

These were serious as well as obvious problems. To solve them Chicago's rail and water systems would have to be substantially redeveloped, just as people were demanding. The fire seemed to have created a determination as well as an opportunity to make the necessary changes. Oddly enough, however, neither the city nor the railroads actually implemented any of the improvements in the aftermath of the great fire, except the one to increase the number of railroad rights of way.

Paradoxically, a great deal in infrastructural improvement took place in Chicago during reconstruction. The two year period following the fire saw the railroads, the Board of Aldermen (the city council), and the Board of Public Works embark on an ambitious program to extend and expand the city's rail, water, street, and sewerage infrastructures. The city established four new railroad rights of way, providing space for the trackage of twelve lines. The Board of Public Works also added 64 miles of new mains and distribution pipes to the water system, 34 miles of new collecting pipes to the sewerage system, and nine miles of paved streets to the street system.[4] This extended these infrastructures into previously unserviced peripheral area, primarily sparsely settled, newly developed middle and upper class districts. Significantly enough, however, neither the city nor the railroads made any of the crucial redevelopments of existing infrastructures demanded after the fire to improve conditions in the inner city. Quite the contrary, the expansion of infrastructures made conditions in the inner city in some ways worse.

One year after the great Chicago fire, another catastrophic fire destroyed 65 acres of densely built-up land in downtown Boston. Bostonians also responded to the disaster by calling for the improvement of downtown water service for fire fighting purposes. In addition, they called on the

city to take advantage of the destruction by widening and straightening the area's infamously crooked and narrow streets, so as to improve traffic flow and allow for the more effective positioning of fire fighting equipment in the future.[5]

As in Chicago, the following two years saw the city government undertake significant infrastructural improvement. As in Chicago, the city continued extending a broad range of public services into outlying areas. In this case, however, the city also undertook some improvements in downtown services. Again, however, the downtown improvement were considerably less than what was needed.

Improvements in the water system were made. Boston's Cochituate Water Board embarked on a $380,000 project to modernize the distribution pipes and fire hydrants in the downtown area. The Water Board and the City Council ignored requests by the Fire Department for $220,000 in additional improvements, however. Furthermore, the Water Board refused to heed Fire Department and City Council demands that it construct an auxiliary salt water supply for fighting purposes in the downtown area.[6]

Street improvements were also made. The City Council enacted a program to widen and lengthen a number of streets in the burnt district. In most cases, however, the widenings fell far short of what was initially expected; and, unfortunately, they left most of the system's bottleneck intact. As a result, the area's traffic jams continued to be a growing problem.[7]

What happened in these two cities is symptomatic of the process of infrastructural development in America in the 19th century in general. Municipal governments, utility companies, transportation companies, and real estate developers constructed huge water works and power generating

plants. They also built vast systems of water distribution pipes, paved roads, sewers, parks, harbor facilities, railroads and streetcar terminals and tracks, steam conduits, and telegraph and electric utility lines in city after city and town after town.

Their remarkable achievements continually fell short of community need, however. They often established infrastructures and they typically modernized and redeveloped them only after a catastrophic fire, an epidemic, a serious environmental crisis, and/or a successful political reform movement forced them to take action, which was usually long after the need for the improvement had become apparent.

True, government agencies and utility and transportation companies often moved quickly to extend services to upper and middle class neighborhoods, once they made the initial decision to provide the infrastructures. Some real estate developers even put some public services into selected areas years before the first houses were built, in the hopes of raising land values prior to home construction.[8] The real problems were in the inner city, however, where old infrastructures could not handle the demands for services from increasingly densely settled populations. The problems were also in the outlying areas in which poor people resided. Real estate developers rarely extended services to them in advance of settlement. Instead, as horrified health officials pointed out, poor people often had lengthy waits for such basic services as public water and sewerage, a situation which in many cases forced them to draw water from ground wells contaminated by seepage from unsewered privies.

What accounts for this paradoxical pattern of infrastructural development? The purpose of this paper is to discuss the factors which explain the contradictions and failures that characterized the otherwise magnificent achievements of this period. Infrastructural development involved three

basic kinds of change in 19th century America: the establishment of new infrastructures; the extension of infrastructures into unserviced areas as the city expanded; and the renovation, enlargement, and improvement and redevelopment of existing infrastructures to meet the expanding and changing needs of the inhabitants of the older, increasingly densely built up areas. This paper will focus specifically on the failure to improve existing water and rail infrastructures in Chicago after the great fire of 1871. It will also take a look at the problems of water and street improvement in downtown Boston after the great fire of 1872. To put these cases into proper perspective, the paper will also consider the general probelms of infrastructural development in 19th century cities. To address the larger issue, a brief review of the literature on the subject will be undertaken. A broad, interdesciplinary conceptual framework for analyzing the general problems of infrastructural development will also be outlined.

Historiographical Review

As a number of observers have recently pointed out, urban historians have not given the process of environmental development in American cities the attention it deserves. This is particularly true of infrastructural development. Historians have not completely neglected this aspect of city growth. For the most part, however, they have studied it in an essentially descriptive and cursory sort of way, primarily in the context of traditional narrative histories of individual cities, typically making little more than passing reference of the subject of public works while chronicling a wide variety of municipal developments and city government achievements.

A few historians have done much more than this. They have gone beyond the genre of city biography to focus directly on some aspect or as-

pects of the process of infrastructural development, such as the development of water, sewerage, electric utility, or streetcar service in a particular city or set of cities. A small number have also taken up the subject of the engineering technology that made possible the construction of a variety of infrastructures. For the most part, these historians have continued to work within the framework of traditional narrative history. Because of the narrowness of their focus, however, they have provided a richness of detail and a degree of narrative sophistication and analytical complexity about the history of infrastructures that has far surpassed anything provided by traditional city biography. Books like Nelson Manfred Blake's Water for the Cities, Thompson King's Consolidated of Baltimore, Louis P. Cain's Sanitation Strategy for a Lakefront Metropolis, Robert Caro's The Power Broker, and Harold L. Platt's City Building in the New South, to name a few notable examples, have given us a wealth of information about the problems as well as the process of infrastructural development in the 19th and 20th century cities.[9]

For all their richness of detail, however, these narrative studies of the history of urban public service development have also had their weaknesses. The basic limits have been the inherent limitations of the narrative style itself. In developing narrative studies of one kind of infrastructural change in a particular city or set of cities, historians have tended to leave us short of general insights into the multifaceted and complex problems and processes of infrastructural development as a whole. This is true even of Nelson Manfred Blake's comparative study of the provision of water services in Philadelphia, New York City, Boston, and Baltimore. Blake's detail is so thick, his narrative so literate, and his comparison so provocative, that the book is a minefield for insights into the general political and technological dynamics and problems of water service development. But Blake himself

has made little effort to step back from his narrative to make such generalizations. His comparison has remained largely implicit, apparently because commments on the general process and problems of water service development require a level of abstract analysis that was foreign to his narrative style.

There is no need to rehash either the virtues or the limits of narrative history here. Suffice it to say that in recognition of the constraints, historians in many fields have moved beyond the bounds of traditional narrative history to what is usually called "the new" history, or interdisciplinary history. They have begun integrating the theoretical concepts, comparatively abstract analytical perspectives, and statistical methodologies of a wide range of social sciences into their study of the past. Most have been social, cultural, political, or economic historians with little or no interest in the physical growth of cities. A few, however, have been urban historians, or political, social or economic historians whose work does throw distinctive light on the development of the urban environment, including infrastructural development. These historians approach the subject from a variety of disciplinary perspectives. Unfortunately for our purposes, some study it more obliguely than others, having subjects other than the physical development of infrastructures as their primary concerns. What is important, however, is that all do provide, to one degree or another, a more sophisticatedly abstract and general analysis of the subject than that offered by narrative historians.

The insights these historians provide into the history of infrastructural improvement fall into three different, but sometimes overlapping, interpretive categories: cultural analysis, political analysis, and economic analysis. So few historians do this kind of work that a quick description of

one or two examples in each category will, for the purposes of this paper, provide a satisfactory survey of this literature.

So far the most analytically sophisticated research is that which falls within the category of economic analysis. The most notable example is Alan Anderson's book, The Origin and Resolution of an Urban Crisis: Baltimore 1890-1930,[10] which presents a formal, theoretical model of city growth and the provision of public services. Like all economic models, Anderson's model of the development of public services in Baltimore is solidly grounded in an analysis of the interaction between supply and demand factors. His analysis begins with a consideration of the demand side factors necessitating the development of public services. They are the forces of population and income growth, which combined to increase land values in the central city. Anderson argues that rising land prices prompted city dwellers to use land more intensely. This required that they increase their investment in capital intensive infrastructures and buildings, which increased the ratio of capital to land within the city. The increased intensity of land use in turn created more and more negative externalities, like pollution and congestion, the reduction of which required further investment in capital intensive public services to reduce the negative externalities. In essence then, Anderson argues that the increasing intensity of land use created a demand for public services which was satisfied by government investments in new services. Alternatively, he says, demand was satisfied by private and public investments in transportation, which allowed inner city populations to disperse, causing a decrease in the intensity of land use.

Anderson proceeds to complicate this simple model of the demand and supply for public services. He argues that problems arose because the supply response was not smooth, but marked by discontinuities in which

the capital to land ratio fell below the optimal level. Capital investment in public services fell below the optimal level, because cities like Baltimore could not afford to pay the capital costs of improving existing infrastructures to the optimum, given the inadequacies of the technology of the existing infrastructure and the city's fixed investment in it. This caused an urban crisis, which could be resolved only by a switch to a new, more capital intensive public service technology, which would bring the capital to land ratio up to the proper level. The difficulty was that cities could not end a crisis until the externality costs of their failure got so high that it became economical for them to make the expensive technological switch. Anderson's example of this is Baltimore's early 20th century resolution of its sanitation crisis, which was accomplished by a switch from cesspools and storm drains to an integrated public sewerage system.

Anderson never clearly defines his optimal capital to land ratio. He argues, however, that a capital to land imbalance (and thus an urban crisis) is demonstrated in Baltimore by rising factor costs, which he quantifies in a graph which plots rising public service expenditure per capita. His data show a dramatic rise in municipal public service expenditures in the first years of the 20th century. This, he declares, "is indicative of the crisis which Baltimore faced."[11]

As several reviewers have commented, Anderson's abstract, economic analysis of the problem is intellectually challenging and intriguing. It falls apart, however, to the extent that the empirical proof of his thesis about the origins of the urban crisis rests on his interpretation of increasing factors prices, which he demonstrates with his graph of increasing municipal expenditures on public services. The problem is that the expenditure increases resulted from the city's investment in new infrastructures of all

kinds in the period following the great fire of 1904. Thus the data reflect the city's successful move to improve public services of all kinds (not only sewers), not its inability to do so.[12]

This is not to say the Anderson's economic logic is all wrong. It is essentially correct, at least as far as it goes. It boils down to a very simple explanatory model, namely that cities were able to satisfy growing demand for public services, only when things go so bad that the economic benefits of reducing negative externalities by investing in a new technology finally outweighed the costs of investing in the new technology. The idea that people will consume a good when the benefits of doing so outweigh the costs is of course a principle that is fundamental to all economic theory. Ironically, the idea suggests that no crisis actually existed in Baltimore, at least in a strict economic sense, because it would have been economically irrational for the city to invest in the new technology prior to the point at which it did, according to this logic.

Anderson's economic perspective leads him to construe the process of infrastructural development in fairly abstract terms as the product of a set of quantifiable supply and demand factors. As a result, he is not particularly concerned about the role that politics played in the provision of public services, even though his sewers, highways, and other public services were not private goods that could be provided through the normal operations of the market mechanism, and even though his own focus is on service provision by city government. This is because his economic approach dictates that political factors remain secondary to underlying market factors. In his words, "whatever the nature of the decision making process, it is secondary to technical and economic considerations. Politicians certainly do affect the short-run timing of innovation, but they must always

operate within the narrow constraints of technological and economic imperatives."[13]

Other economic studies of infrastructural development examine the subject in the same apolitical way, also attempting to explain the timing of public service innovation in terms of the economic factors which served to turn a simple need for more and better public services into an effective demand for them at a particular point in time. For example, in a recent paper, another Anderson, Letty Anderson, explained the timing of the introduction of public water supplies in a set of New England towns with the help of a theoretical model used to explain the diffusion of new technology within industry. She applied the model to the diffusion of water works technology from town to town in New England by analyzing econometrically the impacts that such factors as information uncertainty, cost/profit considerations, and town location and size had on the timing of decisions to introduce public water systems. She concluded that the variable that best explains the timing of water works adoption by individual towns was town location and size.[14]

At the opposite end of the spectrum is another category of analysis, political analysis. The political scientists who have studied the history of municipal public policy making have been obsessed with the question of who has held power in American cities. Their work has revolved around an effort to settle a debate over the question whether small, economically elite cliques have monopolized power in an undemocratic way or whether power has been shared by a variety of economic and social interest groups in a comparatively pluralistic, democratic manner. As a result, their books and articles have not been as directly focused on the process of infrastructural development as that of the economists. Nevertheless, because several poli-

tical scientists and theoretically minded political historians have spent a great deal of time and effort studying political conflict over issues relating to public service provision, their work does provide important insights into the subject of this paper. To be specific, it provides information on how different interest groups manipulated a government to obtain particular infrastructural improvements or to prevent the institution of improvements. It also provides information regarding the structural factors that enable certain groups to influence government decision making more effectively than other groups, and so to obtain more than their fair share of public improvements.

A notable example of a book in this category is Carl V. Harris's Political Power in Birmingham, 1871-1921.[15] It is a community power study, not an examination of infrastructural development. Harris breaks the population of Birmingham into three social groups and assesses the relative degree of political influence wielded by each. What is important is that he measures the power held by each group by, among other things, which got the largest proportion of the benefits of municipal expenditures on public services. His findings indicate that the middle ranking group, which comprised the upper 20% of the city's population (including upper middle class and middle class businessmen and residents, but excluding the city's top 1% of industrial elite) got a disporportionately large share of the benefits of municipal expenditures on infrastructural improvement. Within this group, downtown business interests got the lion's share of benefits until the mid-1880s, when a series of betterment assessment laws enabled the city to shift some of the burden of paying for improvements to the owners of abutting property, which then enabled well-to-do homeowners to obtain a large share of public improvements. In comparison, the top 1%

of industrial elites did surprisingly poorly, while the bottom 80% of the population, the working class population, not surprisingly, also did very poorly.

What makes Harris' study relevant to an analysis of the process of infrastructural development is that it includes considerable discussion of how influential groups exerted power over government decision making, besides measuring the degree of power each held. For example, Harris shows conclusively that a willingness and ability to pay betterment assessments gave certain interest groups an important means to manipulate government decision makers to obtain infrastructural improvements. Thus his study provides a political argument regarding the causes of the unevenness that characterized the pattern of infrastructural development in 19th century cities.[16]

The problem is that Harris does not explain the sources of political influence enough. As a result he cannot explain his anomalous finding that while middle class interests controlled the provision of public services, the top 1% elite group dominated government decision making over all. Unable to explain this, he can only say that the discrepancy indicates that power was not monolithically distributd in Birmingham in this period. This is a weakness in his analysis of the distribution of power in the city that is also indicative of a weakness in the political approach to explaining the problems of infrastructural development in cities. Because Harris focuses on political variables as exclusively as economists focus on market factors, he cannot explain his findings as thoroughly as one would hope. Why were Birmingham's middle class business interests able to obtain most of the benefits of municipal expenditure on infrastructural improvements, even before passage of the betterment assessment law? Harris shows that members of

the middle group held an inordinately large share of the offices of city government, but argues that office holding was not an important factor in determining the distribution of power in the city.[17] What then was important? And if the industrial elites were so powerful, why did they obtain so small a share of improvements both before and after passage of the betterment assessment law? Is it possible that they did not want improvements? In other words, is it possible that market factors as well as political factors helped determine the outcome of government policy making in this area, that objective economic demand forces generated by the disproportionately high intensity of land use in the business center influenced the territorial distribution of public improvements, contributing to the disproportionately large share delivered in the business center?

In addition to the economic and political approaches to analyzing the process and problems of the infrastructural development, there is a third approach which is based on cultural analysis. The best example of a study in this category is Sam Bass Warner, Jr.'s The Private City: Philadelphia in Three Stages of its Growth.[18] In this book Warner explicitly confronts the issue of explaining the problems of environmental development. He asks much the same question raised here, namely why, given all the environmental development that took place during the 19th century, did the public and private sectors fail to create "a humane environment for all [urban] citizens?" In attempting to answer the question, Warner to some extent bridges the gap between economic and political analysis. Like an economist he places his analysis within an economic context, decribing the sources of the increasing demand for public services that were not effectively satisfied by either the private or the public sectors. In addition, like a political historian, he makes an effort to discuss government involvement in

public service delivery in terms of the socio-political power structures which helped determine which interests groups would be able to influence government decision making most effectively.

What is important, however, is that his analysis hinges on an argument about the critical role played by cultural values in the failure to create a humane environment. Ultimately his analysis of the problems of environmental development boils down to a single idea, namely that American privatism (that is to say, American cultural exaltation of and obsession with the puruit of individual wealth and personal happiness) was the fundamental structural factor which prevented individuals, businesses, and government officials from taking the initiatives required to properly adapt the build environment to public needs. In Warner's words, the "failure of urban America to create a humane environment is thus the story of an enduring tradition of privatism in a changing world."[19]

Needless to say, Warner's argument makes sense. Alone, however, it hardly provides an in-depth and comprehensive analytical explanation of the problems of infrastructural development. Locked into an essentially cultural interpretation of the problems of city growth, Warner offers no hypotheses concerning political or economic factors that may have contributed to the failure to achieve a humane environment independently of the values of privatism.

In sum, historians have studied the subject of this paper in an interdisciplinary way from three distinct disciplinary perspectives. All of their work is insightful. When taken on an individual basis, however, none of it provides a completely satisfactory explanation of the process and problems of infrastructural development. Nevertheless, when taken collectively, their work provides the thematic framework for an explanation that would be

comprehensive. Clearly what is needed is an explanation of the process and problems of public service development which would in some fashion intergate and synthesize the economic, political, and cultural perspectives. The purpose of the next section of this paper is to construct a conceptual framework which will do just that.

The Conceptual Framework

At the simplest, most abstract level, the process of infrastructural improvement can be conceptualized as a three dimensional relationship between: (1) the economic and demographic stimuli provoking improvement; (2) the adaptive response necessitated by the stimuli; and (3) a wide variety of frictions that mediated the stimulus/response relationship. The frictions in the relationship provide the key to the following interdisciplinary consideration of the history of infrastructure provision. They are the theoretical constructs that will link an analysis of the process of infrastructural development to an analysis of the conflicts, contradictions and failures that plagued the process of development.

Population and economic growth in 19th century cities necessitated that a wide range of improvements be made in a large number of very different infrastructures. The improvements are too numerous to detail here. What is important, however, is that despite the complexity of the subject, it is possible to generalize about the frictions in the process of improvement. Generalizations can be made for three basic reasons. First, redevelopment took place within the framework of America's market and political systems, a framework whose distinctive characteristics imposed a significant degree of uniformity on the diverse aspects of the multifaceted improvement process. Second, redevelopment took place within the context of American culture, a

situation which also imposed a significant degree of consistency on the improvement process. Finally, all infrastructures, street, water, sewer, drainage, power, streetcar, and railway systems alike, shared some important, common physical and economic qualities. These physical and economic characteristics, in combination with the economic, political, and cultural context in which development took place, make it possible to speak in general terms about the many problems that obstructed and constrained the complicated process of infrastructural improvement in 19th century cities.

The common physical and economic qualities of infrastructures provide the key to unifying an analysis of the process of improvement. Briefly put, infrastructures shared the qualities of capital intensiveness, land extensiveness, and monopolistic production. They also displayed the consumption characteristics of public goods. They were capital intensive in that all required substantial and costly capital inputs in the form of pipes, tracks, pavement, various mechanisms, and so forth. They were land intensive in that all formed far-flung land use systems which occupied a great deal of space, either above or below ground. They were monopolistically produced, in that whether produced by private companies or public agencies, all were typically provided by only one producer at any given site, because of economies of scale, the tremendous costs of producing and maintaining infrastructures, the limited availability of space for infrastructural use, and exclusive franchises and rights of way. Even where city governments attempted to guarantee competitive production by granting overlapping franchises to utility and transportation companies, monopolies rapidly developed because the companies secretly merged, divided market territories, or otherwise arranged to cease competing in order to increase profits. Finally, all infratructures were consumed in a peculiarly public way which

complicated market interaction between the consumers and producers of public services. All infrastructures generated positive externalities, like improved health or business conditions, which the members of whole communities or neighborhoods passively enjoyed (that is to say, consumed) even if they did not personally use them. More important, all were jointly used (again that is to say consumed) directly by many people simultaneously and over time. Unlike the private benefits that private goods provided, infrastructures provided "inexhaustible" collective benefits that individuals did not appropriate and use up, but simply shared with other people who were using them at the same time or who would use them later.

Like the economic, political, and cultural context in which infrastructural development took place, these physical and economic qualities of infrastructures gave rise to frictions that mediated the relationship between stimulus and response in the process of improvement, causing the deprivation, the disjunction, and the failure that characerterized improvement. The stimulus-response conceptual model that provides the theoretical framework for the following discussion of the frictions is roughly analogous to the demand-supply conceptual model which underlies classical economic theory. There is a critical difference, however. Because infrastructures were space intensive, monopolistically produced public goods, the simple theoretical constructs developed by economists to describe the normal operation of the private market simply cannot adequately explain why it was so difficult to adapt public services to the requirements of rapidly growing cities.

For classical economists the basic constraint that holds back the satisfaction of human needs is precisely the constraint described by Alan Anderson, namely the unability or unwillingness of consumers to pay the costs

involved in expressing an effective demand for what is needed. Certainly this was, as Anderson points out, an important barrier to the improvement of public services in 19th century cities. To fully explain the problems of infrastructural development, however, it is necessary to broaden the analysis to encompass the consequences of the imperfections in the market caused by such problems as monopolistic production, public consumption, imperfect information, and externalities of production. This requires that the economic analysis of the problems of improvement be placed in a political and cultural context, making it possible, as well as necessary, to unify economic, political, and cultural insights into the subject into a coherent whole.

Supply Side Frictions: Cost and Technological Constants

The capital intensive nature of infrastructures created a variety of barriers to improvement. Because of the size of infrastructures, both private and public producers faced serious institutional, legal, and economic problems trying to raise enough money and obtain enough credit to meet the large, ongoing capital costs of infrastructural development. As a result, they often lacked the resources to make necessary improvement and make them properly.[20] Equally importantly, civil engineers faced a wide range of serious technological and practical problems attempting to develop the engineering theories, designs, and construction techniques needed to build infrastructures that could properly meet society's needs. As a result, they repeatedly designed long term flaws into public service systems, flaws that were extremely difficult to rectify because of the cost constraints and the other frictions to be discussed shortly.[21]

These cost and technological frictions are fairly obvious. They will therefore receive no further conceptual elaboration here. As to their appli-

cation to the Chicago and Boston cases, what is interesting is that the capital cost frictions were much more powerful constraints on infrastructural improvement than the technological frictions, at least during reconstruction. Needless to say, the inadequacies of the then-current state of the art engineering technologies put practical limits on what people in either city could do to improve public services. The real problem in these cases, however, was that for a variety of economic and political reasons, they were unwilling or unable to make use of new technologies to improve services.

Cost frictions hobbled both the railroads and the city governments. They bore especially heavily on the behavior of the city government of Chicago. Chicago had already reached the upper limits of a newly imposed state municipal debt ceiling, so it could not finance improvements by issuing municipal bonds. Worse, city officials had relatively little cash on hand, notwithstanding the timely receipt of $2,955,340 in state aid, because of careless tax collection procedures, unsound budget setting practices, recent state supreme court decisions which retroactively prohibited the collection of betterment assessment taxes, the charity of the Board of Aldermen which had rescinded nearly a million and a half dollars of the city's next taxes, and the generosity of the state assembly which had ordered municipal tax rebates on destroyed property to help the propertied sufferers of the fire rebuild.[22]

Boston's city government does not appear to have been at the boundary line of a state imposed municipal debt ceiling at the time of its great fire. Its budgetary flexibility was further broadened by the achievement of a state betterment assessment law in 1866, which finally authorized the city to begin financing street improvements with the help of betterment assessment taxes.[23] Because of their ability to raise money freely in commercial

capital markets, Chicago's railroad companies also had a degree of financial flexibility that the Chicago city government lacked, at least until the Panic of 1873.

Needless to say, however, none of these producers of infrastructures ever had the flexibility of completely bottomless pockets. Quite the contrary, finite budgets restricted what all three could do to meet the comparatively limitless needs of the people for more and better public services, forcing them to make trade-offs between competing demands for the repair, expansion, and improvement of their infrastructures, to one degree or another.

The question is, of course, why did they make the kinds of trade-offs they made? Despite budgetary problems, both the city of Chicago and Chicago's railroads spent millions to extend and expand water, sewerage, street and rail facilities, as did the city of Boston. Why did they and others like them expand infrastructures to meet the needs of certain users, while failing to make other kinds of equally, or even more, necessary improvements? The answer lies in an examination of the frictions generated by the other physical and economic characteristics of urban infrastructures.

Supply Side Frictions: The Problem of Site Assembly

A second category of friction resulted from the land extensive quality of infrastructures. Streets, sewers, water works and distribution pipes, power generating and distributing systems, railroad tracks and terminal facilities all required large amounts of space. Municipal governments faced no insurmountable legal barriers to acquiring this space because they had the power of eminent domain. They had only to follow prescribed legal procedures and condemn it, and the space was theirs. Because public

rights of way in the street provided space for underground and street-way infrastructures, they did not even need to condemn land formally to acquire sites for many kinds of improvements. Because a number of state legislatures and courts granted railroad and utility companies the power of eminent domain, these companies also had no legal difficulty obtaining the space they needed to extend and redevelop their infrastructures, at least in some cities.

There were, however, serious political problems that continually made site assembly an extremely difficult process, especially for city governments. Space was scarce in cities. As a result, the act of taking any bit of space out of private hands for public use inevitably set off a wave of unhappiness, outrage, and protest from the users, residents, and owners of the space in question. Every bit taken out of public use for a different kind of public use caused the same kind of anger from those whose lives or business would be disrupted by the taking. The individuals and corporations so affected generally turned to the political process to stop the unwanted change. Their ability to pressure court judges, state legislators, and city council members to compromise, delay, or block improvements created powerful site assembly barriers to infrastructural improvement.

To make matters worse, economic site assembly problems accompanied the political site assembly problems. The law of eminent domain required that the owners of condemned land be fairly compensated for their property losses. Railroad and utility companies were often able to escape having to pay fair compensation because they were powerful enough to influence the condemnation juries that assessed damages and determined compensation awards. Municipal governments were not so lucky, however. They were often forced to pay far more than the assessed tax value of the land they

condemned. In fact, they often had to pay condemnation costs that dwarfed the capital costs of infrastructural improvement. Property owners threatened cities with their proven ability to extract budget-breaking damages from condemnation juries, using this as a potent weapon to presure government officials into dropping improvements they did not want. Thus the economic costs of site assembly fed into and intensified the political problem of site assembly, in addition to intensifying the frictions caused by the capital costs of improvement.[24]

These site assembly problems affected infrastructural improvement both in Boston and Chicago. They had little effect on the improvement of water services in either city, because the public rights of way under the streets still afforded ample room for new pipes and conduits in both places. They served as powerful frictions in the street improvement process in Boston and in the street improvement process in Boston and in the railway improvement process in Chicago, however.

As might be expected, they were especially significant obstacles to the improvement of Boston's crooked and narrow streets. Boston's city council initially considered an ambitious plan to take the entire burnt district by eminent domain and completely redesign the street system to improve traffic flow in the congested area. The councilmen contemplated instituting a new, grid-like pattern of broad 80 and 100 foot wide streets, a plan that was so radical in scope that it would have eliminated one whole street and permanently changed all land ownership in the area. This horrified property owners. They promptly and successfully moved to stop the city from going forward with it.[25]

The city council then opted for a more moderate plan which involved only the widening and extending of existing streets to reduce congestion.[26]

Again, however, property owners moved to stop the changes, pressuring officials to drop the widenings or at the very least to take the land from the side of the street opposite to where they had their holdings. As the Boston Board of Street Commissioners said in a report, property owners mounted a wave of contradictory protest to the burnt district improvement plans that was "something unique in the wide experience the Board has gained in its previous dealings with the citizens." By threatening huge damage suits, they forced the Board to compromise its goals. And because they threatened huge damage suits if their land was taken, city officials, in the street commissioner's words, to pursue a "conservative course" and settle for widenings that caused "the least injury or inconvenience to abutters possible."[27]

As this indicates, the site assembly process carried profound dilemmas for government decision makers. How should trade-offs between competing land uses be made? Who should benefit from an infrastructural improvement? Who should be hurt? Such questions were especially difficult to answer in Chicago, where they were raised with particular acuity by the plan to rationalize the railway system through the construction or a lakefront union depot. In this case the answer translated into a complete failure to achieve necessary physical adaptations of the system.

The successful redevelopment of Chicago's rail system hinged on the achievement of the plan to build a union depot on the lakefront. The depot would comprise a huge terminal and vast switching yards that would be located in Lake Park and the submerged lands beyond the park (in Lake Michigan), which would be filled in for the purpose. Lake Park was a long strip of open shoreline, well over a mile in length, that stretched from Park Row on the south all the way to Randolph Street on the north, past down-

town, along the eastern side of Michigan Avenue. The area includes what is now Grant Park.

The Illinois Central proposed the union depot as part of a plan to obtain the authority it needed to expand its own, very inadequate, two-track lakefront right of way and existing depot. Chicago's newspapers, business leaders, and government leaders enthusiastically embraced the plan because it truly seemed to them to offer a fine solution to the long standing problems of the city's poorly laid out rail system. The lakefront was, as the Chicago Evening Post put it, "the spot marked out by nature," the "easiest, cheapest, and the most expedient" place to bring the railroads together and build a union depot. The space the lakefront provided was virtually limitless as well as advantageously located. Moreover, as the Chicago Tribune pointed out, a union depot at any other central location would require that a "perfect wilderness of track" be constructed over the existing gridiron of the street system, which would exacerbate the city's already horrendous street congestion and would be a "constant and increasing jeopardy to life and limb." Thus the lakefront was the only place for a union depot which would not worsen, and might actually relieve, both the city's railway problems and its street traffic and safety problems.[28]

What made the site especially attractive, however, was the fact that it was a place that seemed to offer a detour around the site assembly problem. It was, of course, a public park. The state legislature had consigned it to railway usage back in 1869, however, when it passed the "Lake Front Act." The "Lake Front Act" confirmed the city's earlier grant of lakefront development rights to the Illinois Central, the legality of which had been in question. In addition, the Act empowered the city to sell the three northern blocks of Lake Park to the Illinois Central for the construcion of a

passenger station.[29]

The detour was an illusion, however. Political problems prevented the railroads from taking possession of territory before the fire; and they continued to be a problem after it. After the state legislature had passed the Lake Front Act, the Board of Aldermen refused to sell the three northern blocks of the park to the Illinois Central, because the Aldermen were outraged by the paltry sum of $600,000 the state had specified for the sale. Equally outraged, Michigan Avenue homeowners had obtained a court injunction to stop the railroads from filling in the submerged lands in the hopes of saving their magnificant lake vistas. The federal district court had granted the injunction on several grounds, including complicated title questions and the claim that when the land west of Michigan Avenue had been plotted and sold in the 1830s, the land to the east in Lake Park had been reserved as public grounds to remain forever free and unmolested for the benefit of the owners of the plotted lots on the west side of Michigan Avenue.[30]

Opposition to the development of the park decreased after the great fire. Not only was the new union depot plan far more popular than the Illinois Central's narrowly conceived original plan, but the firm had destroyed the Michigan avenue mansions, presumably eliminating the rationale for the injunction. Most Michigan Avenue homeowners responded by withdrawing from the injunction.[31]

The problem was that the railroads continued to face serious opposition from a small number of powerful Chicagoans who still wanted to see Lake Park remain a park. Led by J.Y. Scammon, an influential lawyer, banker, Michigan Avenue property owner, and civic leader, the friends of Lake Park continued to fight the project. Scammon and one or two other Michigan Avenue property owners stubbornly refused to withdraw from the

injunction suit, and the courts refused to lift the injunction. To compound the Illinois Central's troubles, the District Attorney filed another suit to stop the company from filling in submerged lands and erecting freight houses, elevators, and tracks upon them, activities in which the company had been engaging to the extent possible ever since the passage of the Lake Front Act, despite the injunction.[32]

To get around these site assembly problems, the railroads set out to get the state legislature to give them the authority to take the land they needed for union depots by eminent domain. They obtained a law that gave them this power April 10, which went into effect July 1. By then, however, it was already too late for the lakefront union depot, or, indeed, any sort of union depot plan.[33]

The obstacle was a practical one: the railroad companies wanted to begin rebuilding their burnt-out facilities as quickly as they could. As a result, they began giving up on the union depot plan as soon as it became clear that Scammon was going to fight it. The idea was too good to die an immediate death, but die it did. By October 19, some companies were putting forth the suggestion of an alternative union depot in the West Division. By December 16, plans were "daily growing in favor" to bring the roads together at two West Division union depots on either side of the Chicago river, with a tunnel beneath the river to connect them. In early January, with fifteen new lines clamoring for admittance to the city, the idea mutated to the possibility of building three union depots, with city Aldermen, who were taking an increasingly active role in the affair, proposing a depot for the East Division by the mouth of the Chicago River, a depot for the West Division on three or four blocks of land north of 12th Street and west of the river, and a depot for the North Division on land

near the old Chicago & Northwestern depot on Kinzie Street. Getting the companies to agree on such a large scale scheme remained a problem, however, with the railroads complaining that they could not affort to purchase all the necessary land even if they got the power of condemnation. Thus the union depot idea finally disintegrated completely. The result was that the companies were soon building not one, but five separate depots in various places within a half mile of the central business district, most on the old sites of the depots destroyed by the great fire.[34]

The success the defenders of Lake Park enjoyed makes this confrontation a rather unusual event in the annals of nineteenth century urban history. Nevertheless, the controversy dramatizes not only the power, but also the larger complexities of the site assembly problem in general. As with all above-ground infrastructural improvements, the introduction of the union depot required substitution of one kind of land use for another, and, as a consequence, a fundamental trade-off between the interests of certain land users and those of others. Such trade-offs inevitably generated strife. As a lawyer in Boston put it while speaking on behalf of opponents of a plan to establish a new passenger railway line through congested, downtown Boston streets:

> There is a limit to space. The old doctrine that two bodies cannot occupy the same space is as true today as it ever was ... and the question is, in certain cases, which shall give way? Shall the people in the cars be crowded, or shall the other travel in the streets be crowded? There is inconvenience, injury, evil in both cases, but which shall give way?[35]

In neither Boston nor Chicago did any of the parties to such trade-offs want to give way. In Boston property owners did not want to give way to the people who wanted to move through widened streets more freely. In Chicago, park users did not want to give way to railroads, and vice versa.

In the Chicago case, the substitution was especially difficult to make. It not only necessitated that a trade-off be made between the private interests of a group of well-to-do Michigan Avenue property owners and a group of railroad companies, but also required that a trade-off be made between two public interests. The community either had to sacrifice its bona fide need for an integrated railway system or abandon an equally needed public park. Lake Park was the best place for a union depot. Unfortunately, it was also the only centrally located, inner city park that was accessible to the central business district, the only park that would provide the thousands of people working in Chicago's business center with relief from the pollution, congestion, and general hustle and bustle of downtown.

Like the cost and technological frictions created by the capital intensive character of infrastructures, these site assembly frictions are fairly obvious. They continually complicated and obstructed the process of improving and redeveloping streets, streetcar and railway lines, parks, ports, and (after underground rights of way became crowded), water, power, and sewerage systems in cities and towns in 19th century America.

Supply and Demand Frictions in the Private Sector

More subtle and complex are the frictions caused by the monopolistic production and public consumption of infrastructures. The barriers to change created by these two qualities cannot be analyzed separately because they are integrally related to each other. Nor can they be explained without reference to economic theory with which many historians may be unfamiliar. What is important is that together, monopolistic production and public consumption created several kinds of important frictions in the process of infrastructural development, frictions that overlapped and interacted

with the cost and site assembly barriers to change.

The basic problem was that monopolistic production and collective consumption destroyed the normal quid pro quo market exchange by which consumers traditionally transacted with producers to procure the things they wanted. They did this by enmeshing city dwellers in a web of supply and demand conditions which not only made producers insensitive to consumer demands, but also made it hard for people to express demands.

On the demand side, the market mechanism collapsed because individuals were unwilling to voluntarily purchase infrastructures and infrastructural improvements that many other people would ultimately use, often without paying for them. Few people had enough money to buy an entire infrastructure by themselves, of course. But even if they could afford to do so, few were willing to pay for anything more than the marginal benefit that they, themselves, would consume. Furthermore, collective consumption meant that everyone who would benefit from an infrastructural improvement had to somehow transact with the producer to procure and contribute to its cost, including those who would benefit indirectly through positive externalities. There was no easy way for large groups of people to get together and organize to engage in such collective market exchanges, however. So purely practical considerations also undercut the market mechanism for the public.

At the same time, the market collapsed on the supply side because the monopolistic character of infrastructures gave producers the captive markets they needed to be able to ignore demands that they provide improvements. The market mechanism also broke down on this side because producers were unwilling to provide improvements unless there was enough of a demand to justify production, something the demand constraints frequently prevented

consumers from expressing. It also broke down because collective consumption often made it physically difficult and expensive for producers to charge consumers on an individual, market basis for the use of public goods. For example, while it was possible for producers to attach pay boxes to streetcars and meters to the pipes that connected houses to water systems, it was very difficult for them to charge individuals for the proportionate benefit each derived from the collective use of streets, street lighting, sewers, fire hydrants, and many other public services. Worse, it was often nonsensical for them to try to do so, especially by traditional market methods. There simply was no way for them to charge people via the voluntary exchange mechanism of the market system for the positive externalities they unwittingly consumed in the form of better health conditions, better business climate, public safety and the like.

These conditions served as frictions in the process of infrastructural improvement because they simultaneously undermined both the willingness and ability of consumers to demand infrastructural improvements and the willingness and ability of producers to supply them. People could still use the press, organized lobbies, personal pressure, and the formal mechanisms of political demand articulation, the vote and the petition, to urge producers to provide the public services they needed. The difficulty was that where the producers were private companies, consumers were nonetheless still required to interact with the producers within the confines of the market system.

What does this mean? It means that in Chicago, for example, the public found it extremely difficult to motivate the railroads to viaduct their tracks to eliminate the grade crossings that clogged street traffic and endangered the safety of people using the streets. They also had no way

to induce them to take steps to reduce the noise and smoke pollution their locomotives caused. They could not organize to buy the improvements from the railroads on a collective basis. For the reasons discussed above, they did not even try. Exhortation did not work. So they put pressure on the city government to force it to act to compel the railroads to make the improvements.[36]

This is what happened after the great fire. When passing the ordinances that established the new railroad rights of way, the Board of Aldermen placed a requirement on the companies that they viaduct at least two street crossings per year. It was a small first step toward solving the problem of grade crossings at best. Unfortunately, the city was unable to enforce even this minor requirement. As it turned out, for a variety of political and legal reasons, the city was unable to force the railroads to viaduct their tracks in a significant way until the 1890s.[37]

This was not supposed to happen. In granting corporate charters and franchises to transportation and utility companies, state and local governments usually commanded the companies to serve the public interest. The fact was, however, that the companies were established to make money for their investors. As a result, they naturally ignored demands for improvements which could not generate a satisfactory profit, unless they were expressly required by the courts or by explicit provisions in their franchises and charters. They usually (though by no means always) provided public services in the well-to-do neighborhoods and business areas where they could make profits readily. The problem was that they balked at extending their systems into less renumerative, poor and remote districts. They also balked at redeveloping their systems to make use of new technologies, reduce pollution, and otherwise adapt their facilities to new and more intense

usage. Like Chicago's railroads, railroad companies everywhere refused to heed demands that they eliminate hazardous grade crossings. Gas companes refused to replace their old, too small, and leaky pipes. Telephone, telegraph and electric companies refused to take down their dangerous and encombering poles and roof-top fixtures and voluntarily move their hazardous wires underground. Streetcar companies refused to interconnect and systematize their lines and terminals so that interruptions in travel could be reduced and transfers between lines facilitated. They refused to make the improvements, because the services they provided were monopoly goods, and consumers had no choice but to put up with and use whatever inadequate services they provided.[38]

Supply and Demand in the Public Sector: The Supply Side

Theoretically, government intervention in the infrastructural improvement process offered the perfect solution to this market breakdown. As political institutions operating outside it, governments were not only much freer to produce unrenumerative public goods and unmarketable positive externalities to meet consumer demands than private companies, but they were also far more responsive to non-market forms of demand articulation, like voting, petitioning, and other kinds of public pressures. In addition, their taxing powers gave them an important, non-market means to finance improvements. This gave them extraordinary power to make improvements in areas where the inhabitants could not afford to pay for them. It also gave them the means to pay for improvements that could not be financed through ordinary market transactions between consumers and producers.

The problem was that government officials also operated under constraints that limited what they could do to provide the public services their

communities needed. The most obvious constraints were those on the supply side that affected their ability to produce infrastructural improvements. These constraints resulted from the very nature of government decision making. They went far beyond the cost, technology, and site assembly frictions discussed above.

Government intervention in the infrastructural improvement process replaced the narrowly focused, "bottom line" market-based decision making practices of the private sector with a process of political decision making that was based on the democratic idea of agreement by consensus. Unlike utility and transportation company executives who operated in a corporate arena on behalf of stockholders, government officials operated in a political arena on behalf of voters and taxpayers, the very people who used and paid for infrastructures. In essence, the officials took the separate consumption and production activities that the market normally arbitrated and combined them into a single decision making process: the politically arbitrated process of government decision making. The problem was that because thousands, even millions of people consumed and paid for infrastructures, this introjected all the difficulties and dilemmas of large group decision making directly into the production process. Like their constituents, government officials disagreed about the desirability of making specific improvements on many grounds, battling over budgets, technical considerations, party interests, and the siting of improvements. These conflicts were often quite irrelevant to the exigencies of particular community needs. Because government decision making depended on the formation of political consensuses, however, they were often enough to prevent the production of infrastructural improvements for which objective community needs existed.[39]

To complicate matters, the institutions of municipal government were

structured in such a way as to generally require the achievement of several political consensuses for the production of improvements. Most city councils were made up of two separate houses, both of which had to approve an improvement plan for it to be instituted. In addition, one or more separate city council committees had to approve each plan, as did the mayor, and, in many instances, the members of various executive branch departments and committees, each of which typically had considerable decision making autonomy. To further complicate matters, it was also in some instances necessary to obtain political consensuses that were external to the city government per se. Most Victorian era city governments labored under very narrowly framed and antiquated city charters that did not specifically grant them the authority they needed to undertake certain kinds of improvements. This necessitated that city officials engage in another complicated step in the consensus building process, this time one that involved securing approval from the two independent houses of state government. This meant that officials had to secure the formal approval of a majority of the voters to be able to finance some improvements. Finally, where forced by law suits, city officials also had to obtain judicial endorsement of their plans from justices at various levels of the state and federal court system before they could go ahead and implement improvements.[40]

These government decision making problems served as serious frictions in the infrastructural development process because they gave opponents of any given infrastructural improvement multiple opportunities to compromise, delay, or stop the production process, again regardless of whether an objective need for the improvement existed. For example, they contributed directly to the whittling down and compromisation of the street improvement plans in Boston.

As noted earlier, the site assembly problem was one of the most important obstacles to street improvement in Boston after the great fire of 1872. To complicate matters, the fragmented nature of government authority in the city and the state interacted with the site assembly problem, compounding the negative impact of property owner opposition to the taking of land for the proposed improvements. Divisions of power between the city and the state helped kill the original radical street improvement plan. The City Council had to obtain authorization from the state to take the burnt district by eminent domain in order to implement the radical proposal. The members of the City Council dropped the radical plan in part because of fears that it might take months, or worse, prove impossible, to get both of the houses of the Massachusetts General Assembly to approve the necessary enabling legislation.[41]

The City Council did not have to obtain special enabling legislation to carry out its second, more moderate improvement plan. Instead, the moderate plan fell victim to serious divisions of power within the city government. There were three independently elected agencies within the government which had responsibility for approving most street improvements: the Board of Street Commissioners (created by the state in 1870) -- the Board of Aldermen, and the Common Council (the two houses of the City Council). The independently elected members of the Board of Street Commissioners held the power formerly exercised by the Board of Aldermen for determining and instituting street widenings and extensions. However, the Common Council and the Board of Aldermen had to approve or veto the improvements proposed by the Street Commissioners, whenever the individual improvements would cost the city more than $25,000. This meant that both houses of the City Council had veto power over almost all of the burnt district street im-

provements decided upon by the Street Commissioners. As it happened, their veto power only indirectly constrained the improvement process, since they exercised their veto power only once. It did have an impact, though. It added considerable last minute drama and suspense to the approval of several improvements by one or the other house. More importantly, it put additional pressure on the Street Commissioners to compromise their improvement plans, because they had to plan the improvements in light of the need to move them successfully through the gauntlet of the two houses. This encouraged them to moderate the proposals to increase the likelihood that they would indeed be passed. The members of the two houses of the City Council exercised their independence by holding separate hearings on several of the most controversial proposals.[42]

Interestingly enough, such divisions of power played only a peripheral role as frictions in the process of infrastructural improvement in Chicago after the great Chicago fire. As noted earlier, Chicago's city government did nothing to redevelop the water system aside from installing a few new water hydrants in the central business district, despite demands from many quarters that it redevelop the system on a comprehensive scale for the purpose of better fire fighting. The city did nothing more than this, not because the improvements got bottled up in a stalemated Board of Aldermen or vetoed by the Mayor, but because neither the Board of Aldermen nor the Board of Public Works even put the improvement on their agendas. Both turned deaf ears to the demands being made by the Fire Department, the newspapers, and other interested parties demanding that the system be improved on a major scale.

Government Production: The Demand Side Frictions

The unresponsiveness of the Chicago city government reflects another category of friction in the infrastructural improvement process, namely a set of political demand-side frictions. These constraints also resulted from the monopolistic and public characteristics of infrastructures.

As explained earlier, it was almost impossible for people to express effective, collective demands for public goods through the individualistic quid pro quo exchange mechanism of the market system, because of the problems of joint consumption, externalities, and monopolistic production. This compelled the inhabitants of Victorian cities to turn to political methods of making their needs known, in addition to forcing them to use political means of producing the improvements. The problem was that political demand articulation could often be as fruitless as market demand articulation. Chicago's Board of Fire Commissioners explained the difficulty very well in a report on why the Fire Department had not been able to stop the great fire from destroying the city. The fact was that they had never been given the means to fight the fire effectively, because neither the Board of Public Works had ever paid any heed to their demands that they be given better facilities. The Fire Commissioners had been "advising and entreating" city officials to increase the number of fire hydrants in the city, build a set of Holly pumping works, establish fire reservoirs, and make other improvements since the middle 1860s but they had had absolutely no success. The reason? "NOBODY NOTICED US," they explained wth justifiable frustration. "None of these things were noticed by the major, the common council (Board of Aldermen), or the newspapers. The only thing we could do was ask for an increase of the engine companies, so that we might be prepared as well as possible to contend with the great fires which were and

still are likely."[43]

There was a supply side institutional friction involved here as well as a demand articulation friction. City law prevented the Fire Department, the natural government spokesman for water system improvement, from making any changes in the water system. The law even prohibited the Fire Department from undertaking small scale projects of purely departmental interest, like the construction of new fire hydrants. All power to improve infrastructures was concentrated in the hands of the Board of Public Works. The demand side constraint was that the Fire Department simply had no way to induce the Board of Public Works to take action on its requests, no way to express its demands effectively. The Board of Public Works had a monopoly on the production of improvements. It could therefore do as it wished, unless its hands were forced by the members of the Board of Aldermen. But the Aldermen had no interest in the issue either.[44]

Similar demand articulation problems plagued Boston's Fire Department. Like Chicago's Fire Commissioners, the Chief Engineer of Boston's Fire Department had been calling for major improvements in the city's downtown water system for several years prior to the city's great fire. In Boston's case, the power to make the improvements rested with the Cochituate Water Board. The Cochituate Water Board continaully refused to pay the Fire Chief Engineer any heed, even though the extremely concerned Chief had gone so far as to prepare an elaborate map to demonstrate pictorially the inadequacies of the downtown hydrants and water mains, in the hopes of making his demands effective. The city council had been more receptive to the Chief Engineer's pleas. It had passed an order that instructed the Water Board to construct the auxiliary salt water system the Chief Engineer wanted. Because the Water Board was an independent agency, however,

even the city council had not been able to compel the Board to make the improvement.[45]

The Boston experience differs from Chicago's in that after the great Boston fire the Cochituate Water Board finally did undertake at least some of the improvements that the Fire Department demanded. This appears to be primarily because the City Council appropriated money to pay for the improvements, relieving the Water Board of the need to pay for them through its own finances.[46]

What is striking is that Chicago's Board of Public Works did nothing to improve the water system in downtown Chicago, other than add a few new fire hydrants to the business center, despite demands for broad-scale change from many quarters and despite the catastrophic dimensions of Chicago's great fire. The communications breakdown described above explains this, as do other, more subtle demand-side frictions.

These other demand-side frictions become evident when one puts the Board of Public Work's unresponsiveness on this issue in the context of the many things it was doing to extend water service, sewerage, and paved streets to outer districts of the city. The Board added many miles of pipes and conduits to the water and sewerage systems and several miles of pavement to the streets. But what is interesting about these extensions is that the Board undertook them independently of any planning impulse that might have been generated by the fire, carrying them out in its customery, business-as-usual, ad hoc, piecemeal manner, in response to petitions from homeowners and real estate developers.

The Board seems to have had little choice in this. State law compelled property owners to pay for street improvements themselves originally through betterment assessments and, after the courts outlawed betterment assess-

ments in 1871, through private contracts arranged directly through the Board. This meant that the Board could pave streets only at property owners' requests. The city paid for water, sewer, and sidewalk improvements with general tax revenues, so the Board did not by law have to play the role of private contractor to extend these infrastructures. The Board customarily did as property holders bid here, too, however, making the extensions in response to petitions and requests from the people who would directly benefit.[47]

Again, it had no choice. As John Rauch, the City Physician, noted in a report on Chicago's sewerage problems, homeowners and real estate developers could always get the infrastructural extensions they wanted if they had sufficient economic clout, even if the Board was inclined to ignore them. They simply pressed the Board of Aldermen for street paving orders, favors the duly elected Aldermen were happy to supply, since the city did not pay for street pavements. The paving orders compelled the Board of Public Works to lay down water and sewer pipes before the streets were paved to save the cost of tearing the streets up later, forcing it to commit its limited budget to the extensions whether the money could be better used elsewhere or not.[48]

As this indicates, the Board of Public Works was not completely deaf to consumer demand articulation. The problem was that some groups were better able to capture the Board's ear. This is a manifestation of the other set of demand articulation frictions in the process of infrastructural development.

City dwellers had a difficult time expressing effective demands for infrastructural improvements through political means partly because there were only two formal mechanisms of political demand articulation that were

equally accessible to them, namely the vote and the petition. The problem was that at best all that votes and petitions enabled enfranchised citizens to do was to get their demands placed on a legislative or bureaucratic agenda for further government consideration. Unlike the quid pro quo of the private market, they did not enable people to actually acquire desired improvements. Instead, legislators and administrators had to transact with producers to procure the improvements on the voters' or petitioners' behalf. This is turn required that the officials agree to act on their demands, something that depended on the achievement of a problematic and often time-consuming government consensus.

The uncertainty and obliquity of this forced the individuals who were determined to obtain public improvements quickly and efficiently to use less formal, more direct methods of influencing officials. Not surprisingly, they turned to political proxies for the quid pro quo exchanges of the market. The most obvious proxies were monetary bribes. As a result, as innumerable political reformers, muckrakers, and historians have pointed out, "pay-offs" became one of the most important means by which government decision makers determined municipal public policy.

Urban historians have often interpreted these pay-offs as benefits that machine politicians distributed to their supporters to reward them for supporting their activities. In an influential book, Seymour J. Mandelbaum has gone so far as to link this reward system to a political communications failure that resulted from the lack of effective intra-city postal, telegraph, and telephone service and the absence of an unbiased, unsegmented urban press, a situation which, he argues, forced government officials to pay bribes in order to mobilize support for government expenditures in the socially and geographically fragmented cities of the 19th century. In

Mandelbaum's words, "The lines of communication were too narrow, the patterns of deference too weak to support freely acknowledged and stable leadership. Only a universal payment of benefits--a giant pay off--could pull the city together in a common effort."[49]

There was, as Mandelbaum asserts, a serious communications gap that payoffs were designed to bridge. The gap resulted from problems that were much more fundamental than the technological conditions to which he refers, however. It resulted rather from the very nature of the public goods that government provided and from the intrinsic weakness of the vote as an instrument of collective demand articulation, conditions that forced the users of urban public services to turn to political equivalents of the market's quid pro quo, as well as power-hungry politicians.[50]

Lobbying gave city dwellers another, more ethical way to manipulate decision makers. Since it did not involve a direct quid pro quo exchange between demand makers and decision makers, lobbying was a less potent demand articulation mechanism, since people simply tried to convince officials that doing as they wished would yield an important public benefit, rather than promising that it would give them an important private benefit. Nonetheless, lobbying was more effective than simply voting for or petitioning officials.

These demand conditions served as powerful frictions in the process of infrastructural development because they influenced government decision making in a way that biased and distorted the production and distribution of improvements. City planning as it is today did not exist in the 19th century. Although professional engineers helped design and construct the public works of the time, the "experts" did not "plan" them. As the behavior of Chicago's Board of Public Works (and the Boston Board of Street

Commissioners suggests, neither they nor the politicians who ran city governments attempted to organize the production process in a modern, "scientific," top-down, bureaucratic manner, gathering and interpreting a large part of the information on which they based their development activities independently of the political process in order to systematically devise improvements to meet the needs of the future. Instead they planned improvements in a highly political, comparatively democratic, ad hoc, from-the-bottom-up manner, in response to consumer demands expressed through hearings, payoffs, public and personal pressure, votes and petitions. Because payoffs and personal contact and pressure functioned as superior instruments of political communication, this allowed individuals and corporations with the ability to apply pressure and make bribes to dominate the demand articulation process. This, of course, required wealth, influence, and access to decision makers. The uneven distribution of these properties in urban society prejudiced the whole process of infrastructural improvements against the needs of poor, politically weak, and inarticulate city dwellers in favor of the relatively narrow interests of a comparatively articulate and privileged few.[51]

Successful demand articulation depended on a willingness as well as an ability to express demands through votes, petitions, public and private pressure, and bribes. As a consequence, apathy and ignorance also slowed and distorted the process of infrastructural development. Once basic services were established, ordinary people tended to make do with what they had, no matter how unsafe, inadequate, or inconvenient this was, at least until the infrastructure broke down, burned down, or collapsed. And even then, they did not always understand that the infrastructure needed fundamental redevelopment, rather than simple repair. Even in Chicago people did not organize on a massive basis to force the Board of Public

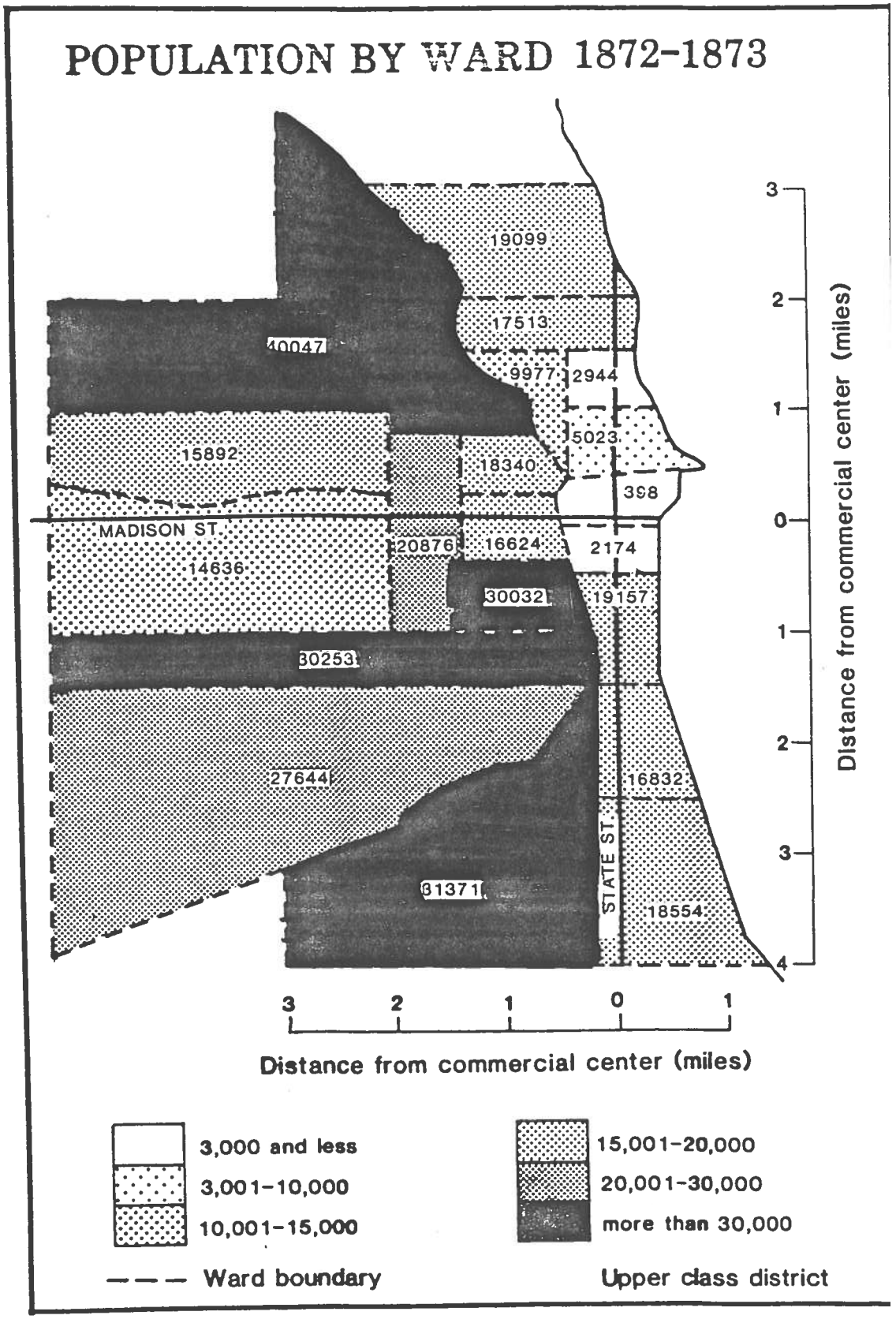
Works to improve the water system for fire fighting purposes after the disaster of their terrible fire. This is not surprising, given the technical complexity of the water system's problems and the "it can't happen again" nature of the fire threat.[52] (It did happen again, however. In 1874, another massive fire ravaged another large section of Chicago's densely built-up inner city, including a part of the area that the 1871 fire had scourged.)[53]

What is important is that such failure to demand improvement translated into another communications breakdown that was a serious problem in an era in which government officials based their public policy decisions on input from their constituents. Significantly enough, this failure further biased government decision making toward a pattern of satisfying the demands of a relatively articulate and privileged few, who were typically suburban real estate developers and well-to-do homeowners eager to enhance the beauty, prestige, and market value of their property.

Nineteenth century methods of financing infrastructural improvement also reinforced the social bias in the development process, further disadvantaging poor people. Requirements, like Chicago's street paving rule, that abutters pay for improvements themselves naturally inhibited improvement in poor areas. Betterment assessments did the same. Betterment assessments placed a special tax on abutting property owners in order to force them to contribute to their cost. The problem was that impoverished working class homeowners who could not afford to pay the tax, like slumlords who had no desire to pay it, rarely petitioned, lobbied, or bribed officials to get improvements instituted.[54]

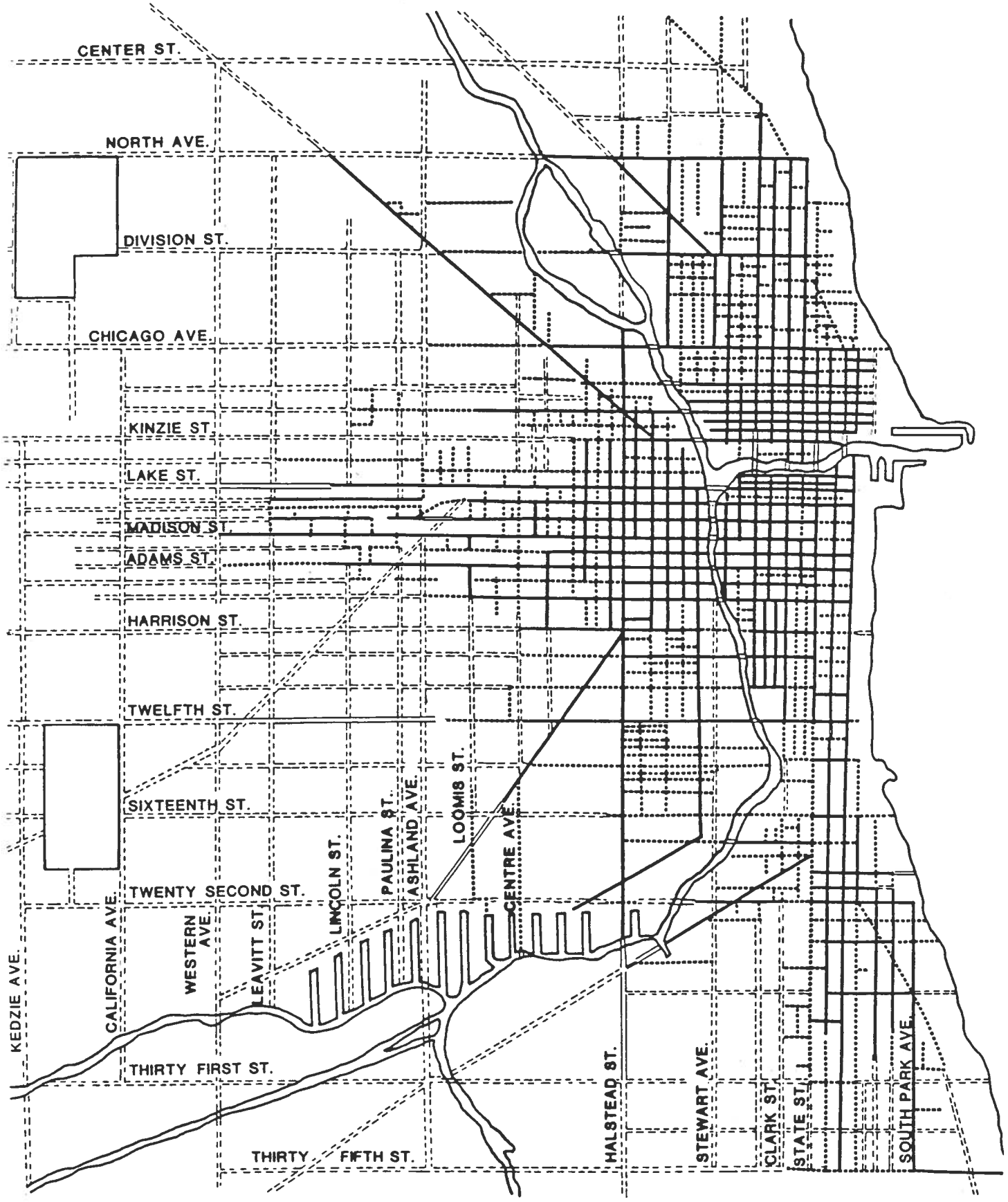
These demand frictions took a serious toll on the improvement of water and sewerage infrastructures in reconstruction Chicago. There is no direct

FIGURE I


POPULATION BY WARD 1872-1873
19099
17513
40047
9977
2944
5023
15892
18340
398
MADISON ST.
20876
16624
2174
14636
30032
19157
30253
27644
16832
STATE ST.
31371
18554
3
2
1
0
1
2
3
4
Distance from commercial center (miles)
3
2
1
0
1
Distance from commercial center (miles)
3,000 and less
3,001-10,000
10,001-15,000
15,001-20,000
20,001-30,000
more than 30,000
Ward boundary
Upper class district

CHICAGO 1873

SHOWING SEWERS, PAVED STREETS AND BRIDGES



Paved streets (wooden blocks or gravel

Paved streets with sewers

Bridge or tunnel

Unpaved streets

Unpaved streets with sewers

FIGURE II

evidence that sururban real estate developers actually bribed officials to obtain extensions of water and sewerage infrastructures. It is clear, however, that they successfully manipulated the Board of Public Works to obtain them, and that they got them at the expense of more needy inhabitants of the city. As the City Physician explained in his sewerage report, prevailing budgetary constraints made demand articulation a devastatingly competitive contest on all counts. "Many" instances occurred both before and during reconstruction, Rauch wrote, "where interested parties...secured sewerage, even to a deviation from the system, when other streets, not far remote and strictly in accord with the system, were neglected, although sewerage in them was much more needed, owing to their density of population, low ground, and nature of soil." The preferential treatment the Board gave middle class, suburban real estate developers and well-to-do homeowners is evident in the maps and in Figures I and II. Map I shows the distribution of population in the city in 1873. Map II shows the distribution of street and sewerage infrastructures by street in 1874. Together they show that many heavily populated working class districts in the North, South and West Divisions were devoid of these infrastructures, while sparsely settled upper class streets like Prairie and Indiana Avenues (which only began to build up after the fire) had sewers as well as pavements as pavements as far south as 35th Street.[55]

What is important is that the Board's reluctance to extend infrastructures into poor areas helps explain its failure to improve and redevelop water services in the inner city. In attempting to excuse its preferential treatment of middle and upper class sururban developments and its neglect of other improvements, the Board of Public Works usually cited the budgetary constraints that prevented it from making everybody happy. As its handling of extensions shows, however, the root problem was the Board of

Aldermen's and the Board of Public Works' whole approach to planning infrastructural improvements. Both Boards depended on the people to tell them, through votes, petitions, political pressure, and political quid pro quos, what improvements the city should make. Because of the unequal distribution of wealth and influence in society, however, they were inordinately receptive to articulate real estate developers and middle and upper class homeowners' demands, which, by distorting governmental information gathering, deafened them to other definitions of the public interest. The Board of Public Works appears to have been more evenhanded in its treatment of critical water service extensions (apparently because of Aldermenic pressure), or so the comparatively large number of miles of water mains and distribution pipes it laid suggests. Inevitably, however, the Board favored extending infrastructures into outlying middle and upper class residential neighborhoods at the expense of everything else, for there was nothing to countervail the socio-economic bias in the demand articulation process on which it based its ad hoc, unscientific, from-the-bottom-up approach to planning infrastructural improvements.

Interestingly enough, Chicagoans ultimately managed to bridge the communications gap that had deafened the Board of Public Works to their demands for redevelopment of the water system in the inner city. The great fire of 1874 destroyed some 60 acres, so alarming people that they finally organized to force the Board to make improvements in the system to protect the inner city from future conflagrations. The city's business and civic leaders formed the Citizens' Association of Chicago and under its auspices waged an intense and massive political reform movement which finally forced the Board of Public Works to begin to modernize the water system. It is significant that it took an organized political reform movement

to achieve the supply response required for the production of these improvements. The lengths to which Chicagoans had to go to obtain improvements in the system is further testimony to the significance of the demand articulation frictions in the process of infrastructural developments in Chicago in this period.[56]

Cultural Frictions

Cultural factors intensified the practical, political and economic barriers to the improvement described above. They resulted from the privatistic values that Sam Bass Warner, Jr. put at the core of his analysis of the problems and process of city growth in Philadelphia. As Warner points out, 19th century American culture socially and morally exalted the pursuit of wealth and personal happiness. Unfortunately, infrastructural development, by its very nature, usually benefited some people more than others or benefited some people while hurting others, while privatism made it difficult for people to perceive or care about the clash between their own self interests and the public interest. Thus cultural factors encouraged city dwellers to engage in political demand articulation with the single-minded goal of enhancing their own interests, stimulating and legitimating the behavior that led to the governmental stalemates, compromises, and biases that plagued the process of improvement. As Boston's Street Commissioners put it in a report on the resons why they had had to compromise on their burnt district street improvement goals, selfish property owner opposition to their plans had compelled compromise: "Everyone was pleased at the idea of a good wide street."[57] The problem was that "nearly all wanted to have the land taken from the opposite side" from where their land was located. John Rauch, Chicago's City Physician, said much the

same thing when explaining how suburban real estate developers and home-owners had distorted the infrastructural improvement process by pushing for sweerage and water service in their neighborhoods with little or no thought to the costs to others: "Little did these parties think or care that the enhanced value of the property incident to drainage was at the expense of the lives of some of their fellow beings, to whom life was as near and dear as to themselves."[58]

Conclusion

In sum, the capital intensive, land extensive, monopolistic, and public qualities of infrastructures interacted with the American political, economic, and cultural systems to create a wide variety of frictions in the process of infrastructural development. These frictions continually complicated the relationship between the stimuli necessitating infrastructural improvement and the supply response (the production of improvements), slowing the production process in many ways, frequently grinding the gears of public service development to the point of environmental breakdown.

Urban historians often treat the process of city growth as if it were the product of a simple and direct relationship between growth stimuli and growth. The purpose of this essay has been to argue that the relationship was not simple, that on the contrary it was continually disrupted and deflected by a number of causal factors, which have been labeled here as frictions. This essay has described the derivations of the frictions largely in terms of their material origins in the infrastructures themselves. As the description of infrastructural development in Boston and Chicago indicates, the frictions cannot be abstracted from the socio-political conditions of 19th century urban life, conditions which distributed wealth and political influ-

ence in unequal proportions across city populations. Neither can they be abstracted from the harsh and simple economic and geographical realities of the limits of municipal and corporate treasuries and the finitude of urban space, both of which were resource scarcities which existed independently of infrastructures with their distinctive physical and economic qualities. It is the argument of this paper, however, that a useful way to conceptualize and think about the problems of infrastructural development in 19th century cities is to analyze the obstacles to change in terms of the intrinsic physical and economic characteristics of the infrastructures themselves. This way of explaining the problems of improvement provides a conceptual framework that can encompass and integrate economic, political, and cultural analysis of the problems of improvement.

Could the problems of infrastructural development have been averted? Could city governments and utility and transportation companies have satisfied the virtually unlimited needs of 19th century urban populations for more and better public services in a prompt and effective way? The implication of this analysis is that no, they could not have. The implication of an analysis of the problems of infrastructural improvement which is based on analysis of the intrinsic qualities of infrastructures is that the problems of improvement were inescapable. Municipal governments and utility and transportation companies might have distributed their inadequate supply of improvements more fairly; but they could have done this only if urban economic, environmental, social, political, and cultural conditions had been different. Thus the problems of improvement were indeed inherent in the very process of improvement.

ENDNOTES

1. For descriptions of the fire and its aftermath see Elias Colbert and Everett Chamberlin, Chicago and the Great Conflagration (Cincinatti and New York, 1871) and city newspapers from October 8, 1871 to October 11, 1873. See also Christine Rosen, The Limits of Power: Great Fires and the Process of City Growth (New York, forthcoming), Chapter 6.

2. Chicago Tribune, October 15, 1871; October 23, 1871; October 27, 1871; November 14, 1871; February 27, 1872; some suggestions were made in letters to the editor: ibid., October 31, 1871; December 19, 1871; March 11, 1872. See also, Chicago Times, December 31, 1871; and Proceedings of City Council of Chicago (P.C.C.C.), December 4, 1871, pp. 8-9; Report of the Board of Police in the Fire Department... Year Ending March 31, 1872, p. 21. (Henceforth all references to city of Chicago departmental annual reports will be shortened to name of department, Annual Report (year ending date).)

3. Chicago Times, December 16, 1871; January 20, 1872; February 8, 1872; Chicago Evening Post, December 19, 1871; January 9, 1872; Chicago Tribune, October 13, 1871; October 19, 1871; November 1, 1871; November 23, 1871; January 13-14; February 21, 1872; P.C.C.C., February 19, 1872, pp. 96-97.

4. Measurements computed from figures in Board of Public Works, Annual Report (years ending March 31, 1872; March 31, 1873; March 31, 1874), passim.

5. For descriptions of the great Boston fire and its aftermath see Boston city newspapers from November 11, 1872 to November 11, 1873; and Report of the Commissioners Appointed to Investigate the Cause and Management of the Great Fire in Boston (Boston 1873), Col Russel H. Conwell, History of the Great Fire in Boston November 9 and 10, 1872 (Boston 1873), Diane Tarmy Rudneck, "Boston and the Fire of 1872: The Stillborn Phoenix" (Ph.D. dissertation, Boston University, 1971). See also Rosen, The Limits of Power, Chapter 7.

6. "Auditor's Annual Report," Boston City Documents (B.C.D.), 1874, No. 56, pp. 31-32; Proceedings of the Boston City Council, (P.B.C.C.), June 30, 1873, p. 268; October 6, 1873, p. 409; October 9, 1873, p. 417; October 13, 1873, p. 419.

7. Boston Globe, November 11, 1872 - April 20, 1873; Boston Daily Advertiser, November 11, 1872 - April 20, 1873; July 2, 1873. See also Rosen, The Limits of Power, Chapter 7.

8. Ann Durkin, "The Role of Real Estate Subdividers and Developers in Nineteenth Century Service Provision: The Case of Chicago" (paper delivered at Social Science History Association Conference, Washington, D.C., October 1983).

9. Nelson Manfred Blake, Water for the Cities: A History of the Urban Water Supply Problem in the United States (Syracuse, 1956); Thompson King, Consolidated of Baltimore: A History of Consolidate Gas, Electric Light and Power Company of Baltimore (Baltimore, 1950),

Louis P. Cain, Sanitation Strategy for a Lakefront Metropolis: The Case of Chicago (DeKalb, 1978); Robert Caro, The Power Broker: Robert Moses and the Fall of New York (New York, 1974); Harold L. Platt, City Building in the New South: The Growth of Public Service in Houston, Texas, 1830-1910 (Philadelphia, 1983). For a useful summary of the historical work on this subject see Joel Tarr, "The Evolution of the Urban Infrastructure in the Nineteenth and Twentieth Centuries," in Perspectives on Urban Infrastructure (Washington, 1984).

10. Alan D. Anderson, The Origin and Resolution of an Urban Crises: Baltimore 1890-1930 (Baltimore, 1977).

11. Ibid., p. 83.

12. John Modell, Book Review, The American Historical Review (December 1978), pp. 1353-1354; Michael H. Frisch, "Modeled Cities and Weary Theory," Reviews in American History (March 1979), pp. 85-91.

13. Anderson, The Origin and Resolution of an Urban Crisis, p. 8.

14. Letty Anderson, "Hard Choices: The Water Supply Decision in New England Towns" (paper delivered at Social Science History Association Conference, Washington, D.C., October 1983).

15. Carl V. Harris, Political Power in Birmingham, 1871-1921 (Knoxville, 1977).

16. Ibid., pp. 146-185.

17. Ibid., pp. 57-95.

18. Sam Bass Warner, Jr., The Private City: Philadelphia in Three Stages of its Growth (Philadelphia, 1968). Warner's book, Street Car Suburbs: The Process of Growth in Boston (Cambridge, MA, 1962) is more broadly conceived and analytically sophisticated than The Private City. It is not so much concerned with the process of infrastructural development, however, as with the general process of suburbanization.

19. Ibid., p. xi.

20. On the problems of private finance see, for example: Blake, Water for the Cities,pp. 63-77; "Electrical Subways," Engineering Record, 83 (February 8, 1896), p. 165. Financial panics could even bankrupt utility companies, as in Adrian C. Leiby, The Hackensack Water Company 1869-1969 (Riveredge, NJ), pp. 50-56. On the problems of municipal public finance see: Charles Phillips Huse, The Financial History of Boston (Cambridge, MA, 1916); Jacob Harry Hollander, The Financial History of Baltimore (Baltimore, 1899); Howard Kimble Stokes, The Finances and Administration of Providence (Baltimore, 1903).

21. The best primary sources for studying the gradual and hard-won development of modern civil engineering techniques and ideas are the reports of municipal engineers and public works commissioners and the engineering journals of the day, like the Transactions of the American

Society of Civil Engineers, The Sanitary Engineer (after 1887, The Engineering Record), and Engineering News. Typical of articles dealing with the problems of technological development are: R. Hering, "Brick Arches for Large Sewers," Transactions of the American Society of Civil Engineers, 7 (September 1878), pp. 252-57 and discussion pp. 258-63; Edward P. North, The Construction and Maintenance of Roads," ibid., 8 (May 1879), pp. 95-148 and discussion, ibid. (December 1879), pp. 333-72. Department of Public Works, City of Chicago, Chicago Public Works (Chicago, 1973), and King, Consolidated of Baltimore, also emphasize the trial-and-error nature of technological development in the public works and public utility areas. See also Stanley K. Schultz and Clay McShane, "To Engineer the Metropolis: Sewers, Sanitation, and City Planning in Late-Nineteenth Century America," Journal of American History 65 (September 1978), pp. 389-411.

22. P.C.C.C., December 4, 1871, pp. 3-7; December 2, 1872, pp. 1-3.

23. Huse, The Financial History of Boston, pp. 127-135.

24. Harry Scheiber, "Property Law, Expropriation, and Resource Allocation by Government," Journal of Economic History (March 1973), pp. 232-251. In contrast, the city of Baltimore, for example, paid over six million dollars to open and widen streets between 1878 and 1892, of which over five million, eight hundred thousand dollars were for property damages. "Annual Report of Commissioners for Opening Streets," Report of City Officers and Departments to the City Council of Baltimore (1877-1892). The general problem is discussed in detail

in Flavel Shurtleff and Fredrick Law Olmstead, Carrying Out the City Plan: The Practical Application of American Law in the Execution of City Plans (New York, 1914).

25. "Report of a Committee of Conference with a Citizens Committee on the Subject of New Streets and a City Loan," B.C.D., 1872, No. 112. Boston Daily Advertiser, November 13, 1872; November 16, 1872; November 22, 1872; November 27, 1872; Boston Post, November 16, 1872; November 19, 1872; P.B.C.C., November 18, 1872, p. 357.

26. Boston Daily Advertiser, November 27, 1872. See Thomas Wood Davis, Map of the Burnt District Showing Proposed Improvements in Streets. November 12, 1872. Map collection, Boston Public Library.

27. "Report upon the Proceedings of the Street Commissioners for 1873," 1874, No. 6, pp. 3-4. See also city newspapers and P.B.C.C. for December 1872 and January through April 1873.

28. Chicago Tribune, October 13, 1871; October 17, 1871; October 19, 1871; December 4, 1871; Chicago Times, December 16, 1871; Chicago Evening Post, December 19, 1871.

29. John F. Stover, The Story of the Illinois Central Railroad (New York, 1975), p.. 179-81; Carlton J. Corliss, Mainline of Mid-America: The Story of the Illinois Central (New York, 1950), pp. 163-64.

30. Ibid.; Chicago Evening Post, December 16, 1871; January 12, 1872;

March 4, 1872; Chicago Tribune, October 17, 1871; October 19, 1871; December 19, 1871.

31. Ibid.

32. Chicago Evening Post, January 12, 1872; February 7, 1872; March 1, 1872; March 4, 1872. Chicago Times, January 12, 1872; March 3, 1872; Chicago Tribune, October 19, 1871; January 21, 1872.

33. "An Act to Provide for the Exercise of the Right of Eminent Domain," Illinois Laws, 1871-1872, Chapter 47. The Chicago Tribune called this the "Union Depot Law" (April 28, 1872; June 2, 1872).

34. Chicago Tribune, October 19, 1871; January 13-14, 1872; Chicago Evening Post, December 16, 1871; January 9, 1872; D.C. Brooks, "Chicago and its Railways," Lakeside Monthly, VII (October 1872).

35. Samuel W. Bates, Proposed Highland Railroad: Arguments of Samuel W. Bates for the Remonstrants (Boston, 1872), p. 4.

36. Charles Zueblin, American Municipal Progress (New York, 1916), pp. 18-20.

37. Ibid.; Chicago Tribune, January 14, 1872; Chicago Times, January 12, 1872; January 13, 1872; P.C.C.C., February 19, 1872; Edward M. Bassett, Report on the Grade Crossing in New York and the Need for Change in The Grade Crossing Law (Albany, 1910), p. 8.

38. Newspapers, municipal reform publications, and government documents are the best sources for information on this sort of problem.

"Annual Report of the Wire Department," Boston City Documents, 33 (1897), for example, discusses the overhead electric utility wire problem in Boston (and also mentions gas pipe problems). In Baltimre, after almost 20 years of growing official and public protest in this area, the city finally took care of corporate resistance to underground subways by cuttng down their illegal overhead wires on its own: "Mayor's Address," Reports of City Officers..City Council of Baltimore (1885), p. 25; (1886), pp. 40-44; (1889), p. 68; "Annual Report of Board of Fire Commissioners," ibid., 1886-1903; Baltimore Sun, October 8-22, 1904.

Criticism of gas companies tends to focus on gas rates, but regulatory commission reports and newspaper articles often reveal the existence of physical problems as well: Baltimore Sun, March 18, 1904; Engineering Record, 41 (June 23, ±900), p. 601; First Annual Report of the Commission of Gas and Electricity of the State of New York (New York, 1906), pp. 22-56, 64, 70-71. See also, William T. Stead, If Christ Came to Chicago (Chicago, 1894), pp. 194-207.

For discussion of transportation company resistance to demands for improvement, see, for example, Report of the Street Railway Commission to the City Council of Chicago (Chicago, 1900), pp. 21-24; Lloyd, The Chicago Traction Question, pp. 30-34; Edwin Jones Clapp, The Port of Boston... (New Haven, 1916), passim; Commission on Metropolitan Improvements, Public Improvements for the Metropolitan District (Boston, 1909), pp. 17-30, passim; Joint Board on Metropolitan Improvement, Final Report (Boston, 1911), pp. 46-78. See also:

Edward M. Bassett, Report on The Grade Crossings in New York and the Need of Change in the Grade Crossing Law, p. 8; Stead, If Christ Came to Chicago, pp. 194-196.

39. Robert L. Bish and Hugh O. Nourse, Urban Economics and Policy Analysis (New York, 1975), pp. 121-125. See also James M. Buchanan and Gordon Tullock, The Calculus of Consent: Logical Foundations of Constitutional Decisionmaking (Ann Arbor, 1965), pp. 92-116 ff.

40. For progressive reformers like Frank J. Goodnow, this powerlessness was one of the main causes behind the failure of city governments to deal constructively with urban ills: City Government in the United States (New York, 1904), pp. 89-99, 303-304; Municipal Problems (New York, 1907), pp. 34-38, 61-62, 73-79; Municipal Home Rule: A Study in Administration (New York, 1895). For a discussion of the legal straitjacket the city of Chicago found itself in regard to its streetcar problems, see Lloyd, The Chicago Traction Question, and Board of Supervising Engineers, Chicago Traction, Twentieth Annual Report (1927), pp. 4-28.

41. P.B.C.C., November 18, 1872, pp. 357-358. Boston Daily Advertiser, November 15-16, 1872; November 19, 1872; Boston Post, November 19, 1872; Shoe and Leather Record, November 25, 1872, p. 136; "Report of a Committee of Conference with a Citizens' Committee on the Subject of New Streets and a City Loan."

42. See city newspapers for December 1872 through April 1873. See also

Rosen, The Limits of Power, Chapter 6.

43. Chicago Times, December 12, 1871. The Fire Department's Annual Reports for 1868-1871 bear this claim out.

44. Ibid.

45. "Fire Department Annual Reports," B.D.C., 1867-1873. P.B.C.C., June 3, 1873, p. 233; June 30, 1873, p. 268; October 6, 1873, p. 409; October 9, 1873, p. 417; October 13, 1873, p. 419. Report of the Commissioners Appointed to Investigate the Cause and Management of the Great Fire in Boston, pp. 102-104, 224; Boston Globe, December 20, 1872. See also Charles S. Damrell, A Half Century of Boston's Building (Boston, 1895), pp. 112-115.

46. "Auditor's Annual Report," B.D.C., 1874, No. 56, pp. 31-32; "Report ... on a Supply of Water for Extinguishment of Fire," B.C.D., 1873, No. 112.

47. P.C.C.C. December 4, 1871, pp. 5-6; December 2, 1872, p. 3. Board of Public Works, Annual Report (year ending March 31, 1873), p. 23.

48. John Rauch, A Report...on the Necessity of an Extension of the Sewerage of the City (Chicago, 1873), pp. 18-19. The haphazardly scattered character of all the extensions is plain in the lists of extensions undertaken each year in the Board of Public Works' Annual Reports.

49. Seymour J. Mandelbaum, Boss Tweed's New York (New York, 1965), pp. 58 passim.

50. Perhaps because they were so much closer to the action (and not as accustomed as we are to assuming that government bureaucracy is the natural source of public policy, 19th century muckrakers realized that this was the direction that most "boodle" flowed. See, for example, Lincoln Steffens, The Shame of the Cities (New York, 1904); and Steffens, "Who, or What, Started the Evil?" reprinted in Edward C. Banfield, Urban Government (Glencoe, IL, 1969), pp. 248-251. See also, Stead, If Christ Came to Chicago, pp. 178-187.

51. For more detail see Rosen, The Limits of Power, Chapters 3, 6, 7, 8.

52. Citizens' Association of Chicago, Addresses and Reports of the Citizens' Association of Chicago 1874 to 1876 (Chicago, 1876), pp. 3-4. See also "Mains and Subways," New York Post, reprinted in Engineering Record, 41 (June 23, 1900), p. 601.

53. Chicago Tribune, July 15, 1874.

54. Harris, Political Power in Birmingham, pp. 146-185. Roger David Simon, Expansion of an Industrial City: Milwaukee 1800-1910 (unpublished Ph.D. dissertation, University of Wisconsin, 1971).

55. Rauch, A Report...on the Necessity of an Extension of the Sewerage, pp. 18-19.

56. Chicago Tribune, July 15, 1874 through November 7, 1874; Citizens' Association of Chicago, Addresses and Reports...1874 to 1876, pp. 7-8.

57. "Report upon the Proceedings of the Street Commissioners of 1873," B.C.D., 1874, No. 6, pp. 3-4.

58. Rauch, A Report... on the Necessity of an Extension of the Sewerage, pp. 18-19.