Aligning Infrastructure Development Strategy

To Meet Current Public Needs

by

John B. Miller

Submitted to the Department of
Civil and Environmental Engineering
in Partial Fulfillment of
the Requirements for the Degree of

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in Infrastructure Development Systems
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Abstract

Since 1933, American public construction has supposedly been “locked”
into the sequential design, then build procurement model for infrastructure
development. This approach, which is entirely dependent on declining cash
appropriations by government, has become increasingly ineffective in
meeting public infrastructure needs.

Procurement methods used in
modern Hong Kong and in the United
States between 1780 and 1933 are analyzed
systematically using two axes to describe
Government's two fundamental strategies
in the development of infrastructure.
The first strategy is either to "push"
projects "directly" through federally
funded contracts, or to "pull" projects in
the private sector through "indirect" means such as incentives, subsidies, and
mandates. The second strategy is either to "segment" each step in the
procurement process -- planning, design, construction, operation and
maintenance -- from one another or to combine all these steps into a single
"system" procurement. Arrayed on two axes, these strategies fall in one of
four quadrants.

In the broad historical context of American infrastructure
development, the current sequential design-then-build process in Quadrant
IV is the aberrant procurement method, not the Build-Operate-Transfer and
Design-Build-Operate methods which are described by Quadrants II and I,
respectively. Advantages of infrastructure development in Quadrants I and II
include independent, multiple verifications of project feasibility, and the
opportunity for governments to select best value from different combinations
of quality, price, and time of delivery. Other significant advantages include
the use and application of state of the art technology to complex infrastructure projects, substantial savings in time, typical savings in capital costs, reduced need for large temporary additions to public engineering staffs, private financing of capital costs, significant leveraging of public financial contributions to projects, predictable future public expenditures for maintenance and operation, improved public fiscal management of infrastructure development, reduced concern over conflicts of interest, and improved management of project risk.

The United States should join the rest of the world in moving to capture the advantages of Quadrants I and II by adopting a mixture of procurement strategies which include, rather than exclude these methods. Recommendations are made for doing so.

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John B. Miller earned his undergraduate degree in Civil Engineering and his master's degree in Soil Mechanics, both from M.I.T. in 1974. He received his Juris Doctor and Master of Law (LL.M.) degrees from Boston University School of Law in 1977 and 1982, respectively. He is a member of Chi Epsilon, the national civil engineering honorary society.

Prior to his return to M.I.T. as a doctoral candidate in 1993, he served as a lecturer at M.I.T.'s Pierce Laboratory from 1987 through 1992. His teaching and research have focused on systems, strategies, and methods for aligning procurement strategies for infrastructure development with economic strategy in the United States, and upon term efforts to conduct and publish "problem solving" research on civil and environmental projects throughout the world, including program planning, contracting strategies, partnering, dispute avoidance, facilitation, and mediation.

John B. Miller is the 1994-5 Chair of the American Bar Association's Section of Public Contract Law, the only national association of attorneys focused upon improving procurement processes at the federal, state, and local government levels. Mr. Miller is a member of the Federal Contracts Report Advisory Board. He is a past Vice-President of the Massachusetts Society of Professional Engineers, and a member of the Boston and American Societies of Civil Engineers. For many years prior to returning to M.I.T., he practiced construction and government contracts law with Gadsby & Hannah in Boston and Washington, serving as a general partner in the firm from 1986 through 1992.

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To
Edith and Hugh Miller
and to
Joan, John, Douglas and Mary

"You can never get enough education!"

and

To

Henry L. Michel

for his advice and encouragement
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I. Introduction

A. The Problem: Maintaining and Extending America’s Infrastructure Legacy

Generations of innovation in infrastructure literally surrounds us. Indeed, the infrastructure\(^1\) of the United States is the envy of much of the world. The American economy contributes to the world’s movement of people, goods, energy, and information far in excess of its 4.3% population share.\(^2\) Infrastructure is the means by which this is accomplished. Numerous statistics confirm the special role of infrastructure in leveraging the United States in a global economy.\(^3\)

Replacement, renewal, and maintenance of the nation’s infrastructure facilities is now commonly considered to be an intractable national “crisis”. This dissertation presents the results of research into the means by which infrastructure\(^4\) has been developed in the United States, both currently and historically. One key aspect of this crisis -- the system by which public infrastructure is procured -- is examined here. The United States is caught in the complex web of regulations and laws controlling the smallest details of infrastructure development.\(^5\) From the basic system established by Congress in 1947, these rules have steadily become more intricate, primarily as an outgrowth of the administration of large federally funded construction programs for state and local infrastructure projects. Characterized as “grants-in-aid” in the amount of 90% of design and construction costs, large federal programs for infrastructure works required state and local government to adopt federal procurement systems and rules, and accept federal administration of these programs.

In the twenty-five years between 1955 and 1980, federal grant programs for interstate highways, transit systems, and waste water treatment plants have come to be relied upon by state and local governments, and by the public, as a federal commitment to fund infrastructure. Since 1980, however, federal funding for infrastructure has given little assurance to anyone that such a commitment still exists. Yet, state and local governments cling to the hope that federally funded programs will once again be available to meet primarily local needs. As this hope slowly and steadily fades with declining Congressional appropriations, a curious situation has developed in which complex administration remains, but the federal programs intended to be administered have disappeared.

There is simply insufficient resources available to meet state and local expectations for federal infrastructure programs of the past. The result is not unexpected -- a national, divisive, “tug of war” to divide insufficient federal
resources among infrastructure "needs" whose worth is often in the eyes of
the beholder. The current "federal" paradigm is little more than a zero-sum
game in which states and local governments compete with one another in
Congress and before federal agencies for higher allocations of federal cash.\textsuperscript{6}

Federal procurement processes for infrastructure have "evolved" to a
complex administrative allocation of federal resources through increasingly
strict requirements. Administration has become so involved, so time
consuming, and so resource intensive, that it is now the ascendant strategy
behind federal infrastructure development -- an end in itself. For example,
the administrative process requires that engineering and construction
expertise be divorced from one another in connection with infrastructure
development, inhibiting innovation between engineers and constructors and
encouraging further fragmentation of the engineering and construction
industry. Administration requires that finance, program development,
design, construction, maintenance and operations be separated from each
other in the development of infrastructure.

Administration is openly hostile to alternative methods for delivering
needed public infrastructure projects, such as design-build, turnkey, build-
operate-transfer, and design-build-operate. This hostility is curious, since the
administrative process repeatedly confirms that the prevailing project
delivery method -- sequential design, then build -- simply cannot meet
infrastructure needs alone. The result is the assertion of plenary government
control, accompanied by increasingly complex administration of
infrastructure development, and further accompanied by the crippling effects
of wholly inadequate government funding. The system by which
infrastructure is supplied is able to meet less and less of the public's needs,
and in the environmental remediation area is completely paralyzed.

Indeed, Congress has committed so much of the nation's tax receipts to
entitlements, interest on the debt, and defense, that only 15\% of the federal
budget is currently available to Congress for what would commonly be called
"discretionary expenditures".\textsuperscript{7} This is the total amount of federal resources
available to run the government, fund agencies such as the IRS, the SEC, and
each executive agency, fund the courts, and fund all other discretionary
programs including infrastructure development. If entitlements and interest
payments on the debt grow as expected in future years, Congress will be free to
direct even less than 15\% of the federal budget, of which infrastructure is but
a small part.

For the foreseeable future, federal funding for big-ticket, federal
infrastructure programs is over. Congress has removed itself as a major
player in the rehabilitation of the nation's infrastructure.

B. The Hypothesis
The hypothesis underlying this research is that continued administrative zeal to perfect more and more details of this single federal procurement method is fundamentally wrong — in effect, we have dug ourselves into a hole and need to stop digging. Instead of more detailed administration, we need to step back from the current paradigm to review other systems used for infrastructure development. The hypothesis is that other systems are likely to offer alternative approaches to infrastructure development, particularly in situations where national funding is restricted.

Two systems for infrastructure development are systematically analyzed in this dissertation: that currently used in Hong Kong, and that formerly applied in the United States between 1780 and 1933. Hong Kong is currently completing one of the most rapid reshaping of infrastructure facilities ever attempted by a modern industrial society. As incorporation into the People’s Republic of China approaches, Hong Kong’s infrastructure program presents a remarkable opportunity to observe how strategic societal goals are being implemented through infrastructure development. The American experience between 1780 and 1933, too, is the most astonishing infrastructure development accomplishment in history. This research began with the hope that each of these extraordinary success stories contain the seeds of a fundamentally different future for infrastructure development in the United States.

1. A Framework for Analysis

Procurement methods were analyzed systematically using two axes, which are used to describe the Government’s two fundamental strategies to the development of infrastructure. The first strategy is based upon an election to either "push" specific projects "directly" through current appropriations used to fund contracts or grants, or to "pull" specific projects "indirectly" through incentives, mandates, subsidies, and other measures which encourage the private sector to accomplish Government goals.

The second strategy is based upon an election by Government to implement planning, design, construction, operation, maintenance operations, and (sometimes) finance in one of two fundamental ways: (a) by clearly separating each of these different steps in the procurement process from one another (a "segmented" process) or (b) by combining all these aspects of an infrastructure project into a single procurement of the completed system (a "system" process).

These two strategies can be conveniently arrayed on two axes, which can then be used to categorize specific government programs or specific projects in one of the four resulting quadrants, I through IV, shown in the figure below.
These quadrants provided a convenient framework which was applied repeatedly to categorize infrastructure procurement strategies throughout American history, and in Hong Kong. Congress has relied upon each of these four strategies over the past two hundred and fifteen years, in a curious counterclockwise pattern beginning with Quadrant II.

C. Testing the Hypothesis

1. Hong Kong

Procurement strategy for infrastructure in Hong Kong is based on the premise that a conscious effort should be made to maintain project development in each of Quadrants I, II, and IV. Current strategy is to invest approximately 80% of government’s annual appropriations in the sequential design-then-construct method of Quadrant IV, and 10% each using Design-Build-Operate and Build-Operate-Transfer methods of Quadrants I and II, respectively. The latter investments of 10% each are directed at projects where time savings, capital savings, and innovative design and construction methods are critical to the government. The government’s investment in Quadrant II is used as “seed money” aimed at inducing the private sector to finance, design, construct, maintain and operate major infrastructure facilities over a significant portion of the design life. The government’s intent is to leverage its “seed” investment many times over through private sector investment in major infrastructure projects. Private sector financing is frequently sought in Quadrant I, most notably in connection with large environmental projects.
Implicit in Hong Kong’s strategy are a number of core beliefs. First is the recognition that government resources will never be sufficient alone to meet public needs. As a result, private sector investment in public infrastructure development is believed to be a practical necessity. The government recognizes that it has the unique capacity to create a competitive environment in which arms-length transactions can be established for the private sector to meet public infrastructure needs. To protect public investment of taxpayer funds, government believes that the larger the project, the greater the need to test technical feasibility, cost, and quality through competition in the private sector. To encourage the introduction of innovation and modern technological systems into infrastructure facilities, government believes it role should be to offer mechanisms by which infrastructure is provided on a system basis, and not through segmented processes.

Hong Kong’s experience with Quadrants I and II mechanisms has produced substantial time savings, and a significant increase in the number of choices available to government to finance, design, construct, and operate major infrastructure facilities. Other benefits include substantial improvement in the design selection process, and substantial savings in both capital and operations expenses. A number of world-class technological innovations have been introduced in Hong Kong on large tunnel, bridge, and environmental projects in Quadrants I and II, which has directly translated into one or more of the following benefits: capital, operational, or time savings, and improved quality of equipment, features, and performance.

Long term franchise arrangements made in Quadrants I and II have provided the Hong Kong government with the ability to accurately predict the annual costs associated with particular infrastructure facilities, which in turn permits improved budgeting and fiscal management practices associated with infrastructure development. At the same time, use of Quadrants I and II processes have obviated the need for Hong Kong to add significant permanent engineering staff for the administration of large projects.

2. The United States Between 1780 and 1933

Between 1780 and 1933, American procurement strategy for infrastructure development bore little resemblance to current practices. Congressional strategy was founded upon four principles: first, cooperation between public and private entities; second, recognition that infrastructure was best provided through a combination of public means, private means, and often a mixture of both; third, a constant search for different, more effective ways for government to encourage the assistance of private entities in infrastructure development; and fourth, almost exclusive reliance on a system approach (Quadrants I and II) for delivering infrastructure.
Over ninety percent of Congressional enactments directed to infrastructure between 1780 and 1933 were system procurements in Quadrants I and II. Congress consistently demonstrated a commitment to both direct (Quadrants I and IV) and indirect (Quadrant II) procurement processes throughout the period. Over sixty percent of Congressional enactments in the period were indirect, while slightly less than forty percent of the statutes reviewed in the same period were direct.

The result was an entirely different, more innovative period in infrastructure development. Throughout the period, both government and the private sector constantly searched for different, innovative ways in which public and private sector contributions could be formulated, combined, allocated, and used to promote infrastructure development. In effect, infrastructure facilities were developed jointly by government and the private sector through a continuous process in which different combinations of private capital, private expertise, public interests, and public incentives or funds were assembled and reassembled until a mutually advantageous combination was found, one project at a time.

Not considered in depth here, but well worth mentioning, is the private development of large segments of infrastructure with minimal early involvement of the national government. Commencing with the invention of the telegraph in the middle of the nineteenth century, significant technological advances in infrastructure were developed without substantial government participation. Examples include the telegraph, the telephone, electric power, and natural gas, all of which became key elements of the nation’s infrastructure. These systems were developed, installed, and operated privately, sometimes with the indirect help of government and at other times in spite of attempts by government to interfere.

In the public sector, Congressional activity in Quadrant I was generally related to the development of navigation aids and channels on navigable rivers, harbors, and lakes, and to the design and construction of federal buildings in Washington, D.C., and scattered around the nation.

Activity in Quadrant II generally related to the development of large projects tied to national functions, such as the postal system, navigable waters, and territorial development. A number of federal programs were designed and implemented during the period to induce extensive private sector contributions to infrastructure extension, expansion and renewal. Major achievements in Quadrant II during the period include construction and operation of a national network of post roads, a national network of railroads, twenty or more canals of major economic significance, a national network of railroad and highway bridges stretching from coast to coast and from Canada to the Gulf of Mexico, and a national network of dams, water
power projects, water supply projects, and reclamation projects (swamp drainage). Congress also used Quadrant II processes to assist in the construction and operation of the nation's steamship fleet (ostensibly for mail delivery) and to connect America to the world through new technologies like cable and telegraph.

During the period, Congress was not always effective in generating arms-length procurement transactions with the private sector for infrastructure. Competitive procedures were not typically used to shape the content of major transportation projects, to obtain best value, or to obtain price and quality comparisons among different proposers. Throughout the period from 1780 to 1933, with a few exceptions toward the end, Congress awarded franchises for such projects to companies, to individuals, and sometimes to municipal or state governments, not on the basis of competition, but on the basis of who asked first. In today's parlance, these procurements were unsolicited proposals awarded on a sole-source basis. The result was occasional scandal, and public doubt as to whether government's relative contribution to infrastructure development was greater than that which might have been established through competition.

Throughout the period, Congress employed a number of indirect mechanisms to encourage infrastructure development, including subsidies, land grants, income streams, franchises, and other incentives designed to induce private investment of time or money in infrastructure. Congress adeptly managed the procurement system in Quadrants I and II to control infrastructure development outcomes, while encouraging private sector financing, design, construction, and operation. By controlling how infrastructure projects were packaged, Congress exerted influence over the course of infrastructure development far in excess of its meager cash contribution to the effort.

D. Lessons Learned

A number of lessons were learned from this research. The common, current perception that federal, state, and local infrastructure development policy is locked into Quadrant IV processes by lengthy historical success is little more than empty rhetoric, and should be discarded. A more accurate description of the American experience would be that Quadrant IV processes are the aberration in the course of infrastructure development. The figure below traces the course of this pattern in schematic fashion.
Rather than “exclusive veneration”, Quadrant IV processes should be seen merely as one possible approach to infrastructure development. Quadrant IV processes should only be used when government resources are available but consciously committed, and when there are good reasons to believe that the advantages of separate advance competition for design services are outweighed by the advantages of competing for the entire project on a system basis.

A second lesson is that system based procurement techniques are widely and successfully used for public infrastructure development around the world. The experience in Hong Kong is but one spectacular example where innovative and creative governments have successfully packaged a large number of infrastructure mega-projects in Quadrants I and II. Arms-length transactions have been established through competitive procedures to induce the private sector to finance, design, construct, maintain and operate urgently needed public infrastructure facilities precisely as desired and planned by government officials.

A third lesson is that these projects have been structured to allow government to leverage its seed money many times over, which in turn permits conservation of public resources for other uses. Hong Kong’s experience is not an isolated occurrence, and it is being repeated throughout the Far East. The opportunity to leverage public resources in Quadrants I and II is shown in the next two figures.
Exclusive reliance on Quadrant IV defines the outer limit of public support for infrastructure development and is therefore self-defeating in situations where needs are greater than resources. Adding Quadrant I and II processes permits the government, through appropriate packaging, to leverage its resources many times through private sector investment in infrastructure investment. The figure below shows this opportunity schematically.
A fourth lesson is that system-based procurements (Quadrants I and II) are best conducted through competitive procedures which are structured to incentivize proposing teams to explore a various combinations of time, capital cost, operating and maintenance costs, and levels of performance. Such competitions regularly produce extraordinary choices for government to select best value, while maintaining competitive pressure for savings in cost and time and improved quality.

E. What Should be Done

*Expand to Quadrants I and II.* Congress should expand statutory options for infrastructure development to once again include strategies in Quadrants I and II, in effect, re-opening patterns to private investment in infrastructure that were extensively followed throughout most of America's history and are currently being followed in much of the rest of the world.

*Restructure Competition in Quadrants I and II.* In connection with use of Quadrants I and II, the nature of the competition for private sector provision of projects must be fundamentally altered. First, competition must occur later in the project development cycle, after government has clearly defined and described its needs and requirements through a solicitation seeking system solutions to those needs. Second, competition must be broadened to cover a significant portion of the project's life cycle, from
schematic design and finance, through final design, construction, maintenance and operations over an extended period. This type of competition, particularly on large, complex projects, aligns the interests of proposers with the long term interests of the government in the most cost effective life cycle facility. A third change in the nature of competition flows naturally from the first two. Award criteria should be changed in Quadrants I and II away from a single criteria, such a lowest price or highest technical capability, to “best value” to the government. Best value would typically be defined by evaluation criteria which include time of delivery, initial capital cost, maintenance and operations costs, and functional features.

**Use Quadrants I and II Processes to Increase the Pace.** The opportunity to leverage public resources with private investment in Quadrants I and II should be used to pick up the pace at which public needs are met by the government. Government funding should permit leveraging by factors of ten or more.

**Renew Legislative and Administrative Roles in Infrastructure Development.** The role of legislatures, including Congress, should be redirected toward identifying urgent public infrastructure needs and creating a competitive atmosphere, including incentives where appropriate, in which these needs can be met through competition in the private sector. The role of executive agencies at all levels of government should be redirected toward facilitating the completion of projects in any one of Quadrants I, II, or IV, with a view toward leveraging public infrastructure, wherever practical and feasible through competitive processes in Quadrants I and II. In particular, government should apply design-build-operate processes in Quadrant I to environmental remediation projects. Legislative and regulatory goals for Quadrant I and II processes should be to provide a stable, predictable, consistent climate for private sector investment in design-build-operate and build-operate-transfer projects to occur.

**A Paradigm Shift.** In short, we need to fundamentally rethink why it is that infrastructure development can only take place in modern America if its participants are walking North-West in Quadrant IV. Simply stated, we need to re-open the roads to the North-East and the South-East, which were so frequently traveled by our ancestors. These roads lead away from administration, toward private sector investment, toward innovation, toward new technology, and toward new synergism between America’s engineering and construction companies, the nation’s largest economic sector. These roads also lead to substantial, leveraged, reinvestment by the private sector in American infrastructure development, a key element to long term economic growth. Aligning American procurement methods with much of the rest of the world will also tend to enhance the competitiveness of America’s engineering and construction sector abroad.
The current "fiscal crisis" in American infrastructure renewal has dramatically restricted infrastructure development in Quadrant IV. Properly construed, however, this "crisis" is little more than the demise of Quadrant IV as the exclusive public procurement strategy of the United States. The solution has been literally in our own backyard: we need to reopen well traveled "roads" to Quadrants I and II.

China offers more than the Hong Kong experience, which confirms the continued vitality of these "roads" in meeting modern infrastructure needs. Ancient wisdom from China may be of greater value to American policy makers concerned about adjusting current procurement methods to include Quadrants I and II. "A journey of a thousand miles begin with the first step."

II. Infrastructure Development in Hong Kong

To test ideas from research into the development of America's early infrastructure, a trip to Hong Kong was arranged to see these "old" ideas in use there. A number of people intimately involved in the development and finance of infrastructure, both inside and outside the Hong Kong Government, were interviewed. They confirm the overall assessment that procurement structure in the United States needs to be changed in order to permit economic and infrastructure development strategies to be aligned with each other, rather than opposed.

The most significant differences between procurement strategies followed in Hong Kong and those in the United States arise in the allocation of roles between government and the private sector. The end sought is the same in both countries -- widely available facilities to support efficient, effective, and safe movement of people, goods, and information. The means adopted to achieve them are quite distinct. Of more importance, however, is that the approach now applied in Hong Kong is remarkably similar to that used in the United States between 1789 and 1950.

Can the processes applied in the United States prior to 1950 work in an established, industrial, urban center with substantial existing infrastructure and an established international economy? Hong Kong is using these processes to refurbish and add to an infrastructure base, including a special effort in environmental protection. The effort in Hong Kong is of critical interest to the United States.
This chapter summarizes significant features of public infrastructure procurement in Hong Kong, and presents twenty-four case summaries from Hong Kong's recent infrastructure projects.

**A. Hong Kong's Procurement Strategy: Key Differences**

Four significant differences in the relationship between procurement strategy and economic activity are highlighted in this section.

1. **A Positive Relationship Between Improved Infrastructure And The Economy is Taken for Granted**

   Each person I interviewed in Hong Kong assumed as "proven" that a positive relationship exists between improved infrastructure facilities and increased economic activity. The proposition that an expanding economy requires a steadily improving capacity to more efficiently move people, goods, and information is viewed as fact — mere tautology. Each interviewee accepts that economic growth and infrastructure variables are not independent, but positively and strongly correlated with one another.

   **An Example from the Philippines.** Government expenditures on power production in the Philippines over the last twenty years provide one clear example of just such a correlation between economic growth and infrastructure.\(^{18}\) In connection with the examination of financing proposals for new Philippine power plants, financiers in Hong Kong were shown a direct multiplier effect between the availability of reliable electrical power and economic output.

   Since the middle 1970's increasing demand for electrical energy outpaced increased capacity. The cumulative annual shortfall in new electric capacity resulted in many parts of the Philippines experiencing daily electrical blackouts (or brownouts) of up to nine hours in the mid-1980's. Factories were prevented from operating in affected areas, and factory output was less than maximum reduced. In response, individual solutions to power needs were found, including private operation of gas and oil generators to supply needed electrical power on a spot basis. This in turn created a significant air pollution problem for urban areas of the country. Beginning in the late 1980's government expenditures on the development of power and the corresponding direct increase in GDP provides direct verification for the proposition that increased expenditures on useful infrastructure correlates positively and strongly with economic growth.

   The effect is qualitatively shown in the following figure.
Although the correlation between infrastructure and economic activity may be harder to see in well developed industrial countries like Hong Kong, the United States, the United Kingdom, or Germany, financiers in Hong Kong are absolutely convinced that the basic relationship exists and forms a reliable basis for investment.

**Correlative Note II-1**

Contrast this with current experience in the United States, where federal and state governments have assumed direct responsibility for planning, designing, building, maintaining, and operating most major infrastructure projects. There is widespread agreement that these same facilities are in substantial need of repair, rehabilitation, enhancement, or replacement. Yet, there is significant debate as to whether increased public expenditure on infrastructure is in fact positively correlated with increased economic activity. For example, the papers of Aschauer, Gomez-Ibanez, Gramlich, Holtz-Eakin, Munnell, Peterson, and Winston indicate substantial disagreement among economic commentators whether increased public capital investment yields improved economic performance.

Numerous historical analyses support the conclusion that economic growth and infrastructure are positively and strongly correlated. See for example, studies by Conzen and Putnam of the Illinois & Michigan Canal connecting Lake Michigan through the Illinois River to the Mississippi River and New Orleans; the discussion of the development of canals and railroad in the United States by Goodrich; Hood’s study of construction of the New York City subway system; McCullough’s study of the construction of the Brooklyn Bridge and the Panama Canal. Yet, we are currently steeped in intellectual controversy over the strength of this relationship in a developed, industrialized nation. Are the benefits of additional government expenditure...
on infrastructure of less value than those afforded through government expenditures on other government programs? The debate is an intractable one, because it is focused upon an impossible assessment of the relative benefits which result from different allocations of “insufficient” government funds to meet the competing demands and interests of government programs.

2. True Strategic Planning

Another key difference is the level of government involvement in and attention to true strategic planning. The words “strategic planning” are used to mean a planning process focused upon fundamental issues and aimed at an integrated whole. With the prospect that Hong Kong would again become part of China, the government of Hong Kong, out of necessity, has engaged in a complex, public planning process with the governments of Britain, China, and the public and private sectors in Hong Kong. This effort has truly been “strategic”.

According to an old saying in the United States, “necessity is the mother of invention”. Hong Kong’s need in 1984 was acute: to make wise, stable, strategic decisions which would substantially affect the long term role of Hong Kong in Southern China and the Far East. The result of this strategic planning effort has been broad consensus on a vision for the future of Hong Kong integrated into Southern China and Southeast Asia. Infrastructure development is one important strategic tool to implement this vision of the economic future of Hong Kong.

Correlative Note II-2

The concept that infrastructure development can be used as a tool aligned with economic strategy highlights the inadequacies of America's current direct/segmented paradigm and confirms that the "old" approach of America’s early years, in which economic and infrastructure development strategies were aligned, is still useful in modern industrial societies. Exclusive reliance on direct/segmented infrastructure procurement in the United States is self-limiting, and ultimately, self-defeating, because government spending becomes an end in itself rather than the means to implement longer, more productive strategic economic goals. Government appropriations for infrastructure development become "process", the goal of which is "fair" allocation, rather than strategic, substantive economic improvement.

a) Early Strategic Planning in Hong Kong -- 1965-1987

Between 1965 and 1987, a number of studies were directed at various planning elements for the future of Hong Kong. These studies generally
focused on one or two key planning issues, and were not intended or
designed to integrate all planning issues together. Examples of such studies
include the Container Committee report of 1966, Hong Kong Mass Transport
study of 1967, the Hong Kong Long Term Road Study of 1968, the Colony
Outline Plan of 1972, the Territorial Development Strategy of 1984,39 and the
Port Development Strategy Study of 1986. Projects planned in the 1960’s and
1970’s were conceived and built independently.

Although the early studies looked at only segments of Hong Kong’s
infrastructure needs, most identified a number of key elements in the
successful operation of Hong Kong’s economy, including:

• the need for a new airport,

• the location and private franchise for the design, construction, and operation of seven (7) new container
   terminals at Kwai Chung (since completed through private franchise agreement),

• the modernization of the Kowloon/Canton Railroad by
double tracking and electrifying the line all the way to the
Chinese border (completed at HK$3 billion),

• the phased construction of the Metropolitan Transit Railway
[subway] System (completed ahead of schedule and under
budget at HK$22 billion),

• identification and construction of new supplies of water for
the Territory,

• redevelopment of public housing in “new town”
development programs (housing completed to date at a cost
of HK$34 billion),

• dramatic expansion of electrical power (current growth needs
have been met by the private sector), and

• significant expansion in telecommunication systems
throughout the Territory (current growth needs have been
met by the private sector).

b) Developments in the People’s Republic of China
("PRC"): 1979 to 1989

Events in Hong Kong did not occur in a vacuum.40
In 1979, the PRC created five Special Economic Zones. One of these, the Shenzhen Special Economic Zone, lies along the entire northern territorial border of Hong Kong. Growth in Shenzhen has been spectacular, averaging over 12% per annum in real terms since 1979. Manufacturing has greatly expanded throughout the Zone, which now accounts for almost one fifth of the value of China's entire overseas exports. The Shenzhen Zone contained, in 1991, nearly 9000 joint ventures with Hong Kong firms, employing about two million workers in the Zone.

In 1984, the PRC designated 14 coastal cities as "Open Areas" for foreign investment, including the Pearl River Delta, located nearby to the Northwest of the territory. Development in the Pearl River Delta has been similarly impressive, contributing heavily to an average annual growth in value of over 46% in re-exports from China between 1984 to 1989. Most of this trade passes through the port of Hong Kong. The high rate of growth of trade into and out of the Pearl River is expected to continue, and extend throughout South China.

c) Crossroads: 1986 to 1987

In 1984, the United Kingdom and the People's Republic of China agreed, by Joint Declaration, to transfer Hong Kong to China on July 1, 1997. Under the terms of the Joint Declaration, Hong Kong is to be administered as a Special Administrative Region ("SAR") after 1997 in accordance with terms in the Declaration which were intended to maintain and preserve the economic prosperity and social stability of Hong Kong.

Following the Joint Declaration, the level of energy applied to "strategic planning" for the future of Hong Kong went up significantly. The focus shifted to the big picture. Much more basic strategic questions needed to be answered. Would there be a place for Hong Kong's economy in Southern China after 1997? How could that place be established and made secure? What opportunities could be created for Hong Kong to interact with Southern China before and after 1997? How could Hong Kong become the principal gateway to China for the Far East and the world? Rather than competing, how could Hong Kong adjust its growth and infrastructure to protect the existing economy, protect its investment in infrastructure, and, at the same time, assist in the economic growth of other cities, ports, airports, and economic regions in Southern China?

Correlative Note II-3

Similar questions, opportunities, and choices face much of the United States, for example, Boston, Massachusetts, and New England. How can metro-Boston become a significantly more important gateway between the United States and Europe? Rather than competing with the rest of New
England, how can metro-Boston adjust the growth of its economy and its infrastructure to protect its existing economy, protect its investment in infrastructure, and, at the same time, assist in the expansion of the economies of other cities, ports, airports, and economic zones in New England?

In 1986 and 1987, Hong Kong truly was at a crossroads. Either Hong Kong would embark on a massive program to re-invent itself for its new role as part of China after 1997 or it would likely stagnate and wither. The address by Governor Christopher Patten on October 5, 1994 at the opening of the 1994-95 Legislative Council describes the starting point for a fundamental change in strategic planning that occurred in Hong Kong shortly after 1984. 41

[B]ack in 1984, the maintenance of Hong Kong's prosperity and stability looked to some like a pretty tall order. There were many who doubted our ability to discharge this responsibility. There were dire predictions of economic disruption and even of social disorder. There was no shortage of commentators who looked on the Joint Declaration as a dead-end, who refused to recognize the resilience of the people of Hong Kong and their determination to seize the opportunities created by the Joint Declaration. [There were] those who prophesied nothing but trouble ahead, and those who predicted the painful decline of Hong Kong's way of life... 

Between 1984 and 1986, the government began the effort to integrate the results of the many independent studies described above.

In November, 1986, the government received an additional push from Gordon Wu of Hopewell Holdings Ltd., Hong Kong, who presented to government a series of ideas for:

"the joint planning and development of new port and airport facilities, along with shared transport infrastructure and associated urban uses, principally as a mean of stimulating the future economic growth [of the entire territory of Hong Kong as an intermediary center of trade and transshipment] for South China". 42

Mr. Wu made three alternate proposals, one which included a new airport at Chek Lap Kok and two which provided for a new airport in the Western Harbor. All three alternates were fully integrated with proposed new port facilities of sufficient proportion to maintain Hong Kong as the major transshipment point in the Far East. Each scheme provided for highway and transit links west from Hong Kong Island to Green Island to North Lantau Island, and for highway links north to the Chinese border, along with substantial new development of land for housing, industry, and other urban use. 43

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Mr. Wu's proposals provided the impetus to an integrated effort to strategically plan for Hong Kong's place after 1997 in the economy of South China and throughout the Far East. The conclusive effort to provide this strategy began on July 28, 1987, when the Executive Council of the Hong Kong government approved a study which came to be known as the "Port and Airport Development Study" ("PADS"). PADS was the vehicle created for all interested parties inside and outside the Hong Kong government to "sit down and think out a way by which all the primary development issues affecting the long term provision of key economic infrastructure facilities could be brought together in a comprehensive and coordinated way." In order to ensure good communication between planners in Hong Kong and the Chinese government, high-level government teams from Hong Kong visited the Shenzhen Special Economic Zone and other parts of the Pearl River Delta on numerous occasions beginning in mid-1987. The purpose of these visits was both to gather information on China's development plans for South China and to brief high-level officials in the Chinese government on Hong Kong's strategic planning process.

An unusually efficient strategic planning process was the result of these unique political and economic circumstances. The process was strategic in that it addressed the future of Hong Kong in the broadest regional and international context. The scope of the planning effort was significantly broadened to include issues and questions not comprehensively considered before. Planning in Hong Kong changed fundamentally from a process which looked inward, and which focused predominantly on internal issues, to a strategic process which looked out at the current and potential roles of Hong Kong in South China and in the Far East. The Territorial Development Strategy Review illustrates this expanded view by focusing upon how Hong Kong's economy will fit into a much larger region including the Pearl River delta, the developing areas inland from the delta, Macau, and surrounding provinces.

A smaller number of strategic goals have emerged: retaining or enhancing Hong Kong's current economic vitality, establishing Hong Kong as the leading transshipment point for cargo and passengers in South China, and establishing significant economic interdependence between Hong Kong and South China.

Between the time that these strategic goals were identified and the completion of the Port and Airport Development Strategy effort in 1987, a remarkable series of agreements were reached, including a coordinated set of infrastructure projects to implement these strategic goals by 1997. Substantial upgrades to port, airport, transit, highway, waste disposal, waste treatment, water treatment, and housing facilities were planned throughout Hong Kong. Many of these projects are described later in this chapter.
A large number of financiers, banks, designers, contractors, suppliers, and operators have been enthusiastic participants with government in implementing this strategic plan, which has put Hong Kong well on the road toward economic interdependence with Southern China. Confidence in this process is sufficiently high, for example, that Hopewell Holding, Ltd. is now financing major electrical power generation plants in Southern China and the development of a toll road from the China/Hong Kong border to the Pearl River Delta city of Guangzhou.

China is now Hong Kong’s largest trading partner, the largest market for Hong Kong’s exports, the biggest supplier of Hong Kong’s imports, and the biggest investor in Hong Kong. Hong Kong, in turn, is the biggest investor in China. The Figure below indicate but one of the ways in which the economies of Hong Kong and China have become more intertwined.

Figure II-2

Hong Kong’s Re-Export Trade

Two important features of this procurement strategy jump out. First is the intentional alignment (or linkage) between long term strategic economic goals of Hong Kong and projects selected to implement those goals. In Hong Kong’s model, the key to successful implementation of strategy is the alignment of economic strategy with infrastructure projects which support
that strategy. Sequencing is important. Projects are identified as a result of broad economic strategy, not the other way around.

Second is the lower priority given to the procurement method used on specific projects. In Hong Kong’s model, the methods by which public projects are built is, in the first instance, disconnected from the strategic process followed to identify projects. Economic strategy drives the process, not particular projects, and not the method by which particular projects will be procured. In short, the big picture, i.e. the long term economic interest of the region, is the focus of both strategic economic planning and the identification of infrastructure projects which implement that strategy. The actual procurement methods selected to design, build, and operate projects present another opportunity to align economic strategy with infrastructure development, but it is of secondary importance, and not subjected to intense regulation and control. Rather, selection of procurement methods are viewed as a predominantly ministerial process in which substantial discretion is afforded to the government to achieve project goals at the least cost to the government, in the shortest time, with high quality.

The following figure illustrates these distinctions.

**Figure II-3**

![Diagram](image)

**Correlative Note II-4**

Much about the Strategic Economic Planning process in Hong Kong has not been described. Cultural, historical, and political differences between Hong Kong and the United States make these details less significant. The more important fact is that a strategic economic planning process was conducted which defined a vision for Hong Kong in South China and in the Far East. If these lessons were to be applied to Florida, to the Southwest, to
New England, or to Massachusetts, for example, the details would differ, while the overall focus must remain the same. What are the strategic strengths and weaknesses of the region vis a vis its competitors in the world market? What is the region’s vision for stable, effective competition in this market?

Useful frameworks already exist to conduct the kind of strategic economic planning needed to permit infrastructure development to be aligned with long term improvements in economic activity. For example, the framework proposed in 1980 by Michael E. Porter for use in corporate strategic planning might usefully be adapted to regional strategic economic planning. Substantially more attention must be given to how these and other concepts for strategic regional economic planning apply to particular regions or states.

3. Government Is Presumed Less Efficient Than the Private Sector

A third key difference in Hong Kong’s strategy for large infrastructure projects is the perception, generally held, that the private sector can more efficiently provide large infrastructure projects than the public sector. The conventional wisdom in Hong Kong is that “if the private sector will provide them, it is substantially better for the public and for the government to have private entities design, build, operate and maintain major infrastructure facilities.” The government is better suited to maintain and operate numerous, small, distributed, components of the infrastructure base, such as local streets and highways, sanitation activities, water distribution systems, and waste water collection systems.

a) Testing Projects In Private Capital Markets

Hong Kong and the United States are at the opposite ends of the spectrum as to whether large projects should be publicly or privately financed. In Hong Kong, the larger the project, the greater the need to confirm the wisdom of expenditures through independent, private sector means. Similarly, the larger the project, the greater the need to confirm through the private sector that individual users of the proposed facility are willing to pay user fees to cover development and operation costs of the facility over its life. Just the opposite is true in the United States. Under the current direct-segmented paradigm, the larger the project, the greater the need for public funding, which permits “exporting” the project’s cost among the largest pool of taxpayers. These differences are qualitatively shown below.
b) Characteristics of an Infrastructure Project Suitable for Private Financing

Private financing of large scale infrastructure projects has at least a thirty year record of success in Hong Kong. Private financing of infrastructure requires at least one, and usually many, investors to choose the risks and rewards of investing in a project over other private investment opportunities. Unlike tax revenues, the stream of private investments in infrastructure projects is in competition with other investment opportunities, such as domestic and foreign stock markets, money markets, and bond markets. In an economy which offers all of these investment opportunities, a substantial number of large infrastructure projects have been privately financed in Hong Kong. In effect, billions of private dollars have been invested in infrastructure development based on the investors' expectations that returns from these investments would at least meet, and more likely exceed, returns available from other investments.

What makes large infrastructure projects suitable for private financing, from the point of view of financial markets?

Just as in the United States, Hong Kong offers no easy answer for at least two reasons. First, each project is unique in terms of location, difficulty, and potential revenues. Second, each project enters the financial market at a different time with different market conditions.
Although there is no formula, three prerequisites appear to have evolved in Hong Kong and throughout the Far East.\textsuperscript{51} Hundreds of facts and circumstances combine differently for each project to meet these requirements.

First, the project must have "good" sponsors, that is, the individuals proposing the project have, among other characteristics:

- lasting local political knowledge and strength in the country where the project is to be built (often through a well-established local member of a group of project sponsors);

- sponsors willing to put a substantial amount of their own capital at risk early in the project;

- financial strength sufficient to overcome expected and unexpected problems in designing, building, operating, and maintaining the facility proposed (if not available locally, through an established foreign member(s) of the group of project sponsors).

Second, there must be a "good" project rationale, that is,

- the project is feasible in terms of design, construction, and operation;

- the project makes good economic sense, generally because it generates reliable revenues sufficient to finance the project;

- the project is well supported by the appropriate local, state, and national governments, thereby reducing the risks of work or revenue stoppages; and

- the project is well supported by local banks, willing to assist in either long-term or construction finance for the project.

Third, there must be a "good" return available from the project,

- for the sponsors;

- for the financing investors; and

- at levels higher than other, more traditional, investments.  
  (Returns of 15-18% are typical for these projects in Hong Kong.)

These three prerequisites have been met for a number of mega-projects in Hong Kong, described in the next section. ThOSE projects which have been
privately financed are among the largest, most visible additions to Hong Kong’s stock of infrastructure, including each of the three major roadway tunnels across Victoria Harbor, two transit tunnels across the harbor, the Tate’s Cairn Tunnel to the New Territories, and pending plans for a Route 3 tunnel toward the Chinese border. Major components of the new airport at Chek Lap Kok have met these requirements and will be privately financed. Still other mega-projects, predominantly commercial and residential structures integrated with mass transit stations, have been privately financed and developed. These same requirements have been applied in arranging for private financing of large environmental projects throughout Hong Kong, including land fills and hazardous waste treatment facilities, based upon minimum income streams guaranteed by the government for materials handled.

4. The Basis of Competition is Fundamentally Different For Large Projects

A fourth key difference in Hong Kong’s approach to the procurement of large infrastructure projects is the way in which “competition” is employed by the government. “Competition” is different in at least three significant ways.

a) At a Later Point in Project Development

First, competition is introduced at a later point in project development, generally after the government has completed its analysis of basic project requirements, including alignment, schedule, basic minimum design requirements, and operating and maintenance requirements. Rather than conducting a competition at the outset of a project to give design responsibility away to a single architect or engineer, government retains development responsibility for the project through conceptual design. Competition comes later in the project.

b) At a Single Time Over More Parts of the Project

Second, competition is conducted on a significantly broader basis. Unlike the current direct/segmented paradigm in the United States, where competition is limited to construction and measured by sealed, firm, fixed-priced bidding, the goal in Hong Kong is to compete over a much larger package than construction alone.

For franchised projects, commonly known as Build-Operate-Transfer or “BOT”, competition is conducted for all remaining aspects of the project for a thirty year period, including value-engineering, completion of design, financing, construction, commissioning, warranty repair, operations and maintenance of the project for its entire useful life, and including risks associated with design, construction, maintenance, operations, and revenues.
For Design-Build-Operate or DBO projects, competition is conducted in a fashion similar to that for BOT projects, except that much of the risk associated with revenue is assumed by the government through guarantees of minimum quantities of waste, water, or materials in given periods.

For Design-Build or DB projects, competition is conducted for design and construction of the project, including value-engineering, completion of design, commissioning, and warranty repair, including risks associated with design, construction, and startup of the facility. Financing, maintenance, and operation, and risks associated with revenue are not included, and instead, are assumed by the government.

c) Based on Best Value to the Government

The third significant way in which competition is applied differently in Hong Kong relates to the fundamental purpose of competition. Competition is used in Hong Kong to obtain the best value to the government: that is high quality facilities at the earliest possible time for the least overall project cycle cost.

Based on actual experience in Hong Kong, the use of BOT, DBO, and DB processes has substantially reduced the time required till commencement of facility operations, while maintaining or improving quality. Although more difficult to assess quantitatively, BOT, DBO, and DB processes appear to produce substantial capital and operating savings for the government -- in the short term through time savings, and in the long term through integrated planning, finance, design, construction, and operations.

Because of the extensive use of BOT, DBO, and DB processes, there are more project delivery (or procurement) methods available for use in Hong Kong. Because “best value to the Government” is the strategic goal of the procurement system, the means to obtain “best value” takes on significantly more importance in Hong Kong than in the United States.

For example, assume the government decides to provide a central facility to process all hazardous waste generated in metropolitan Hong Kong. To obtain “best value”, the government is more likely to select a DBO or BOT process, which allows it to receive and compare several different “turnkey” proposals, than it is to select one engineer to prepare one design of the project (based on a statement of past experience with other projects) and then select a contractor based solely on price.

DBO and BOT processes in Hong Kong are generally confined to large projects. Hong Kong still relies upon direct-segmented procurement methods for much of its routine public construction, maintenance, and rehabilitation. The current approximate mix of procurement methods includes: 80% sequential design then build (direct-segmented), 10% design-build and design-
build-operate, and 10% build-operate-transfer. The allocation of resources to each of these methods, both now and in the future, is shown in the next figure, based on dollars expended or to be expended.

Figure II-5

B. Mini- Case Studies from Hong Kong

A number of useful techniques can be drawn from Hong Kong's extensive experience with Design-Build, Design-Build-Operate, and Build-Operate-Transfer for application in the United States to the development of public infrastructure. This section describes a number of these projects. The purpose in doing so is to highlight how Hong Kong's economic strategy is aligned with infrastructure development.

1. Case Studies in Design/Build

Summary: Four case studies are presented from Hong Kong in which the Design/Build format was used. The key advantage of using design/build as the project delivery method over sequential design then build (a segmented process) is savings in time. The general experience in Hong Kong is that although capital savings cannot always be counted on in advance using design build methods, a substantial time savings from project design through construction is virtually assured. There is general agreement that design/build processes produce capital savings as well, but the magnitude of such savings is not readily measurable. A substantial portion of any savings in capital costs is likely related to time savings, which minimizes labor and material price increases.

The Hong Kong government is pushing very hard to expand the frequency with which design/build processes are used throughout the colony.
Case Study II-1

a) The Tuen Mun to Tsuen Wan Road

This project represented a substantial upgrade to the existing two-lane road between the cities of Tsuen Wan (located just northwest of Kowloon) and Tuen Mun, approximately 15 kilometers along the coast to the west. Traffic on the existing road was burdened with heavy trucks from the container port at Kwai Chung, bound for China. The road had no passing lanes, but numerous grades. The road was environmentally sensitive because of its proximity to the coast. After a public process in which plans for the road were discussed, landscaping was determined to be a prominent feature of any improvement to the road.

(1) Project Description and Requirements

The procurement strategy selected by the government was Design-Build. A "Project Brief" was prepared for the project by the government highway branch with help from outside consultants. The Project Brief described the minimum general requirements for the road, including general layout, number and length of passing lanes, and minimum landscaping requirements, down to the type of trees to be planted along the route.

The Project Brief also contained the government's requirements for the content of design-build proposals. Each submission was required to include 100 drawings which were to reflect at least schematic views of what each proposal for the project would look like as designed and constructed. In essence, the Project Brief required each proposer to approach the 30% design stage in order to make an effective presentation of its design and construction proposal.

Proposal costs were at the expense of the bidders.

(2) Project Estimates and Proposer Interest

The original government estimate for the project was HK$1B (roughly US$130 M). In response to the publication of the Project Brief, eight (8) different consortia expressed interest in the project. A prequalification process conducted by the government reduced this number to a "short" list of six (6). The government then received design-build proposals from each of the six proposers.

(3) Proposal Evaluation

The Project Brief includes a statement of the weights that will be ascribed to the technical and price portions of each proposal, for evaluation purposes. Technical merit was of significantly greater weight than price,
though price remained a significant factor. Proposals were evaluated and ranked technically following an evaluation process described in the Project Brief. Price was then considered using weights also specified in the Project Brief.

A single proposal was selected from the six (6) submitted, which includes eight (8) kilometers of climbing lane and full length breakdown lane along the route. The selected design required substantial cutting and filling, significant bridge widening, and landscaping throughout.

(4) Results

(a) Substantial Time Savings

The government signed a Design/Build contract fourteen (14) months after authority was obtained by the government to build the project. Construction of the project commenced twelve (12) months earlier than would have been possible using the “sequential design then build” process.

(b) Significant Improvement in Options Available to Government

The government had the opportunity to intelligently choose among six (6) different schemes for improving the road, each of which was described in 30% design documents. These designs included different approaches to provide break-down lanes, bridges, and passing lanes while integrating and blending these improvements into the natural features of the land. From the point of view of the government, the process significantly improved the government’s opportunity to select the proposal that represented the best value for the government.

(c) Substantial Capital Savings to Government

Assuming that the government estimate was reasonable, the Design-Build process did produce a substantial capital savings on this project. Prices submitted by the six (6) proposers ranged between 50% and 85% of the government’s estimate.

Case Study II-2

b) The Ting Kau Bridge

(1) Project Description and Requirements

This project is a key part of the “Country Park” section of Hong Kong Route 3, now under construction, which will create a direct north-south
highway connection between the cities of Hong Kong and Kowloon in the south and the People’s Republic of China in the north. The project is a complicated bridge to be built from Tsing Yi Island northward across a channel to Sham Tseng. One primary purpose of the project is to provide a highway connection for travelers from the new airport at Chek Lap Kok to turn northward toward China via Route 3 on the island of Tsing Yi, instead of entering the densely populated area of Tsuen Wan.

The project required high quality design to resist wind and water action. Timing was also critical because this bridge is one link in the chain of projects connecting the new airport north to the Chinese border. A Design-Build process was selected in an effort to obtain a high quality design and to save substantial time.

A process was followed which was similar to that used for the Tuen Mun Road. Minimum project requirements were set forth in significant detail in the Project Brief, which also included evaluation criteria and weightings.

(2) Results

(a) Substantial Time Savings

Construction on the bridge was commenced one year after the date the Design/Build contract was executed. This represents of time savings of 12 months compared to the traditional process.

(b) Substantially Better Design Selection Process

In the traditional process, the design that is produced for construction by a single designer may not be the best design, either from a cost, technical, or aesthetic point of view. The Design-Build process produced several different approaches for building the bridge, one of which included an innovative, state of the art stabilizing system to protect the bridge from wind. This design, which greatly improved aerodynamic performance, allowed the proposing group to make substantial savings in the cost of materials and installation.

Through the Design-Build process, the government was given the opportunity to see, at one time, several different approaches to design and construction of the bridge and to evaluate the economic advantages and disadvantages of each design as express in each proposal to build the facility.
Substantial Capital Savings to Government

The price submitted by the successful proposer was 60% of the government's estimate for the project. Assuming the government estimate was reasonable, the combination of a quicker construction schedule, an innovative stabilizing system, construction methods aligned with the innovative design, and the resulting design produced a 40% capital savings to the government.

Case Study II-3

c) The Tsing Ma Bridge

(1) Project Description and Requirements

This bridge will be the "signature" link of the Lantau Fixed Crossing, the transportation connection between the new airport at Chek Lap Kok off Lantau Island, and the rest of the Territory of Hong Kong. When completed, the bridge will be the longest suspension bridge in the world carrying both highway and rail traffic. The bridge will have an overall length of 2,200 meters, with a main span of 1,377 meters and two towers over 200 meters high. Named for the two islands it will connect — Tsing Yi and Ma Wan, the bridge deck will cross the Ma Wan channel approximately 62 meters above the water, carrying six lanes of traffic on the upper deck. On the sheltered lower deck will be two rail tracks and two additional lanes for traffic, which can be used either for emergency or for traffic flow in high wind conditions.

The procurement method selected by the government for this facility was Design-Build, for reasons similar to those applied with respect to the bridge at Ting Kau. As the most important single link between the new airport and all other destinations — Hong Kong, Kowloon, and China — time savings are critical. In addition, the Design-Build process provided the government with the opportunity to review competing technical schemes from consortia of the world's foremost bridge designers and constructors for the design and construction of this most important of the airport transportation links.

This project is described in more detail below as part of the Airport Core Program.
(2) Results

(a) Substantial Time Savings

Approximately a year was saved from project go-ahead to start of construction.

(b) Substantially Better Design Selection Process

The most significant result of the Design-Build process was an improved, innovative cable stabilization scheme for the bridge, comprising a box construction which stabilized the bridge and offered levels of transport inside the box and on top of the box. In high wind conditions, the box construction provides assured means of transport for transit and road vehicles to and from the airport.

Case Study II-4

d) Kap Shui Mun Bridge

The bridge across Kap Shui Mun channel is the smaller part of the Lantau Fixed Crossing, which, together with the Tsing Ma bridge, completes the bridge connection between Lantau Island, to which the airport is connected, and the rest of Hong Kong.57

(1) Project Description and Requirements

The main span of the bridge at Kap Shui Mun is 441 meters long and 54 meters above the sea. Facilities include a toll plaza, maintenance depot, control center, and administration building for the Lantau Fixed Crossing. Design-Build procurement processes were used to save time and associated capital costs in providing this relatively small, but important link in the Lantau Fixed Crossing.

(2) Results

The results were similar to those experienced with the previous three case studies:
(a) Substantial time savings to the start of construction, and

(b) Substantial improvement in the design/construction options available to government.

2. Case Studies in Design/Build/Operate

<table>
<thead>
<tr>
<th>Summary: Fourteen case studies are presented from Hong Kong in which the Design-Build-Operate (&quot;DBO&quot;) format was used. Design-Build-Operate is relatively new to Hong Kong, and represents a &quot;middle ground&quot; between Hong Kong's successful experience with Build-Operate-Transfer (described below) and Design-Build. All fourteen cases relate to environmental facilities. The government's interest in DBO arises, in part, from bad experiences with sequential processes. Facilities have not always performed in accordance with expectations, and the government has had a difficult time identifying and solving problems when neither the designer nor builder will acknowledge responsibility.</th>
<th></th>
</tr>
</thead>
</table>

Key advantages of using DBO as the project delivery method over sequential design then build are these: (a) time savings, (b) private financing (i.e. not government) of design, construction, maintenance, and operation, supported generally by fees passed directly through government to users, (c) single responsibility for design, construction, maintenance, and operation, (d) incentives to innovate in rapidly changing technological areas, and (e) adaptability to environmental projects.

The operator takes responsibility for the entire package of activities required to meet levels of performance specified by the government, including finance, design, construction, maintenance, and operation for the contract period, all as set forth in the Project Brief. The Project Brief establishes minimum environmental standards and performance requirements to be met by each proposing consortium, but also provide "maximum flexibility" to proposers to develop and suggest their own approaches to meet these minimum requirements. The result is that innovative technology is frequently proposed and used in these projects to meet minimum government requirements, including those relating to noise, air emissions, and concentration levels.

Current high population and economic growth in Hong Kong have combined to produce a strategic plan to significantly upgrade environmental infrastructure. Key elements of the plan include: (a) a dramatic increase in Hong Kong's capacity to safely and properly transfer and dispose of solid waste, (b) commissioning of a central chemical waste treatment center, and (c) substantial expansion in Hong Kong's capacity to safely and properly treat
waste water. These three efforts have produced fourteen (14) examples of the use of DBO processes, comprising a government response to pressing environmental problems that is unique in the world.

Waste Transfer and Storage Projects

A forty percent (40%) increase is expected in the quantity of waste generated in Hong Kong between 1994 and 2006, from 9500 tons per day to 13,000 tons per day. Most existing landfills were not designed in conformance with current engineering knowledge, and pose significant dangers to the environment. Hong Kong’s overall strategy is to accomplish three things at once: (a) close unsafe landfills and incinerators, (b) meet expected demand with new landfills and transfer facilities for the entire Territory, and (c) reduce overall disposal costs per ton.

To implement this strategy, three (3) very large landfills are being developed in remote parts of the country through DBO procurement methods. A network of nine (9) waste transfer stations is being provided throughout Hong Kong to collect waste at the local level for transshipment to these three large landfills. These twelve (12) facilities are being built and financed through DBO processes.

At the same time, several landfills and incinerators are being decommissioned using traditional contract processes. These include the Jordan Valley Landfill, the Lai Chi Kok Incinerator, and the Kennedy Town Incinerator, all located in urban areas. A fourth major facility, the Kwai Chung Incinerator, will be closed shortly.

a) Strategic Land Fill Projects

To solve solid waste storage problems over the next decade, three strategic landfills are being constructed in Hong Kong, located remotely in the Territory. Each of these three projects are very large, and use state of the art technology, engineering, and construction methods. Impervious liners are included to prevent (or minimize) leakage down or out through the facility. Gases generated in the waste and contaminated liquids which leach through are to be collected and separately treated.

Included in the government’s procurement strategy for these strategic landfills is explicit recognition that one key to success is to attract the world’s finest waste management companies to design, build, finance, and operate the new landfills. The government has made a series of specific decisions to provide a climate which is attractive to major corporations to submit proposals for these projects. These decisions include imposition of the highest international environmental standards and reasonable allocations of performance risks in the Project Brief between the government and proposers.
Case Study II-5

WENT (West New Territories) Landfill - Open November 1993

West New Territories Landfill ("WENT") is the first of the strategic landfills to come on line in Hong Kong. The facility is located at the western end of the New Territories, north and west of Tuen Mun, close to Deep Bay.

Case Study II-6

SENT (South East New Territories) Landfill

The South East New Territories Landfill ("SENT") is located to the east across Victoria Harbour from Hong Kong Island.

Case Study II-7

NENT (North East New Territories) Landfill

The North East New Territories Landfill ("NENT") is located far to the north from the City of Hong Kong, close to the Chinese border, near Shenzhen.

The table below contains further information on each of these three landfills.59

<table>
<thead>
<tr>
<th></th>
<th>Scheduled Commission Date</th>
<th>Estimated Capacity (M cu.m)</th>
<th>Site Area (ha)</th>
<th>Estimated Life (yrs)</th>
<th>Estimated Capital Cost *(M HK)</th>
<th>Est. Annual Recurrent Cost *(M HK)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case No 5 WENT</td>
<td>11/19/93</td>
<td>61</td>
<td>106</td>
<td>25</td>
<td>1470</td>
<td>80</td>
</tr>
<tr>
<td>Case No. 6 SENT</td>
<td>Late 1994</td>
<td>39</td>
<td>100</td>
<td>13</td>
<td>1642</td>
<td>100</td>
</tr>
<tr>
<td>Case No. 7 NENT</td>
<td>Mid 1995</td>
<td>35</td>
<td>67</td>
<td>16</td>
<td>1841</td>
<td>70</td>
</tr>
</tbody>
</table>

* All costs shown are based on August 1993 Hong Kong Dollars.
In selecting the Design-Build-Operate procurement method for these landfills, the government stated that it was pursuing five simultaneous goals: (a) a well-publicized program open to competition from around the world, (b) a fair tendering process, (c) high environmental standards for design, construction and operation, (d) a long term commitment for operation of the facilities with steady employment of workers, and (e) an allocation of the risk associated with disposal of solid waste in which both the tenderer and the government accepted part of this risk.

The means by which government takes part of this risk is by specifying levels of performance in the contracts which are reasonable and capable of being performed. The consortia proposing to develop these landfills, including engineers, constructors, technology suppliers, and financing banks that guarantee the performance of the facility are able to evaluate and assess these risks in advance. The income stream generated by these projects have proven to be sufficient to attract high quality, well-financed consortia to tender and win these projects, and, at the same time, to reduce overall costs to the government per ton for solid waste disposal.

The next table presents a rough estimate of cash flows from these projects, and provides a better understanding why private investors and government are attracted to these projects.

Table II-2

<table>
<thead>
<tr>
<th>Landfill</th>
<th>Capacity Cu.M.</th>
<th>Capacity Tons</th>
<th>Total Cash Flow</th>
<th>Annual Cash Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>WENT</td>
<td>61</td>
<td>161.65</td>
<td>$12,124</td>
<td>$485</td>
</tr>
<tr>
<td>SENT</td>
<td>39</td>
<td>103.35</td>
<td>$7,751</td>
<td>$596</td>
</tr>
<tr>
<td>NENT</td>
<td>35</td>
<td>92.75</td>
<td>$6,956</td>
<td>$435</td>
</tr>
</tbody>
</table>

Notes: $ are in HK millions. Figures are not discounted. Ton capacity based on average weight of 150 #/cu.ft. Constant tipping fee of $75/ton assumed over life.

Each of these projects will produce annual cash flows from 400-600 million Hong Kong dollars, more than sufficient to finance construction and recurrent costs, and provide a return on investment that equals or exceeds other possible investments in the market. Cash flows are high enough to interest very high quality firms to form consortia and compete for these projects, which include the associated risks of complying with environmental standards.⁶⁰
(1) Description of the Procurement Process

Just as in the case for other procurements in Hong Kong, a Project Brief is prepared by the government which describes the location and the general design requirements for the project. The project Brief describes the basis upon which DBO proposals will be evaluated. There are typically three factors:

a. technical merit

b. cost to the government, and

c. impact on the environment.

The manner in which the winning proposer ("operator") will be paid is also described in the Project Brief. The government guarantees a specific minimum volume of refuse to be delivered to the landfills over the life of the operating portion of the contract and also agrees to pay specific tipping fees during the same period. Payments to the DBO operator are contingent, however, on consistently meeting the technical performance requirements contained in the Project Brief. For example, if odors exceed levels permitted in the Project Brief, there is a corresponding reduction in payments to the operator. If the operator is unable to process the daily tonnage levels specified in the Project Brief, there is a corresponding reduction in payments to the operator. If detection devices required by the Project Brief indicate that the leakage through the impervious liner exceeds maximum limitations set forth in the Project Brief, the operator is required to repair the facility at its expense and accept a corresponding reduction in payments to the operator.

The contracts between the government and operators for the development, operation, and closure of strategic landfills are typically for terms approaching fifty (50) years. Termination for default is a remedy retained by the government, which remedy includes the right to call upon substantial guarantees required by the Project Brief to be available in the event of such default.

The cost of placing a tender for one of these large strategic landfills is estimated by the government sources at $1M US. The 50 year income stream from the projects is believed to be producing 15-18% rates of return.

One of the goals of the government was to attract the world’s best firms to design, build, and operate these facilities. This strategy appears to have been successful, particularly for American or American supported consortia. Teams led by BFI and WMI have been selected as operators for two of the three landfills.
(2) Results

The results of the strategic landfill program to date have been remarkable.

(a) Reduction in Landfill Costs

The cost per ton for waste has been reduced by approximately 6% from HK$80 to HK$75.

(b) Predictable Future Landfill Costs

Through the DBO arrangement, the government has greatly reduced the risk of change in landfill costs over the next 25 years, during which period the three strategic landfills will be available at known costs.

(c) Private Financing

A significant additional benefit is that these landfills were financed in private markets by the operators themselves. No government appropriations were required, except for overhead costs associated with preparing the Project Brief and conducting the competition. An independent checking engineer verifies compliance with design, construction, maintenance, and operating requirements at the operator’s expense throughout the term of the agreement.

(d) Substantial Upgrade in the Quality of Waste Disposal Facilities

The most significant benefit is the substantial improvement in the quality of waste disposal facilities in use in Hong Kong, which replaces outmoded landfills and incinerators with state of the art, engineered facilities.

b) Hong Kong’s New Network of Waste Transfer Stations

To collect Hong Kong’s solid waste for later shipment to the WENT, SENT, and NENT strategic landfills, the Hong Kong government is arranging for a network of waste transfer stations to be separately designed, built, financed, and operated using Design-Build-Operate procurement mechanisms. The procurement procedures used for waste transfer stations is the same as that used for strategic landfills. A Project Brief is prepared which describes the location, general design, and operating requirements for each transfer station. The term of DBO contracts for transfer stations is typically 15 years.
These include the requirement that transfer stations be fully enclosed so that operational noise is minimized, that air inside each station be under a slight vacuum, and constantly treated with purification systems before being released into the atmosphere. Other requirements include the on-site treatment of wastewater generated from operations at the station before discharge into public sewers. Systems for washing all collection vehicles before they leave the transfer station are also required.

The DBO proposals submitted are evaluated on the same three criteria used to select landfill operators:

a. technical merit
b. cost to the government, and
c. impact on the environment.

To date, two of the transfer stations have commenced operations using the DBO format:

Chai Wan (HK Island East), shipping to the WENT landfill, and

Kowloon Bay, shipping to the NENT landfill.

A third transfer station is under construction at Sha Tin, which will ship waste to the NENT landfill.

The nine transfer stations to be built as part of this program are identified below.

Case Study II-8

Kowloon Bay

Case Study II-9

Island East

Case Study II-10

Sha Tin

Case Study II-11

Island West

Case Study II-12

Outlying Islands
Case Study II-13
West Kowloon

Case Study II-14
North Lantau

Case Study II-15
NW N. Territories

Case Study II-16
Tai Po

The table below provides more information about each of these transfer station projects.\textsuperscript{61}

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>No. 8 Kowloon Bay</td>
<td>1800</td>
<td>1724</td>
<td>4/9/1990</td>
<td>$217</td>
<td>$100</td>
</tr>
<tr>
<td>No. 9 Island East</td>
<td>1200</td>
<td>1240</td>
<td>11/16/92</td>
<td>$413</td>
<td>$70</td>
</tr>
<tr>
<td>No. 10 Sha Tin</td>
<td>1000</td>
<td>-</td>
<td>End 94</td>
<td>$222</td>
<td>$30</td>
</tr>
<tr>
<td>No. 11 Island West</td>
<td>1000</td>
<td>-</td>
<td>Early 97</td>
<td>$995</td>
<td>$97</td>
</tr>
<tr>
<td>No. 12 Outlying Is.</td>
<td>365 (608 inc. constr’n)</td>
<td>-</td>
<td>Early 97</td>
<td>$426</td>
<td>$32</td>
</tr>
<tr>
<td>No. 13 W. Kowloon</td>
<td>2500</td>
<td>-</td>
<td>End 96</td>
<td>$624</td>
<td>$110</td>
</tr>
<tr>
<td>No. 14 North Lantau</td>
<td>450-1200</td>
<td>-</td>
<td>Early 97</td>
<td>$270</td>
<td>$23-33</td>
</tr>
<tr>
<td>No. 15</td>
<td>500-1100</td>
<td>-</td>
<td>Early 97</td>
<td>$250</td>
<td>$48</td>
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<tr>
<td>NWNT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>---------</td>
<td>---------</td>
<td>--------</td>
<td>------</td>
<td>------</td>
</tr>
<tr>
<td>No. 16 Tai Po</td>
<td>500 Estim.</td>
<td>-</td>
<td>2000</td>
<td>$130</td>
<td>$20</td>
</tr>
</tbody>
</table>

* All costs shown are in millions of 1993 HK.

(1) **Results**

To date, the results of the waste transfer are remarkable for the same reasons as the strategic landfill program.

(a) **Reduction in Overall Landfill Costs**

The transfer stations play a part in reducing overall disposal costs for waste from HK$80 to HK$75.

(b) **Predictable, Stable Future Disposal Costs**

Through the DBO arrangement, the government has greatly reduced the risk that costs for transferring and disposing of waste will spiral upward over the next 15 years. Instead, the government is pricing its expected needs through the next fifteen years and transferring the risk of cost growth to the DBO operators.

(c) **Private Financing**

The waste transfer stations, too, are being financed in private markets by the operators themselves. No government appropriations are required, except for overhead costs associated with preparing each Project Brief and conducting each competition. As with the strategic landfills, an independent checking engineer verifies compliance with design, construction, maintenance, and operating requirements at the operator's expense throughout the term of the agreement.

(d) **Substantial Upgrade in the Quality of Waste Disposal Facilities**

Again, the most significant benefit is a substantial improvement in the quality of overall waste transfer and disposal facilities in Hong Kong.
Case Study II-17

c) Chemical Waste Treatment Center

In May 1993, the first integrated Chemical Waste Treatment Center in South East Asia commenced operations on the island of Tsing Yi, in Hong Kong. The plant was designed, built, and financed$^{62}$ using DBO processes.$^{53}$

(1)  Description of the Project

Hong Kong’s need for a separate chemical treatment center arises from the rapid economic boom that many South East Asian countries have experienced over the last decade. A quickly expanding industrial sector was producing chemical waste in steadily increasing quantities. During this period, the rate of increase exceeded the rate at which environmental facilities were built to treat chemical waste.

Of particular concern in Hong Kong is the small waste producer, who has no convenient or safe way to dispose of chemical waste. There are thousands and thousands of such small businesses in Hong Kong. Large producers can treat chemical wastes at the source and Hong Kong laws so require. Small producers cannot do so conveniently, properly, or economically. Small producers have neither the technical knowledge nor the wherewithal to install and operate treatment facilities in these businesses. The government estimates that small producers generate ninety percent (90%) of the chemical waste in Hong Kong. In the past, a frequent result is for small producers to illegally mix chemical waste with Hong Kong’s sewer or waste water collection systems.

The Chemical Waste Treatment Center project is aimed at substantially raising the level of voluntary compliance with Hong Kong’s tough Waste Disposal [Chemical Waste] [General] Regulation by providing a convenient, efficient, economic alternative to illegal dumping of chemical waste in Hong Kong. A secondary purpose of the project is to reduce the volume of chemical waste that is combined with solid waste and deposited in the Hong Kong’s new strategic landfills.

The DBO process previously described was used to identify and select one of several different design/construction/operate schemes for the plant. The Project Brief set the general guidelines for the plant, including a 100,000 ton annual capacity, and the general design requirements for treatment, including three major waste treatment processes:

a. an oil/water separation system
b. a physical-chemical treatment system that treats water-based chemical wastes such as acids, alkalis, and wastewater containing heavy metals salts; and

c. a high temperature chemical waste incinerator that is capable of destroying the most hazardous organic wastes such as pesticides and polychlorinated biphenyls.

(2) Results

The DBO process used to develop the Chemical Waste Treatment Center duplicates the benefits offered from the strategic landfill and waste transfer station projects.

(a) Substantially Better Technical Result

The project eliminates large quantities of chemical wastes from waste water and sewer systems and from landfill deposits, while offering a convenient, inexpensive means of complying with environmental laws as to chemical waste treatment and disposal. The treatment center uses vastly superior chemical treatment processes to reduce environmental risk particularly when compared to the old practices of mixing these materials in landfills or in sewer systems.

(b) Likely Reduction in Overall Waste System Costs

Although there is no data on the point, it is likely that there will be a substantial future savings because 100,000 tons of chemical wastes are separated from water, sewer, and landfill waste streams each year.

(c) Predictable, Stable Future Chemical Waste Treatment Costs

Through the DBO arrangement, the government has greatly reduced the risk that costs for treating chemical waste will move dramatically upward over the next 15 years.

(d) Private Financing

The chemical waste treatment center was financed in private markets by the operators. No government appropriations are required, except for overhead costs associated with preparing the Project Brief, conducting the competition, and managing the collection system for chemical waste. As with other DBO projects, an independent checking engineer verifies compliance with design, construction, maintenance, and operating requirements at the operator’s expense throughout the term of the agreement.
3. Case Studies in BOT

Summary: Five case studies are presented from Hong Kong in which the Build-Operate-Transfer mechanism was used. The key advantages for government of using BOT over sequential design then build (a segmented process) are (a) time savings, (b) private financing without revenue risk, (c) verification of project rationale (design, construction, O&M, financing) in the private sector, (d) participation in innovations which reduce capital costs, and (e) the opportunity to choose “best value” from various combinations of design, construction, maintain: ice, operations, and price options.

BOT is typically applied to large, complex infrastructure projects where facilities will generate substantial revenue streams through user fees. Hong Kong has generally applied BOT mechanisms to approximately 10% of its infrastructure projects.

Compared with the traditional sequential design then construct process, the Build-Operate-Transfer delivery method offers substantially different attractions for governments and investors. BOT is one last giant final step along the path from a direct-segmented procurement process to a fully indirect-system process in which the role of government is limited to the identification of overall project goals.

BOT offers a substantially different procurement process. In BOT, the term “risk allocation”, as commonly used in U.S. federal procurement, has little application. Because the roles of the government and tenderers in the BOT process are fundamentally different, risk allocation is based upon different logic, uses different terms, and arrives at different results.

Much of Hong Kong’s experience in BOT processes has been in connection with large transportation projects. Each of the five case studies presented are in this field.

Case Study II-18

a) Hong Kong Central Harbor Crossing

The first BOT tunnel project built in Hong Kong was the Central Harbor Crossing, which connected Hong Kong Island with Kowloon by road for the first time. Opened in 1972, the tunnel was privately designed, financed, and constructed based upon a thirty (30) year franchise agreement, confirmed by Hong Kong ordinance, which authorized the franchisee to provide the facility and collect specified tolls.

The franchisee was selected through a competition among several operators interested in obtaining the franchise. Competition was conducted
in the general pattern described below. This pattern has been followed, with slight adjustments, in each of the BOT projects which succeeded the Central Harbor Crossing.

A Project Brief was prepared by the government, with the assistance of retained consultants, which described the general requirements of the government for the tunnel, including number of lanes, general alignment, required connections to transportation facilities on each side of the harbor, minimum design requirements for tunnel walls, HVAC systems, roadway materials, and all other significant components. The general terms of the franchise sought by the government was also specified, including tolls anticipated for users, length of the franchise, and maintenance and operating requirements. The Project Brief included the results of soils testing, anticipated traffic volumes, general planning studies for Hong Kong, and anticipated growth patterns in both Hong Kong and Kowloon.

In essence, the Project Brief contained substantially more information about minimum design requirements for the facility than would typically be given by American governments before a competition for designers is conducted — roughly equivalent to 10% design complete. In addition to engineering requirements, the Project Brief contained information for proposers to use in preparing a financing package for the project, such as anticipated tolls, traffic volumes, and time frames required to prepare estimates for maintenance and operations during the franchise period.

In response to the Project Brief, several proposals were received by the government to design, finance, build, operate and maintain the tunnel for a thirty (30) year period from the start of construction. A proposer was selected who completed all these tasks and has operated and maintained the facility since it opened in 1972. The risk that traffic volumes would be less than forecast by the government, or independently by the proposers, was borne by the franchisee. All financial risks associated with design, construction, operation, and maintenance of the tunnel during the entire franchise period remains with the franchisee. The performance of each of these obligations is guaranteed to the government by the franchisee, and in turn by the banks which financed the project.

The traffic projection risk turned out not to exist. Traffic volumes have been at capacity through much of the franchise period, despite surcharges by the government to the tolls charged by the franchisee. Because the financial performance of the tunnel is private, the actual rate of return (“ROR”) on this investment are not known, but it is reasonably certain that ROR exceeds 15 - 18%, since traffic volume remains steady at tunnel capacity.

Substantially more information is available about the remaining four case studies.
Case Study II-19

b) Eastern Harbor Crossing Hong Kong

The Eastern Harbor Crossing was the second BOT cross harbor tunnel to be built in Hong Kong, connecting Kwun Tong, at the eastern end of Kowloon Bay, with Hong Kong Island, at Quarry Bay. The franchise for the Eastern Harbor tunnel is held by The New Hong Kong Tunnel Company Limited (NHKTC). The facility is an immersed tube, combined road and rail tunnel, with four lanes for cars and two lanes for transit, as shown in the figure below.

Figure II-6

Eastern Harbor Crossing Schematic

(1) Project Background

Interest was keen in the project for a number of reasons: (a) the apparent success of the Central Harbor Crossing, (b) unusual growth in population in Hong Kong which kept demand high for a second crossing, (c) the extension of the Mass Transit Railway Corporation (MTRC) around Kowloon and back to Hong Kong Island along the same route, and, undoubtedly, (d) an unsolicited proposal to the government to build the facility by Kumagai Gumi Company Limited and Marubeni Corporation in June, 1984. The Kumagai/Marubeni proposal rapidly focused attention upon the possibility that the Eastern Harbor Crossing could be quickly and efficiently provided by the private sector.

Rather than negotiate only with Kumagai/Marubeni, the government decided in October, 1984 to put the project out to open tender. In order to receive a copy of the Project Brief, a HK$1M deposit was required to be posted with the government, returnable upon return of the Brief. On April 1, 1985, nine (9) tenders were received in response to the Project Brief, each proposing different schemes for the design, financing, construction, operations and maintenance of the crossing for the franchise period of 30 years. The rail portion of the tunnel crossing was to be included in the BOT project, but the MTRC was committed to lease the facility from the successful franchisee for the entire period of the franchise.
In June, 1985, the government narrowed the competitors to a short list of three (3). In December, 1985, the government announced that the consortium led by Kumagai was the successful bidder for the project. After negotiations as to the terms of the franchise agreement, the New Hong Kong Tunnel Company Ltd. was formed to develop and operate the roadway portion of the facility and the rail portion of the franchise was assigned to a separate company, the Eastern Harbour Crossing Company Limited (EHCC). These arrangements were confirmed by the government of Hong Kong through the Eastern Harbour Crossing Ordinance on July 17, 1986 and construction commenced three weeks later, on August 7, 1986.

(2) Project Structure

The Road Franchise. The New Hong Kong Tunnel Company Ltd. has eight shareholders, six of whom are companies that participated in the design and construction work. The percentages held in the venture are listed below.

Table II-3

<table>
<thead>
<tr>
<th>Shareholders</th>
<th>Percentage Held</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marubeni</td>
<td>1.438%</td>
</tr>
<tr>
<td>Marubeni Hong Kong Ltd.</td>
<td>1.412% (Total for Marubeni to be 2.775% later)</td>
</tr>
<tr>
<td>Lilley Construction Ltd.</td>
<td>4.75% to be 4.625%</td>
</tr>
<tr>
<td>Paul Y. Construction Ltd.</td>
<td>6.65% to be 6.475%</td>
</tr>
<tr>
<td>Kumagai Gumi</td>
<td>30.875%</td>
</tr>
<tr>
<td>Kumagai Int’l Ltd</td>
<td>40.375% (Total for Kumagai to be 69.375% later)</td>
</tr>
<tr>
<td>China Int’l Trust and Investment Corporation (CITIC), a State-owned business corporation from the PRC.</td>
<td>9.5% to be 9.25%</td>
</tr>
<tr>
<td>Government of Hong Kong</td>
<td>5% to be 7.5%</td>
</tr>
</tbody>
</table>

The Rail Franchise. The Eastern Harbor Crossing Company Ltd. has three shareholders, two of whom are companies participating in the design and construction work. The percentages held in the venture are listed in the table below.
Table II-4

<table>
<thead>
<tr>
<th>Shareholders</th>
<th>Percentage Held</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kumagai Gumi</td>
<td>45%</td>
</tr>
<tr>
<td>Kumagai Int’l Ltd</td>
<td>45%</td>
</tr>
<tr>
<td>China Int’l Trust and Investment Corporation (CITIC), a State-owned business corporation from the PRC.</td>
<td>10%</td>
</tr>
</tbody>
</table>

Financing Structure. The financing structure for the project includes a mixture of (a) debt financing, composed of bank credit facilities and installment sales credit facilities, and (b) equity financing provided by the Company’s shareholders, as described below.

Table II-5

<table>
<thead>
<tr>
<th>Eastern Harbour Crossing Project Multi-Source Financing Package</th>
</tr>
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<tbody>
<tr>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>New Hong Kong Tunnel Road Franchise</th>
<th>Eastern Harbor Crossing Rail Franchise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank Credit Facilities</td>
<td>HK$1.8 Billion, due for repayment in 2001</td>
</tr>
<tr>
<td>Installment Sales Credit Facilities</td>
<td>HK$250 Million, due for repayment in 2005</td>
</tr>
<tr>
<td>Equity Financing from Shareholders</td>
<td>HK$750 Million</td>
</tr>
<tr>
<td>Totals</td>
<td>HK$ 2.8 Billion</td>
</tr>
</tbody>
</table>

Bank credit facilities for the project were organized by a syndicate of local and international banks. Fifty (50) banks and financial institutions from all over the world are participating in the Bank financed debt.

Installment credit facilities were provided by Japanese and Chinese leasing companies, secured by the equipment incorporated into the project. The installment financing was structured so that it became available to refinance equipment costs upon completion of the project.

Contracting Structure. Three of the four private shareholders in the New Hong Kong Tunnel Company, representing over 80% of the shares of the company, were awarded contracts to perform the major portions of the
work. Kumagai Gumi Company Ltd. ("Kumagai") was awarded the contract for design and construction of the entire project. Kumagai contracted with Paul Y. Construction Company Ltd. for detailed design and construction of the Hong Kong Island road infrastructure and Quarry Bay low level station. A separate contract with Lilley Construction Ltd. was executed by Kumagai for detailed design and construction of both road and rail works on the Kowloon side. A number of consultants were retained to assist in the detailed design and management of the work. The Figure below shows these contract relationships.

**Figure II-7**

**Contracting Structure**

- NHKTC Road Franchise
  - EHC Project Management Co. Ltd
    - Project Managers
  - Kumagai Gumi
    - Overall Design/Build
  - Lilley Construction Ltd
    - Design/Build Kowloon Side
  - Paul Y. Construction Ltd
    - Design/Build Hong Kong Side
  - Detailed Designers
    - Freeman Fox
    - Oakervan Perrett & Partners

**Franchise Structure.** Under the terms of the various agreements, the government of Hong Kong entered into a road operating agreement with the New Hong Kong Tunnel Company, Ltd. (NHKTC) and, through the Mass Transit Railway Corporation, entered into a rail operating agreement with the Eastern Harbor Crossing Company Ltd. (EHCC). Rail Franchise and Management Agreements between NHKTC and EHCC, together with an
Engineers Agreement with Freeman Fox and an Independent Engineers Agreement with Maunsell completed the franchise structure required by the government. The independent engineers report both to the NHKTC and to the Government of Hong Kong. This structure is shown in the Figure below.

**Figure II-8**

**Franchise Structure**

The project was built in thirty-eight (38) months, from August, 1986 to October, 1989. The scheduled construction period was forty-two (42) months (completion in February, 1990), but the franchisee beat the scheduled opening by four (4) months. For the highway tunnel, the franchise was awarded for thirty (30) years from start of construction. Finishing early therefore allowed the NHKTC to collect tolls for an four additional months during the franchise period.
(3) Results

(a) Feasibility Independently Confirmed

Nine different consortia presented initial BOT proposals in response to the Project Brief, independently confirming feasibility in a way unlike that found in the current American paradigm. The feasibility of engineering, construction, maintenance, operation, and financing was confirmed by nine different consortia, which considers the risks associated with traffic flows, toll rates, interest fluctuations, subsurface soil conditions, construction techniques, major systems such as the single seal gaskets on the immersed tubes, and numerous other elements of the project.

(b) Project Development Before Proposals Are Submitted

Along with independent confirmation of the project comes extensive development of the project within each consortium, free from interference or control by the government. For the Eastern Harbor Crossing, representatives of highly qualified designers and constructors throughout the world acted together, with financial analysts and banks, to continually shake out design, construction, operation, maintenance, and financing problems before each proposal was submitted in response to the Project Brief. At this stage, every member of each consortium is focused upon what he/she can contribute to the economic vitality of the project. Analysis is directed at improving project value to the government, typically through high quality, lower initial capital costs, lower maintenance costs, lower operations costs, or shorter project delivery time. In this environment, new construction methods, designs, materials, and equipment are explored and wisely applied.

(c) Substantial Time Savings

There was a substantial time savings to the government in opening the facility to public use. From the date the franchise agreement was signed, the project was designed, constructed, and opened for traffic in thirty-eight (38) months.

(d) World-Wide State of the Art Tunnel Technology and Reduction in Overall Capital Costs

The project utilized the first single seal gasket for an immersed tube tunnel in the world, which in turn required innovative construction methods and which also reduced the time and expense for construction and installation of the tube sections.
(e) No Maintenance and Operations Costs During the Franchise Period

Through the BOT arrangement, the government eliminated the risk that its maintenance and operations costs for the crossing will increase over the next 30 years.

(f) Private Financing

An obvious benefit is that the harbor crossing was financed in private markets by the operator. No government capital appropriations were required, except for overhead costs associated with preparing the Project Brief and conducting the competition. MTRC pays the EHHCC rent under the operating lease for the transitway across the harbor, but this is an operating expense which is itself financed through transit fares. An independent checking engineer verified compliance with design and construction requirements and will verify compliance with maintenance and operating requirements at the operator's expense throughout the term of the agreement.

(g) Substantial Upgrade in the Transit and Highway Network

A significant benefit is the substantial extension of transit and transportation facilities that the project represents. A second, eastern connection between Hong Kong was established by road, and the circular transit loop around Hong Kong and Kowloon was completed.

Case Study II-20

   c) Tate's Cairn Tunnel

      (1) Project Background

      The Tate's Cairn Tunnel is another BOT project connecting the urban areas of Kowloon with the newly developed towns in the New Territories of Hong Kong to the northeast. The tunnel is approximately four (4) kilometers in length and cost approximately HK$1.2 Billion. Construction was commenced in July, 1988 under a 30 year franchise agreement with the government which begins from the date construction started.

      The principal mover behind the project was Nishimatsu, a large Japanese constructor who was a leading member of one of the unsuccessful proposers for the Eastern Harbor Crossing project described above.

      Project Rationale. The need for the Tate's Cairn Tunnel is directly related to the growth of the New Territories north and northeast of
Kowloon. One of these towns, Sha Tin, had seen explosive population growth in the mid 1980's. Road connections between Sha Tin and the Kowloon/Hong Kong metropolitan area were extremely poor. Only two roads existed from Kowloon to Sha Tin. The first, through the Lion Rock Tunnel, was already at its absolute capacity of 3400 vehicles per hour in each direction. The second, the Tai Po Road was only two-lanes wide, with poor horizontal and vertical alignments. In addition, this road was operating at or near capacity. Traffic volumes were growing at approximately 12% per year and there were many hours each day when traffic was highly congested.

The Gammon-Nishimatsu Proposal. In 1986, shortly after the franchise for the Eastern Harbor Crossing was awarded, the Gammon-Nishimatsu Joint Venture submitted an unsolicited proposal to the government of Hong Kong to build, operate, and transfer a new tunnel to connect Kowloon with Sha Tin, called the Tate’s Cairn Tunnel. The Joint Venture had assembled a team of investors, bankers, engineering consultants, contractors and other parties to provide engineering, construction, financing, and operations services for the project over a thirty year franchise.

The proposal named the G/N JV as principal contractor, Standard Chartered Asia as financial advisor, Maunsell Consultants Asia as engineering consultants, and MVA Consultancy as transport planners. The proposal that was submitted was sufficient to establish both the engineering and financial viability of the project. The tunnel was to be entirely financed, designed, built, and operated by a single franchisee, the Tate’s Cairn Tunnel Company Ltd., with the guaranteed support and financial backing of the founding shareholders of the Company, the constructors, and well-known financial institutions.

Elements of G-N JV’s Proposal. The G-N JV proposal included the following elements at the time it was first submitted to government: outline drawings; planning study results describing the potential benefits of the new tunnel on Hong Kong’s transport infrastructure; a summary of proposed engineering and construction methods; a financing proposal; an operations plan for the tunnel; proposed toll structures based on traffic studies and surveys; hand over of the project to Government in 30 years; and a schedule for construction of forty-two (42) months.

Government’s Response. In May, 1987, the government responded to the unsolicited proposal by issuing a Project Brief inviting open tenders for a thirty-year (30) franchise for the Tate’s Cairn Tunnel. The Project Brief, prepared for government by a consultant, described the minimum requirements for submittal of conforming tenders.

Six conforming tenders were received, including one by the G-N JV. The G-N JV proposal included the shortest completion period for design and construction (thirty seven months) and an innovative ventilation system.
designed by Parsons Brinckerhoff Asia, which reduced overall capital costs. The JV's proposals included other innovations in the design of elevated connecting roads and tunnel finishes. Rather than just meeting the minimum roadway surface standards in the Project Brief, G-N JV proposed an alternate, more expensive roadway surface that saved money over the franchise period through lower operating and maintenance costs. The G-N JV proposal offered a financing package with a substantial equity contribution from the individual promoters, together with advantageous interest rates. These attributes resulted in a lower proposal for tolls to be charged over the life of the project.

The government of Hong Kong selected G-N JV as the successful proposer and offered the proposed Tate's Cairn Tunnel Company a 30 year franchise to build and operate the tunnel and its approach roads. After further negotiations, a franchise agreement was reached and ratified by the enactment of the Tate's Cairn Tunnel Ordinance in July, 1988.

(2) Project Structure

Financial Structure. Six different companies are founding shareholders of the Tate's Cairn Tunnel Company, as shown in the table below.

Table II-6

<table>
<thead>
<tr>
<th>FOUNDING SHAREHOLDER</th>
<th>PERCENTAGE (%) HELD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nishimatsu Construction Co. Ltd.</td>
<td>37</td>
</tr>
<tr>
<td>China Resources (Holdings) Co. Ltd.</td>
<td>24</td>
</tr>
<tr>
<td>New World Development Co. Ltd.</td>
<td>24</td>
</tr>
<tr>
<td>C.I.T.O.H &amp; Co. Ltd.</td>
<td>5</td>
</tr>
<tr>
<td>Jardine, Matheson &amp; Co. Ltd.</td>
<td>5</td>
</tr>
<tr>
<td>Trafalgar House PLC</td>
<td>5</td>
</tr>
</tbody>
</table>

Six hundred million dollars (HK$600 M) in equity were provided by the founding shareholders, representing 28% of total project capital costs. The remaining HK$1.55 Billion in project financing came through a term loan facility provided by a consortium of international banks arranged by the Bank of Tokyo Ltd., the China Development Finance Company (Hong Kong) Ltd., and the Fuji Bank Limited. The financing agreements provide that the HK$600 Million in equity is spent first to pay for the first fifteen (15) months of construction. The term loan facility is then drawn down to complete the project and to cover initial deficit operations during the first few years of tunnel operations. The loan agreements require that the term loan facility is to be paid in full within 12.5 years from the date the tunnel is first opened to the general public. Annual revenues were budgeted to reach HK$260 Million

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by the fifth year of operation, which is more than sufficient to pay the term loan facility within the 12.5 year period. The continued income stream of HK$260 Million (plus) will be applied over the remaining 14.5 years of the franchise to maintain and operate the roadway and for retirement of the HK$600 Million in equity contributed by the founding shareholders.

Tolls are the only source of revenue for the project, beginning at $4 for private cars, $7 for light goods vehicles, and $8 for medium and heavy goods vehicles and buses. The financing plan submitted with the JV’s proposal projected that 71,000 vehicles each weekday would use the Tate’s Cairn Tunnel when it first opened in 1990, rising to 106,000 vehicles each weekday by the year 2001. All fare increases are subject to prior approval of the Governor in Council. The terms of the franchise agreement provide for a royalty payment of 2.5% of gross operating receipts from the Tate’s Cairn Tunnel Company to the HK government throughout the first five years of operation, which is then raised to 5% for the remaining term of the franchise.

Contract Structure. The Figure below shows the contracting system employed by the Tate’s Cairn Tunnel Company. As in the case of the Eastern Harbor Crossing, both Nishimatsu and Gammon, members of the joint venture who led the proposing consortium, are performing substantial parts of the work. Nishimatsu is the designated Sub-contractor for tunnels and ancillary buildings on the project. Gammon is the designated subcontractor for approach roads and the administration building for the tunnel.
(3) Project Results

The project was completed on schedule. Toll paying traffic has exceeded the projections used in the financing plan for the project. Project income is private, but assuming development costs were as projected, profits to the franchisee are in excess of projections.

The benefits described above for the Eastern Harbor Crossing were realized here, namely, (a) independent confirmation of project feasibility, (b) competitive independent project development prior to submittal of proposals, (c) time savings, (d) innovation in design, construction methods, and maintenance and operations systems, (e) no government expenditure of capital costs, (f) no government expenditure of operating and maintenance costs, and (g) a substantial upgrade in publicly available highway infrastructure.
In addition, four other benefits can be identified.

(a) Project risks wrapped up together.

Through the BOT process used for the Tate's Cairn Tunnel, virtually all risks associated with the project, including engineering costs, engineering design, construction costs, construction methods, finance rates, finance costs, traffic volumes, revenue and pay back periods, public acceptance of the tolls to be charged, operations and maintenance costs, are assumed by the franchisee, and in turn by its shareholders -- the constructors -- in exchange for the cash flow anticipated from toll revenues for the entire thirty (30) year franchise period.

(b) Interests Are Aligned and Wise Conduct Encouraged

Another significant benefit is that prior to the selection of the most advantageous proposal by the government, the interests of participants in each consortium and the interests of the government are the same. The BOT process puts government and each proposing group in one effort to creatively find the most advantageous combination of lowest cost, highest quality, lowest tolls to the public, and quickest delivery schedule.

Moreover, the BOT process encourages the most sound, integrated approach to project development by consortia, because of the large cash flows generated over substantial periods and because of the large costs associated with preparing and submitting a proposal. Consortia have the strongest incentive in these circumstances to assemble the best design, construction, financing, and operations expertise to incorporate techniques which save money, save time, and improve quality. The project is treated as an integrated whole, from design to "handover" thirty years hence, by each consortium which prepares a proposal.

(c) Government Has A Significantly Better Opportunity to Choose Best Value

The government is in a much stronger position to obtain best value in the BOT setting, since it can choose among several different complete thirty year packages for the project. It can review and approve criteria adopted in the detailed design, monitor the quality of the work as it is constructed, and be assured, at the end of the franchise period, that the facility have not only operated as designed for thirty years, but has been maintained according to the terms of the franchise agreement.
(d) Government Avoids Additions to Permanent Engineering Staff

Another advantage of using BOT on large public infrastructure works is that much more of the engineering work required over the life of these projects is performed by the proposing consortia and the eventual franchisee. The role played by government engineering staff is significantly reduced, as is the need for outside consultants. Projects which involve state-of-the-art engineering or construction techniques need not require permanent government engineering staff in parallel.

Case Study II-21

d) County Park Section of Route 3 to China

This is the section of new Route 3 that comprises a road-tunnel-road project northwest of Kowloon toward the China border, beginning just north of the Ting Kau Bridge (Case Study 2 described above). The project is currently at the proposal stage, in which government is analyzing responses to the Project Brief.

Since the project is in the development stage, it is useful to focus on what the government has done to develop its opportunities to get the project built through the BOT process. The government conducted feasibility studies to define the major elements (basic scope) of the project, including preliminary design. It assembled the land for the project, publicized the project to generate interest, and assembled and published the Project Brief and supporting materials.

As is typical with other BOT projects in Hong Kong, the Project Brief contains minimum requirements which must be met by proposers in order to qualify as a conforming tender. Various alternates may be submitted in addition to the minimum conforming tender, which has been done for the Country Park project. What is not typical about the Country Park project is that numerous value engineering suggestions have been made in the proposal process which government has felt obliged to communicate to other proposers for pricing through revised proposals. A second round of proposals was sought by the government because of a dramatic suggestion to improve the project received from the first set of proposals. The Project Brief sought three lanes of travel in each direction with the capacity to add a fourth lane in each direction at some point in the future. One of the responsive proposals recommended that the first three lanes be designed with supports which would accept the fourth lane whenever it was needed. The suggestion was a real advantage to the government, but a fundamental change from the project first described in the Project Brief.
The decision was made to reconfigure the project and compete again. Another, similar change in project configuration caused yet a third competition among proposers. The results have been steadily better for the government — an increase in quality, a decrease in cost, and a decrease in the time required for construction. These circumstances are troubling, however, since the process now resembles an auction, with bidders attempting to minimize losses from an unusually expensive BOT process.

The project is currently being negotiated by the government with several proposers. One contentious issue not previously addressed in other case studies is the mechanism for adjusting tolls over the life of the franchise. Although the details of the negotiation of toll rate adjustment is not known, it appears likely that the agreement will tie toll increases to net cumulative earnings on the roadway. One such mechanism is described in the following figure. Ceiling and floor rates of return are established for the project. If the franchisee earns a rate of return in excess of the ceiling, the amount of money so earned is accrued through bookkeeping entry as a “reserve fund”. If, at other times during the franchise, the rate of return is below the floor, the “losses” from such periods must first be applied by the franchisee to deplete the reserve fund before the franchisee is eligible to request an increase in tolls.

Figure II-10

Toll Adjustment Mechanism

Are Cost Audits in Hong Kong’s BOT Future?? Until this project, the profit/loss experience of BOT franchisees in Hong Kong has been purely a private matter. A self adjusting toll arrangement based on profit and loss performance would require the government to have audit rights -- a major departure from past practice and a dubious value. On what basis would
audits be conducted? What operating costs are "reasonable" and what costs are unreasonable in determining internal rates of return? How should direct overhead be audited for these projects? Will the underlying design, construction, operating and maintenance contracts entered into by the franchisee be audited for "reasonableness", since most of these entities are related to the franchisee? Unfortunately, this type of toll adjustment structure is likely to lead to familiar patterns experienced in federal cost-reimbursement contract audits in the United States.

Case Study II-22

e) Hong Kong Western Harbor Crossing

The Western Harbor Crossing is the third BOT tunnel project to cross Victoria Harbor. The project is typical of other BOT projects discussed above, but includes several interesting features not previously discussed. The typical BOT attributes of the Western Harbor Crossing can be quickly described. Because of prior success with the two previous harbor crossings and because of the large size of the proposed third harbor crossing, BOT processes were selected. The government retained Maunsel ASA and Parsons Brinckerhoff (Asia) to conduct a feasibility study, with the aim of reaching approximately 5% design for the project.

The Project Brief was then prepared by the government, which presented the results of the feasibility study, and called for the preparation of proposals which would take the project to approximately 25-30% design. Substantial elements were added to the Western Harbor Crossing project by the government to provide benefits to communities on the Hong Kong side, including approach roads and connections to Route 7. The government arranged for financial models of the project to determine how many such additional elements could be included within the franchise without making it financially unattractive to investors. The government’s model appears to conclude that an internal rate of return between 15% and 18% is required in order to attract investors to BOT projects. By conducting these financial models, the government was able to get these additional elements free through the BOT process.

The tunnel is expected to cost HK$5.7 Billion, and form a key link in the new road system connecting Hong Kong to the new airport at Chek Lap Kok. The tunnel is 2 kilometers long and is designed to handle 180,000 vehicles per day. Initial traffic is expected to be 75,000 vehicles per day. Twenty toll lanes are included on the Kowloon side of the project.

The familiar feasibility study was completed quickly, and checked independently by consortia which initially proposed to get the franchise. The financial feasibility of the project was independently confirmed. Value engineering, that is, project development prior to construction, was
incorporated into the project as part of the tendering process. There will be no long term government overhead on project, in design, construction, operation, or maintenance. The capital cost to the government is essentially zero ($0). All proposers received the output from feasibility studies, site investigations, traffic projections, and planning studies in connection with the project. The government is not responsible for these projections under the terms of the Project Brief.

The Project Brief was made available on March 6, 1992, upon the tender deposit of HK$1,000,000. Proposals were subsequently received from two consortia, which during analysis by the government, was reduced to a single proposer. Based upon the government's initial estimate of cost, a thirty (30) year franchise was awarded to the Western Harbor Crossing Tunnel Company to design, build, finance, operate and maintain the crossing. The construction period is from August 1993 through June 1997, a total of 47 months. The project represents the first dual three lane immersed tube tunnel in the world, formed from 12 pre-cast units each approximately 115 meters long, 33 meters wide, 8.5 meters high and each weighing 35,000 tons.

**Contract Structure.** The Joint Venture of Nishimatsu Kumagai is the contractor responsible to the Western Harbor Crossing Tunnel Company to design and build the entire project. The figure below shows the contract structure used to allocate this responsibility among three large experienced design/builders in Hong Kong.
Three unexpected benefits arose from the BOT process for the Western Harbor Crossing.

(a) Raised Tunnel Profile

The successful proposer was able to raise the tunnel profile by two meters, saving substantial capital expense.

(b) Closer Borrow Area

The successful proposer located and purchased an area to obtain borrowed fill which was closer, and thus less costly to use than that arranged and described in the Project Brief.
(c) Shortened Construction Schedule

The successful proposer was also able to propose a shorter design and construction schedule than that called for in the Project Brief, which schedule has been adopted in the franchise agreement.

C. Joint Development -- A Variation on DBO and BOT Processes

Another feature of Hong Kong’s procurement strategy is worthy of separate treatment here, although it can not neatly be characterized as a Design Build Operate or a Build Operate Transfer process. For lack of a universally accepted term, I call it Joint Development, i.e. infrastructure development which is orchestrated by government or quasi-government agencies, but which depends in large part on participation and cooperation of private sector partners. Some in America would describe these as public private “partnering” or “partnership”, but either term implies a joint liability which simply does not exist.

Two examples of Joint Development are described in this section, although these concepts are in widespread use in public housing programs as well.

Case Study II-23

1. Subway Construction The MTRC

Hong Kong’s Mass Transit Railway Corporation (“MTRC”) is a quasi-public “crown” corporation similar to many public authorities in the United States, such as the New York Port Authority, the Massachusetts, Port Authority, the various transit districts through North America. The MTRC was created for the purpose of constructing and operating “on prudent commercial principles,” a mass transit railway system in metropolitan Hong Kong. In conjunction with transit construction, MTRC has, in cooperation with the private sector, led an effort to develop key residential and commercial properties above stations and depots, the activity which I call “joint development”. MTRC is engaged in other activities related to transit operations, such as property management, property investments, and related real estate investments, but its “joint development” activities are the focus of this section.

Wherever possible, MTRC jointly developed its transit stations and depots in conjunction with private developers. Most of the subway stations in Hong Kong are an integrated part of retail shops, housing, commercial offices, or industrial facilities that are built together. Air rights above and beside proposed stations are advertised for competitive proposals in much the same way of BOT or DBO projects are advertised. The overall requirements of the transit station are described as a result of feasibility studies. Entities
interested in developing the space surrounding the stations are given general
guidance as to uses which will be permitted as part of the joint development,
the term for which air rights will be granted, and the cost to be charged by the
MTRC for air rights. Proposals are received and “franchises” awarded for
concurrent development of these stations.

Through 1990, joint development contributed HK$3.984 Billion dollars
in profit to MTRC, over 15% of total capital expenditures for the entire transit
network. In addition, approximately HK$400 Million per year is received in
rental revenues, approximately one-third of annual interest and finance
charges paid by the MTRC.

Correlative Note II-5

Compare this to the Massachusetts Bay Transportation Authority,
which received a series of federal grants to extend the Red Line from Quincy,
Massachusetts through Cambridge, Ma. Federal funds paid for 80% to 90% of
total capital costs for these improvements. A direct, segmented process was
required in which each phase of the project was separately designed, after a
competition for a single designer solely on technical merit, and then
separately constructed, after a competition for a single contractor solely on
price. The Project comprised the lengthening of all stations on the line, and
massive reconstruction of most Red Line subway stops, including those at
Harvard, Central Square (Cambridge), Kendall Square (MIT, Cambridge), and
Park Station (Boston). Two massive concrete terminals were built in Quincy
and at Alewife (Cambridge), and two other new stations were constructed in
Cambridge -- Davis Square and Porter Square.

Joint development, that is joint competition for the design and
construction of public and associated private sector facilities, is simply not
permitted in the United States. The results indicate the effect of the
procurement paradigm which constrains infrastructure development in the
United States. Although the new Red Line is spectacular engineering and
construction achievement, stations are not integrated with nearby business
and retail facilities, particularly at each end, and an opportunity was missed to
integrate the new Red Line into the areas it serves, to reduce capital costs, to
improve service, and attract transit riders.

Case Study II-24

2. Hong Kong’s Container Port

The second noteworthy example of Joint Development in Hong Kong
is the Container Port at Kwai Chung, on the western side of Kowloon. In
cooperation with the government over more than two decades, the private
sector has created the largest container port in the world, which, pursuant to plans now underway will be significantly enlarged still further.

The development at Kwai Chung was begun over two decades ago when the government offered a private concession (or franchise) for the design, construction, and operation of a container port to serve Hong Kong. The process used to advertise the franchise and to pick a franchisee was quite similar to that now used for DBO and BOT projects. American based Sea Land won the first concession, which is still operating. A series of additional facilities have since been added, called “Container Berths”, all based upon private concessions. Subsequent franchisees have been awarded to HIT (part of the Hutchinson Group) and Modern Terminals Ltd. (part of the Wharf group), among others.

Two new concessions, for Container Port No. 8 and No. 9 and in the process of being awarded now, as part of a substantial addition to modern port facilities on reclaimed land off the island of Tsing Yi.

D. Mixing and Matching Procurement Methods -- The New Airport

The last project to be considered from Hong Kong’s recent infrastructure development experience is the largest, integrated infrastructure project in the world -- the new airport at Check Lap Kok and supporting transit, roadway, housing, and bridge structures.

Case Study II-25

The Airport Core Program for Chek Lap Kok. The total capital cost for the airport core program is estimated to be between HK$150 Billion and HK$175 Billion dollars. Because of the unique political circumstances that exist in Hong Kong, as 1997 draws near, much of this package, between 70% and 80% is being directly funded by the Hong Kong government. Major exceptions to this funding arrangement are the Western Harbor Crossing franchise, Case Study 22, described above, and four significant elements of construction at the airport itself, described below.

The Airport Core Program comprises ten (10) distinct transportation projects. The ten projects are described below.

25-1. New Airport at Chek Lap Kok.

This project includes land reclamation to level the island of Chek Lap Kok and to expand the site through dredging from 302 hectares to 1,248 hectares. Fully constructed the new airport will have two parallel runways that are 3,800 meters long, a midfield passenger terminal complex, together with road, rail and ferry access along the eastern boundary of the site.
25-2. Lantau Fixed Crossing

The Lantau Fixed Crossing is the means by which access to the new airport will reach Lantau Island from the island of Tsing Yi. It is formed by three different projects, the Tsing Ma Suspension Bridge (Case Study No. 3), the Ma Wan Viaduct across the island of Ma Wan, and the Kap Shui Mun Bridge and toll structures (Case Study No. 4). These structure will have upper and lower decks, with dual three lane roadways on the upper and two rail tracks and two single traffic lanes on the lower deck.

25-3. Airport Railway

This transitway will follow the main highways from the airport to Hong Kong Island, crossing Victoria Harbor to Hong Kong in a transit only tunnel. There will be two services provided, one to connect Tung Chung New Town on Lantau Island to other urban areas and a second to connect the airport to downtown Hong Kong via express service, stopping only in Kowloon and on Tsing Yi.

25-4. Western Harbor Crossing

This is the only piece of the Airport Core Program that is provided through BOT processes (Case Study No. 22), and is described above.

25-5. North Lantau Expressway

This roadway will traverse the northern coast of Lantau Island between the Lantau Fixed Crossing and the Airport, on existing and reclaimed land.

25-6. Route 3 (Tsing Yi and Kwai Chung Sections)

This is the section of Route 3 that connects airport bound traffic over the Lantau Fixed Crossing with Tsing Yi island with Kwai Chung on the mainland.

25-7. West Kowloon Expressway

This is the section of Route 3 which below Kwai Chung toward Kowloon on reclaimed land.

25-8. West Kowloon Reclamation

This is the new land to be created west of Kowloon which substantially expand the Kowloon peninsula for infrastructure and urban development.

25-9. Central and Wan Chai Reclamation
This is the new land to be created to host the airport railway terminus at Central and to host relocated ferry piers and other waterfront services in downtown Hong Kong.

25-10. Tung Chung New Town Development (Phase I)

This part of the program will provide housing and facilities for up to 20,000 to live by 1997, when the airport opens, with steady expansion to eventually house 200,000 people.

**Mini-BOT Projects at the Airport.**

The Provisional Airport Authority, an organization managed by the Hong Kong Government with input from the People’s Republic of China, is developing the airport site. Although the entire airport is not being built through BOT processes, key elements, or mini-projects are being provided through such processes.

Fuel distribution systems for the airport, catering facilities, a large independent facility to provide aircraft maintenance services to airlines using the airport, and separate cargo facilities designed to handle air freight out of Hong Kong are being treated as separate projects within the total airport development. The best information available in Hong Kong indicates these four elements at the airport will be provided with private financing through BOT processes. Successful proposers will build their own facilities at the airport, pay the Provisional Airport Authority a stipulated sum per year throughout the franchise, and collect their expenses through charges to users, who might be aviation fuel purchasers, food customers, air freight shippers, and airlines seeking maintenance service.

At Chek Lap Kok, approximately 25% of the capital fund expenditures required to construct and operate the facility will be supplied through BOT franchises for these four basic services at the airport. Current estimates are that approximately HK$15B will be spent by franchisees on airport improvements out of total capital expenditures of HK$63B, or 23.8%. 
III. The Post 1933 Infrastructure Development Paradigm in America

In November, 1932, at the height of the Depression, Franklin Roosevelt was elected President of the United States. Upon assuming office early in 1933, Congress and the Executive Branch embarked on a decidedly different legislative path to respond to the emergency created by the Depression.

The Depression destroyed once and for all the old puritanical concept of poverty as the wages of sin, sloth, and stupidity. Grinding poverty had hit thousands of temperate and sturdy workers in 1930 and was not showing much of a tendency to lift by 1934. Industrial poverty could hit anyone, and industrial society poorly equipped its finest specimens for its own occasional lapses. . . . The poor in 1934 were not a select group. The poor were all those people whose jobs and abilities were affected by the [collapse of the stock] market. 77

Congress responded by enacting the Social Security Act in 1935 and a host of other statutes. A number of these statutes were designed to create jobs through a massive federal new public works program. 78 Others of these statutes were intended to expand the scope of old public works programs. 79 Still other statutes were aimed at regulating the government's procurement system for the purchase of goods made in the USA 80 , to secure payment for labor and materials supplied on federal contracts 81 , and to regulate the wages and working conditions of labor on federal projects. 82

Prior to 1933, federal government strategy for infrastructure development was a dual one. For projects which it could fund itself, Congress operated in Quadrant I, a direct, system approach, which directly funded federal projects such as courthouses, customhouses, and improvements to navigable waters. For those infrastructure projects Congress desired, but could not afford, Congress consistently focused on offering incentives to the private sector to get them. 83 The practical effect of incentives offered by Congress was to share the risk with private sector developers that particular projects would not be completed and operated successfully.

After 1933, in response to the emergency of failed capital markets and widespread unemployment, federal infrastructure development policy shifted to federal funding, management, and control of infrastructure development through large federal programs. As these programs were implemented, infrastructure procurement moved quickly to the segmented,
direct procurement mechanisms of Quadrant IV. The old combination of federal incentives and private investment prior to 1933 was replaced by direct federal funding, almost exclusively in Quadrant IV.

This chapter describes the emergence of the current federal paradigm in Quadrant IV for infrastructure development. Also discussed are the curious developments in Congressional procurement strategy beginning 1980, as federal funding has been increasingly hard to produce. Congress' experiment in Quadrant III with environmental remediation contracts is described.

A. Legislative Adoption of Quadrant IV Procurement Processes 1933-1972

The current federal segmented procurement system for construction evolved from mechanisms employed by the federal government for its own buildings (in Quadrants I and IV) and from early federal grant programs for state infrastructure development. There is no indication that Congress consciously concluded, after one hundred and fifty years of experience in Quadrants I and II, that these quadrants would be abandoned in favor of exclusive use of Quadrant IV. Yet, although not expressed, this is what happened between 1933 and 1972.

1. The Evolution of Procurement Processes In Which Design Is Segmented From Construction

a) Pre-1933 -- Permissive Use of Segmented Design in Building and Public Works

Prior to 1893, design and construction were not separate functions in the procurement process. In 1893, Congress permitted, but did not require, the Secretary of the Treasury, who then controlled the money to fund construction of federal buildings, to separately procure the services of architects to prepare plans and specifications. The engineering consulting profession was in its infancy, but the advantages to be gained from the application of rigorous training in engineering and architecture were becoming more widely known. William Barclay Parsons was yet to serve the Rapid Transit Commission as Chief Engineer for the New York subway. Edwin S. Webster, of Stone and Webster, was yet to work on designing and constructing the Keokuk dam. By 1893, however, Congress recognized that there were projects where expert engineering or architectural assistance should be available to the Treasury Department.

In 1916, Congress provided the first federal cash grants-in-aid to State Highway Departments to improve rural post roads. Congress authorized a 50% federal cash reimbursement upon completion of rural road projects under federal guidelines. One of these guidelines was "advance federal approval" of a complete set of plans and specifications for each road proj...
These plans and specifications had to be prepared by someone, and the cost of doing so was reimbursed by the government. As the volume of design work rose, an increasing percentage was performed by designers outside the employ of the federal government. The grant-in-aid program was operating in Quadrant IV, not by legislative requirement, but in practice.

Similar advance approvals of complete plans and specifications were required by the Federal Water Power Commission [for private or public development of water power, water storage, and navigation improvements], and after 1926, by the Secretary of the Treasury [for publicly funded federal buildings in the District of Columbia]. The 1926 Public Buildings Act required prior preparation of plans and specifications by the federal employees of the Treasury Department before construction could begin, but permitted the Secretary to hire architects and engineers to assist.

Consistent Treatment for Overseas Construction. Also in 1926, three weeks before the enactment of the Public Buildings Act, Congress gave the Secretary of State the authority to build and remodel facilities in foreign countries for the use of the government, including the option, but not the obligation, to contract for special architectural and technical services. The Foreign Service Buildings Act of 1926 put a cap of 5% of the cost of construction on architectural and engineering fees.

In 1933, it was permissible, but not required, to use architects and engineers in the design of foreign and domestic federal buildings. Similar authority existed in connection with the design of federal aid highways.

b) From 1933 to 1972 -- Permissive, But Expanding Use of Segmented Design for Federal Buildings

Between 1933 and 1972, although there was substantial change in federal statutory procurement structure, there was little change in the permissive nature for procurement of architectural and engineering services.

The 1947 and 1949 Procurement Statutes. Congress completely restructured the procurement process for the armed forces in the Armed Services Procurement Act of 1947 ("ASPA"), and for all other civilian agencies in the Federal Property and Administrative Services Act of 1949 ("FPASA"). However, substantial flexibility remained in how design services were to be procured. Both Acts focused upon prior advertising of agency requirements so that full and free competition could be sought in advance of government procurements. The ASPA required prior advertising for all supplies (including "public works, buildings, and facilities") and services, and required that "specifications and invitations for bids shall permit such full and free competition as is consistent with procurement of types of supplies and services necessary to meet the requirements of the agency concerned." Award was to be made to "that responsible bidders
whose bid, conforming to the invitation for bids, will be most advantageous to the Government, price and other factors considered. Contracts negotiated by the Agency head were permitted to be of any type which "promote[d] the best interests of the Government." The Act permitted, but did not require, the award of architectural or engineering contracts for the design of a public work without negotiation and without prior advertising only conducted by the head of a federal agency.

The Federal Property and Administrative Services Act of 1949 created the General Services Administration ("GSA") and transferred to the GSA all of the functions of the Bureau of Federal Supply, the Commissioner of Public Buildings, and the Public Roads Administration. Sections 301 to 310 of the 1949 Act (known as Title III) prescribed new procurement procedures for all the civilian agencies of the federal government, which duplicated the requirements set forth in the ASPA.

**Correlative Note III-1**

Congress was obviously interested in promoting full and free competition in 1949, just as it claims to be in 1995. It did not, however, specifically define how agencies should provide this "competition" in the procurement system. For example, there was no statutory requirement that competition in construction be based on price alone. There was no statutory requirement that there would be price competition only among general contractors proposing to build a particular piece of infrastructure. There was no statutory requirement that competition only occur, once a single design had been produced by an architect or engineer, independently hired by the government.

*The 1954 Lease-Purchase Statute -- A Brief Revival of Quadrant I Procurement.* In 1954, Congress initiated a new program for a system approach to building acquisition. The Lease-Purchase statute authorized the GSA and the Post Office to procure public buildings through "lease-purchase" agreements, in which the government solicited proposals to finance, design, construct, and maintain facilities for "rent" by the GSA or the Post Office. Rental payments which represented installment purchase payments were to be made for terms between 10 and 30 years, at the end of which title was transferred to the government. These procurements were system procurements, directly funded by the federal government in Quadrant I. Architectural and engineering design was furnished by private developers, not by federal employees and not through contracts awarded by the federal government. Between the date of this legislation and July 22, 1957, when lease purchase authority expired, construction of five (5) post office buildings had commenced out of forty-eight (48) approved for the program, and twenty-nine (29) GSA buildings had commenced out of one hundred and three (103) approved for the lease-purchase program.
The Public Building Act of 1959 -- Back to Quadrant IV. After the Lease Purchase Act was not renewed in 1957, the 1959 Act continued to permit, but not require, the Administrator of GSA to employ "established architectural or engineering corporations, firms, or individuals," by contract or otherwise, whenever the Administrator determines it to be necessary. Although not required to do so, the GSA increasingly used architects and engineers, hired directly, to prepare plans and specifications for federal public buildings.

The Act took one clear step toward centralized authority by providing that no "public building" could be constructed except by GSA's Administrator. The term "public building" was defined to include federal office buildings, post offices, customhouses, courthouses, border inspection facilities, and warehouses. Excluded from the term "public building" were structures on public lands; in foreign countries; on native Indian lands; buildings on or used in connection with river, harbor, flood control, reclamation, or power projects; housing projects; buildings on military installations and on Veterans' Administration installations. The 1959 Act did not require advance submittal of complete plans and specifications for Congressional approval of each project, but did require the submittal of a "project prospectus".

However, Congress also took two clear steps backward in the 1959 Act. Clearly for political reasons, Congress was unwilling to delegate real control over federal building construction to the GSA. Congress acknowledged the influence of politics in the first section of the act, by requiring that each and every building to be constructed by the GSA be approved by separate resolutions of both the House and Senate Committees on Public Works "[i]n order to insure the equitable distribution of public buildings throughout the United States".

Correlative Note III-2

Congress has had difficulty settling upon a stable procurement policy for public buildings, which is indicative of similar indecisiveness with infrastructure generally. Once the decision has been made by Congress to commit federal resources to directly fund large infrastructure programs such as the Interstate Highway System, or state and local waste water treatment plants, or mass transit system extensions, Congress is simply unable to find enough money to fill all national needs. The result is an never-ending competition among states, districts, and regions to influence the allocation of insufficient federal resources among too many projects.

The Public Building Act of 1959 is but one example of this phenomenon. Congress was simply unable to really define the circumstances under which it would approve particular public buildings and not others,
leaving the GSA to develop plans and prospectuses for too many buildings to be funded by too few federal dollars. Congress had built into the procurement process an unwieldy, purely political step that guaranteed delays in project delivery, while Committees of the Congress evaluated which proposed projects would produce “equitable distributions of public buildings.”

More interesting, however, is that Congress had apparently come to believe that constructing an “equitable distribution” of federal buildings was a strategic goal worthy of the national government.

The Public Building Amendments of 1972 -- Back to Quadrant I. By 1972, the ability of the GSA to deliver public buildings had deteriorated significantly. There was a backlog of 63 federal buildings which were approved, but undelivered by GSA, at an estimated cost of $1 Billion.\(^{107}\) GSA was taking up to seven (7) years to construct buildings that the private sector would normally complete in two to three years.\(^{108}\) GSA estimated that if annual funding levels remained steady and if GSA worked exclusively on removing this backlog, ten (10) more years would be required to complete these 63 buildings, some of which had been approved for nine years already. This was simply too much for Congress, which enacted the Public Buildings Amendments of 1972.\(^{109}\) The Amendments required GSA to return, on an interim basis, to the lease purchase mechanisms authorized in the Lease-Purchase Act of 1954. The House Committee on Public Works offered two reasons why the 1972 Lease-Purchase program was superior to that which it opposed in the 1954 Act. First, interest rates would not be capped at 4% as they were in 1954, offering the private sector market interest rates on their investment in federal buildings. Second, the House Committee asserted that market conditions in 1972 were much different than in 1954, when there was little competition for developing federal buildings under the old statute.\(^{110}\)

Correlative Note III-3

The House Committee on Public Works made two interesting observations in the legislative history behind the 1972 Amendment.

First was the observation that private finance, design, and construction of these buildings “present a reasonable temporary accommodation between [the desire to complete the projects] and the budgetary conditions that will prevail in the reasonably foreseeable future.”\(^{111}\) The Committee thus recognized that procurement strategies can and should change based on available funding levels. Congress would do well to remember this observation in 1995.

The second observation, that the 1959 Act failed miserably, but still represents the most efficient procurement strategy, is nonsensical, but
provides an indication of how deeply committed Congress was in 1972 to
direct federal spending for infrastructure.\textsuperscript{112}

\textbf{c) Statutory Segmentation of Design -- The 1972 Brooks Act}

In 1972, Congress forced the separate procurement of design and
construction services when it enacted the so-called Brooks Act,\textsuperscript{113} which
established a specific statutory selection procedure for architects and engineers
on all federal construction and related projects.\textsuperscript{114} The Act requires all
agencies of the federal government to public announce all requirements for
architectural and engineering services, and to negotiate contracts for these
services first on the basis of demonstrated competence and qualifications, and
second, at fair and reasonable prices.\textsuperscript{115} The process by which an A/E is
selected under the Brooks Act is that all proposers compete with one another
on the basis of their experience, qualifications, and capabilities to perform the
particular project being advertised. The agency ranks the competitors on the
basis of technical competence. Then, the agency attempts to negotiate a fair
and reasonable price with the highest ranked firm, in no event more than 6%
of the estimated construction cost of the project.\textsuperscript{116} Provided that a fair price is
agreed upon, the highest ranked firm is awarded the contract. In the event
the government cannot reach agreement on a fair price, the highest ranked
firm is removed from the competition and negotiations are opened with the
second ranked firm in an effort to reach a fair price. In the event a fair price is
still not agreed upon, the agency turns to the third ranked firm.\textsuperscript{117}

Undoubtedly, between 1949 and 1972 at least, federal agencies were
permitted, but not required, to employ architects and engineers through
negotiation and based upon qualifications. The Brooks Act could have
simply confirmed -- as the legislative history implies -- the permissive use of
a qualification based selection procedure for architects and engineers by
negotiation. Congress, however, was reacting to a proposal by the General
Accounting Office that the 6\% cap of A/E fees be removed and that the
selection process for A/E services include competitive proposals in which one
of the evaluation factors would be price.\textsuperscript{118}

After passage of the Brooks Act in 1972, the permissive use of
professional designers suddenly became a mandatory requirement.
Whenever an architect or engineering services are required in connection with
federal construction and related projects, a separate procurement must be
conducted by the government. In addition to producing a steady stream of
litigation as to the scope of the terms architecture and engineering, and
several changes in the regulatory definition of these terms,\textsuperscript{119} the Brooks Act
has been interpreted to preclude competition among proposers to finance,
design, construct, maintain, and operate infrastructure facilities for the federal
government.
Correlative Note III-4

Throughout the period from 1780 to 1972, when the Brooks Act forced design to be segmented from construction, the federal government could have solicited proposals to "design, construct, finance, maintain and operate" specific infrastructure projects, based upon schematic documents only. There simply was no legislative requirement that complete plans and specifications be prepared for projects as the first step prior to a price competition for construction services. Congress, on occasion, sought to have plans and specifications prepared as a pre-requisite to a federal commitment for cost sharing,120 but Congress could just as easily have required only schematic plans and specifications for this purpose. Indeed, Congress did so with respect to public buildings proposed for construction by the GSA.121

Up until 1972, when Congress first enacted a statutory requirement separating procurement of design services from procurement of construction services, each of Hong Kong's well-known tunnel projects122 -- the Central Harbor Tunnel, the Eastern Harbor Crossing, the Western Harbor Crossing, and the Tate's Cairn Tunnel -- could have been procured in the United States through a proposal process similar to that used in Hong Kong.123

d) Segmented Construction on a Firm Fixed Price Basis

Once procurement of design services was separated by statute from procurement of construction services, the current practice of awarding lump sum, firm fixed price construction contracts on the basis of sealed bids to the lowest responsible and responsive bidder became nearly universal. All federal agencies were required to advertise for construction services under ASPA and FPASA. With the A/E already hired and working separately and directly for the government, franchise and lease-purchase methods could not be applied.

e) Segmented Direct Procurement "Enshrined" in Government Wide Federal Regulations

The current federal paradigm of segmented, direct procurement in Quadrant IV is now fully enshrined in the Federal Acquisition Regulation (or "FAR"),124 which contains government-wide procurement policy. For construction, the FAR requires submittal of sealed, firm fixed priced bids (or in limited situations, lump sum unit prices).125 Contract clauses are set forth in the FAR and required to be included in invitations for bid.126 Subpart 36.6 contains the regulations which implement the Brooks Act selection procedures for engineers and architects.127
The effect of the Brooks Act between 1972 and 1995 has been to isolate architecture and engineering from other elements of project development, effectively precluding design build and turnkey procurement methods from being used on public infrastructure projects, and also precluding both Build-Operate-Transfer and Design-Build-Operate franchise arrangements for public infrastructure development.

2. Limited Statutory Exceptions to the Use of Quadrant IV Procurement Processes

There are two limited exceptions to the segmented, direct process described above. The first is overseas construction, which is still governed by the procurement principles set forth in the Foreign Service Buildings Act of 1926, which gave the Secretary of State the option to separately retain qualified architectural and engineering services by negotiated contract.

The second exception is contained in the Federal Acquisition Streamlining Act of 1994 ("FASA"), just enacted by Congress and signed into law on October 13, 1994. FASA gives the government the authority to enter into design-build contracts for federal buildings and public works. Regulations have not yet been issued for public comment. Design-build is only one step in the direction toward a full range of government options to arrange for financing, design, construction, operation and maintenance of infrastructure projects.

B. High Water Mark for Quadrant IV – 1956 to 1972

The high-water mark for federal infrastructure procurement in Quadrant IV came between 1956 and 1972, when the federal government appropriated and spent in excess of $100 Billion for two major construction programs, both of which were funded through grants in aid to state and local governments. The first was for the design and construction of the Interstate Highway System, and the second was for design and construction of the waste water treatment plants called for by the Federal Water Pollution Control Act of 1972 (hereinafter, the Construction Grants Program, or "CGP").

Case Study III-1

1. Interstate Highway System

   a) Enactment of The Interstate Highway Act of 1956

   The events leading to the enactment of the Interstate Highway Act of 1956 are an interesting early example of the role interest groups play in establishing public infrastructure programs. Congress reached the decision to build the Interstate Highway System through a lengthy political process beginning in 1880.
In the years after W.W.II, congestion on highways had become so widespread that many states were turning to independent tollway authorities (quasi-public authorities) to increase roadway capacity, build and maintain high quality roads, and alleviate traffic congestion, all with user funds rather than the general revenues of the state or federal governments. The Pennsylvania Turnpike is an early example of such a project, commenced in the 1930's to stimulate economic development in Pennsylvania and to connect the eastern and western portions of the State. To finance the project, the state reverted to the colonial and revolutionary practice of collecting tolls. Because of congestion on competing roads, travel time and fuel savings more than compensated users for the toll charged. In the years following W.W.II, many other states began building toll roads on the Pennsylvania model. By 1960, 3000 miles of toll road were in place, and it was possible to drive from New York to Chicago entirely on tolled facilities.\textsuperscript{135}

Congestion might have produced sufficient demand that new turnpikes could have been financed and constructed through user fees -- tolls. However, countervailing forces were also at work. Soaring automobile registrations had produced jammed traffic, significant instances of food spoilage, a growing instance of traffic related injuries, and employer-employee tension about on-time work arrival.\textsuperscript{136} In 1951, an organization called "Project Adequate Roads" was founded in Chicago and announced in Washington, D.C. The Project, known as PAR, was a coalition of highway users (primarily truckers), manufacturers (of automobiles, of gasoline, and of goods manufacturers, who sought to lower the cost of moving goods and raw materials), public officials (primarily state highway departments whose jobs were partially funded through prior federal road-aid acts), and federal traffic researchers at the Highway Research Board and Automotive Safety Foundation.\textsuperscript{137} PAR proposed that tolls on highways be eliminated and that the federal government fund the construction of a national network of roads. When the American Automobile Association and the US Chamber of Commerce added their support to PAR's proposals, it became a political movement. Other auto clubs joined PAR, as did the Associated General Contractors ("AGC").\textsuperscript{138} Arrayed against these interest groups as opponents of substantial federally funded highway programs were President Truman, railroad companies, states who had and were investing substantial state funds in tollway development, and farmers who were opposed to any program to upgrade urban roads unless farm roads were upgraded first.\textsuperscript{139} After failing with its early proposals to create a federal highway trust fund, in which would be stored all federal excise taxes on motor vehicle and gasoline for use in road construction, PAR ceased to be an effective force.

President Eisenhower became interested, and in August, 1953, appointed a study committee composed of the Secretaries of Defense, Treasury, and Commerce, and the head of the Council of Economic Advisers. Based upon the results of the report, and after a number of compromises
among interests\(^{140}\) represented in Congress, the Federal Aid Highway Act of 1956 was enacted by Congress on June 29, 1956.\(^{141}\) The act authorized substantial, regular increases in federal aid for building urban, primary, and farm-market roads, with 90% of the cost to be paid by the federal government, distributed on the basis of need to avoid congestion.\(^{142}\) A highway trust fund was established to collect dedicated federal excises on gasoline, at three cents per gallon.\(^{143}\) Revenues grew quickly and continuously over the first 20 years of the program, because of the extraordinary increase in cars on the road and in the miles they traveled.

The decision to build the Interstate System through a federally funded program was a deliberate turn away from state and local control over highway development, funded locally through state and local taxes or user fees.\(^{144}\)

\(b\) Implementation

The federal procurement rules relating to design and construction applied to states accepting federal grant in aid funds. The statute called for a pure building program in which federal and state highway engineers arranged for the design and construction of the roadway network already laid out by the Bureau of Public Roads.\(^{145}\) The proposed roads were routed through 406 of the nation's 435 Congressional districts.\(^{146}\) Not surprisingly, this legislation enjoyed widespread support in Congress. Federal engineers were charged with ensuring that the entire system was constructed. City and state governments did not have authority to eliminate portions of the system, or to change road alignments without federal approval. Design and construction proceeded using the segmented, direct procurement processes of Quadrant IV. Approximately $40B has been spent on construction, maintenance, and research associated with the Interstate System through 1990.\(^{147}\)

Up until 1970, rural construction of the interstate system was moving forward rapidly, although urban construction had become problematical. Cost per mile to complete the system rose from $4 million in 1959, when 33,858 miles remained, to $20 million per mile in 1979, when only 2,723 miles of construction remained.\(^{148}\) The revival of downtown retail centers had not occurred as expected, indeed, just the opposite. The growth of suburban shopping centers and malls had been so rapid along interstate routes that it became apparent that interstate highways were supporting suburban commercial growth at the expense of urban center renewal and expansion.

By the middle 1970's, approximately 90% of the Interstate system was designed and constructed. Twenty (20%) percent of the nation’s traffic, twenty-one (21%) percent of the truck traffic, and forty-nine (49%) of the country's trailer truck traffic was carried on the system.
On August 13, 1973, the Federal-Aid Highway Act of 1973 was enacted, which for the first time made revenues in the highway trust fund available to purchase buses after 1975, and to purchase facilities and rolling stock for fixed rail systems after mid-1976. The 1973 Act also shifted management authority away from engineers to local politicians. Designation of urban routes now started with city officials rather than with state engineers; local officials could also eliminate Interstate routes, and were authorized to use the funds saved to finance non-highway public transportation. By 1975, most of the remaining portions of the unfinished system was scrapped by political leaders. The "free" federal freeway era had ended.

c) Results

Whether the Interstate Highway System was successful depends primarily on the metric applied. Federal authority was so great in the implementation of the program, at least until 1973, and the Quadrant IV process so well tuned, that design and construction proceeded expeditiously, with the entire process managed primarily by engineers who understood that the program was for design and construction. The passage of the 1973 Act, which wrested control from construction officials in the federal government, has had a continuing effect on federal procurement programs following the Interstate Highway program. Efforts to stop what was perceived to be a juggernaut of Federal Highway engineers led to the passage in 1969 of National Environmental Policy Act of 1969, which, among other things, established a system of environmental impact statements to evaluate development projects in advance of construction.

Rather than reviving inner city retail establishment, the interstate served to create an entirely new class of travelers known as commuters. Rather than solve highway congestion in the inner city, the interstate highways created a new form of traffic jam, centered around the beginning and end of the work day. The program also added significantly to public infrastructure holdings, which require annual maintenance and repair.

Professor Friedlaender's analysis of the program concluded that economic gains from construction of the urban portion of the system outweighed the losses from the rural portion of the system, that the urban portion of the Interstate Highway System ("IHS") was a preferable alternative to a system of smaller highways which would not be adequate to carry commuter traffic, and that the rural portion of the IHS was not the best alternative, and if constructed at all, probably should have been an upgraded system of two lane roads.
Case Study III-2

2. The EPA Construction Grants Program ("CGP")

   a) Enactment

   The EPA Construction Grants Program was established by Congress in 1972, under the Federal Water Pollution Control Act of 1972. Under the program, approximately $60B was provided in grants and loan to provide cash subsidies for the design and construction of municipal waste water treatment plants, lateral and interceptor lines, and pumping stations. In 1972, when the program began, the federal government reimbursed up to 75% of most costs incurred, with states, such as Massachusetts, providing an additional 15%. Cities and towns, in the early years, were thus eligible for up to 90% reimbursement of the costs of designing and constructing waste water treatment facilities.

   b) Implementation

   The program was implemented through regulations issued in May, 1975 by the EPA, which established a segmented, direct process in Quadrant IV, for designing and constructing these facilities. Grant agreements were standardized by EPA Regulation, as were engineering contracts and construction contracts which municipal grantees were required to execute with designers and constructors as a condition of receiving federal funds. Through these standard provisions, EPA incorporated all significant principles of federal construction procurement into the contracts that cities were required to sign with designers to produce complete plans and specifications, and later, after firm fixed price sealed bidding, to construction contractors. Federal cost principles were incorporated into the grant agreements between EPA and grantees. In short, the CGP operated as the federal procurement system did, although indirectly.

   Grantees were contractually obligated by the terms of their contracts to their designers and contractors. EPA's grant terms authorized and required EPA to review all costs incurred by grantees against federal requirements, and to disallow reimbursement for failure to comply with such requirements. No reimbursement of costs was permitted with EPA audit and approval. EPA’s regulations also permitted it to hear bid protests filed by equipment suppliers alleging non-compliance with federal "or equal" requirements. The program produced significant treatment works construction throughout the seventies and into the early 1980's.

   c) Results

   The program provided a jump start for improving waste water treatment levels across the nation, but did not nearly complete the task of
meeting waste water quality standards. As of 1992, EPA estimated that $137.1B more would be required to meet known waste water capital needs over the next 20 years. Operation and maintenance costs would substantially increase this amount, as would EPA’s processing of nearly 4000 major and minor municipal permit applications pending in 1992.\textsuperscript{164} The $60B spent so far by EPA has not been sufficient to meet clean water standards set by the federal government, and funding trends are unlikely to make additional funds available.

Stiefel describes a number of perverse effects of the CGP, which are consistent with the effect of federal cash on infrastructure projects throughout the past two hundred years. Early grantees were permitted to design and construct reserve treatment capacity well beyond any near term requirements for such capacity. Communities were encouraged to design and build oversized plants to fill needs projected 20 to 30 years into the future, since constructing these plants with only 10 cents local contribution on the dollar was cheaper than declining the federal program and meeting clean water requirements more effectively through other means. Raising sewer fees or real estate taxes to meet clean water standards other than through new plant construction also created a political problem for elected officials.\textsuperscript{165}

As grant funds became harder to get during the later years of the program and communities began to compete with one another for CGP funds, those municipalities who had generated the worst pollution problems were given preferences for remaining grant funds. Since failure to comply with clean water standards was never punished through fines by the EPA, doing little or nothing about water pollution was the surest way for a community to acquire 90:10 funding for a new treatment plant.\textsuperscript{166}

EPA regulations, as noted above, required EPA approval of all expenses. Also required was EPA review and approval of all change orders to engineers, and changed orders to contractors. These approvals also produced substantial disputes between EPA and its grantees, who were required to take positions on all such change orders without advance knowledge of whether EPA might approve or disapprove. EPA review of each and every procurement action typically caused delays of up to six years to the overall construction process. Delays of two to four years were typical.\textsuperscript{167}

The complete review and approval of all design and construction actions connected with each plant created substantial confusion and controversy when a number of problems were identified in the operations of CGP plants. Cities and towns were held responsible to solve these problems without federal grant assistance. Grantees believed this to be unfair, since EPA, not the grantees, controlled design review and acceptance. A GAO review of these problems confirmed that so many parties were involved in
reviewing and administering the CGP that assessing accountability was unusually complicated.\textsuperscript{168}

Finally, Stiefel reports\textsuperscript{169} on an interesting study conducted by Jondrow, J., and Levy, R A,\textsuperscript{170} in 1984. The study concludes that twice the amount of federal funds provided for the Construction Grants Program was displaced from pollution control by local governments. In other words, upon the appropriation of $60B for federal grants and loans in the CGP, local governments reallocated approximately $120B from programs earmarked for local pollution control to other uses.

To summarize the discussion of the CGP, one has to question how effectively this federal cash program was able to match spending to solve real pollution problems. Twice the federal outlays were taken off the table by local governments looking to export costs to larger federal pockets. A number of plants were overbuilt, and the extra layer of federal approvals undoubtedly added to overall program costs. Could cities and towns have found means, in Quadrant II, to more effectively tailor engineering solutions to their water pollution problems, in less time, with greater efficiency, and at lower overall costs? The answer would appear to be clearly, yes.

Case Study III-3

C. Segmented, Unfunded Procurement in Quadrant III — CERCLA 1980 to 1995

1. Enactment

This case study focuses upon the “Comprehensive Environmental Response, Compensation, and Liability Act” (commonly known as “CERCLA”). The procurement strategy followed by Congress has produced a graphic example of the triumph of “process” over “substance”. Faced with an intractable, complex procurement problem, Congress boldly asserted plenary legislative control over the field of environmental restoration, but made no coherent, substantive decisions about what was to be done. Indeed, Congress gave internally inconsistent, self-defeating instructions to the Executive Branch for developing an implementation strategy.

EPA’s solution was to rely upon the adversarial nature of the rule-making system to “process” the competing views of groups interested in implementation of CERCLA, with frequent resort to the courts.\textsuperscript{171} With no workable statutory mandate, Executive agencies have been reduced to “processing” and “adjudicating” the “value” of competing, conflicting positions advanced by interested parties one site at a time.\textsuperscript{172}
a) The Statutory Procurement Scheme

Congress enacted CERCLA on December 11, 1980, during the last days before the Christmas recess of the "lame duck" 96th Congress, just prior to the inauguration of President Reagan and the shift in Senate control from the Democrat Party to the Republican Party. Although there was extensive floor debate on the bill, the committee reports of the Senate and House contain no extensive analysis of the statute, since the bill was significantly amended after issuance of the reports. No committee of Congress ever addressed or discussed the changes which were finally enacted. CERCLA was a last hour compromise among various factions of the Congress, and has been quite fairly described as "hastily and inadequately drafted". The original House bill, H.R. 7020, proposed to create liability for personal injuries caused by hazardous waste disposal. This aspect of the House bill was objectionable to many factions in both Houses of Congress. The Senate bill, S.1480, was substituted in its entirety for the House bill and enacted as an appropriation measure by the House and then by the Senate. President Carter signed the bill before leaving office.

(1) The Procurement Strategy Underlying CERCLA

Broad Assertion of Federal Power and Control. Congress asserted broad federal power in CERCLA over hazardous waste site identification and remediation. The Act contains the broadest imaginable definitions of the terms "environment", "facility", "hazardous", and "release." The Act asserts federal control over "all" "releases" of "hazardous" substances from a "facility" into the "environment" listed by EPA on the National Priorities List.

Cost Shifting Away From The Federal Government. The key procurement strategy in CERCLA is "cost shifting" -- that is, shifting responsibility for cost away from the federal government. CERCLA makes present and former "owners" and "operators" of Superfund sites jointly, severally, and strictly liable, generally without dollar limit, to the federal government for (1) "response costs", (2) other "necessary" costs, and (3) damages for injury to natural resources with respect to Superfund sites. "Response costs" are defined in CERCLA as costs incurred by EPA with respect to a particular Superfund site which are "not inconsistent with the National Contingency Plan". To avoid reimbursing EPA for its claimed "response costs", Potentially Responsible Parties ("PRPs") under Superfund must prove that costs incurred by the EPA were not consistent with the National Contingency Plan, a challenge virtually no PRP has successfully met. Although the statute does not so state, courts have consistently construed the statute as applying retroactively.
**Broad Delegation of Federal Power to EPA.** A third key element of CERCLA is broad delegation of power by Congress to the President (through EPA) to implement the Superfund program. CERCLA gives EPA enormous discretionary power to require remedial actions ("permanent actions") or removal actions ("emergency actions"). In exercising these powers, EPA may use appropriated funds to clean sites\(^{183}\) and recover these costs in litigation\(^{184}\) from PRPs, or it may issue administrative orders to PRPs to take EPA specified response actions to halt and remedy a release, which orders may be enforced in federal district court.\(^{185}\)

**Aggregation of Liability.** The fourth key element of CERCLA procurement strategy is what I call "aggregation of liability". By designating particular land as a Superfund site, EPA aggregates all the prior uses of the designated land, irrespective of their connection to one another, either by activity or time, together into a single, indivisible, retroactive liability under CERCLA. The next figure presents an example of the concept of "aggregation" at the "Industri-plex Site" in Woburn, Massachusetts. Portions of the site were used as chemical manufacturing facilities between 1853 and 1931 by three different corporate entities, only one of which, Monsanto, is still in existence today.\(^{186}\) Other portions of the site were used during W.W.I. in the manufacture of munitions to support the war. From 1934 to 1969, overlapping but distinct portions of the site were used by three different corporate entities in the manufacture of gelatin and glues from animal hides. Only one of these entities, Stauffer, is still in existence today.\(^{187}\)
A "National Contingency Plan". The fifth key element of the statutory scheme to remediate sites under CERCLA relates to the "National Contingency Plan" required to be developed by the President. As planned, EPA was to draft a National Contingency Plan (the "NCP") which would establish (a) priorities among releases and threatened releases, (b) methods for evaluating and remedying any release, (c) methods and criteria for determining the appropriate extent of cleanup, and (d) a priority list of sites to be remediated (the "National Priorities List", or "NPL").188
The 1986 Amendment to CERCLA, known as SARA, added a number of further requirements to be followed by EPA in drafting the National Contingency Plan. These requirements, however, competed with one another internally, and could never be reconciled by EPA into a National Contingency Plan meeting the requirements of CERCLA.

2. Implementation One Site at a Time, Locally

As implemented, the NCP has never been national and never been a plan. EPA has not provided guidance of nationwide application to the Superfund program. The NCP provides no description of what remediation methods are appropriate, nor what constitutes the appropriate extent of a remedial action, and no substantive standards for assessing the adequacy of a proposed or completed response. The NCP is merely an inventory listing of remediation methods and techniques that may be considered by the EPA in remediating Superfund sites. Congress added to the confusion as to who was in charge and what standards applied when it authorized private citizens to sue in the event they believed the requirements of CERCLA or SARA were not being met by EPA or by PRP’s, including compliance with cleanup deadlines.

a) The Industri-Plex Superfund Site in Woburn

In a prior paper, the experience at the Industri-Plex Superfund Site in Woburn was described and a two proposals made to ameliorate the immediate problems posed by CERCLA.

The Industri-Plex site illustrates, however, many of the problems associated with standard-less, unfunded procurement in Quadrant III. Between 1982 and 1984, Stauffer, the only Solvent PRP who conducted hide tanning operations at the site, conducted a preliminary assessment of the site leading to a recommended treatment strategy for groundwater, air, and soil, which is summarized in the figure below.
Figure III-2

Between 1984 and 1989, when a Consent Decree was entered in federal court allocating financial responsibility for Response Costs among the 22 PRPs, little progress was made toward cleanup. The Consent Decree allocated 50% of all Response Costs to Monsanto, 45% to Stauffer, and the balance of 5% to the remaining 20 PRPs. Since 1989, ISRT has reached the construction remediation stage, which was repeatedly rescheduled awaiting EPA approvals. A substantial dispute arose between ISRT and EPA over groundwater treatment. ISRT has awarded a contract for air and soil remediation, but the parties were still at an impasse in 1994 with regard to what the Consent Decree required PRP’s to provide for groundwater remediation. In the meantime, conflicting estimates of remediation costs increased significantly, while cleanup languishes, as the next figures show.

Figure III-3
b) The Conservation Chemical Company Superfund Site

In 1979, EPA began tracking a six acre hazardous waste site on the flood plain of the Missouri River near Kansas City, Missouri. The site had been operated by the Conservation Chemical Company as a chemical handling facility since 1960.

Drums, bulk liquids, sludge, and solids were buried at the site. Some wastes, such as drummed cyanide wastes and arsenic and phosphorus containing wastes, were disposed of on site without treatment. . . approximately 93,000 cubic yards of materials are buried on site.¹⁹⁹

Eight years later, after numerous studies and the selection of four different remedial plans, EPA selected a fifth remediation plan for the site in a Record of Decision (ROD). EPA sued four "Potentially Responsible Parties" (PRPs) it claimed were responsible for the cost of one aspect of cleanup at the site. These four defendants, in turn, brought third party claims against 250 additional PRPs. The parties to this litigation spent $19.6 Million dollars disputing the allocation of $29.5 M in cleanup costs (66% of the cost of cleanup), as described in the table below.
### Table III-1

<table>
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<th>Transaction Costs (incurred by)</th>
<th>$ (Millions)</th>
<th>% of Total</th>
<th>% of Cleanup $</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPA</td>
<td>$2.0 M</td>
<td>4.1%</td>
<td>6.7%</td>
</tr>
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<td>Four Defendants</td>
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<tr>
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<tr>
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<td>39.9%</td>
<td>66.3%</td>
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<tr>
<td>Actual Cleanup Costs</td>
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<td>100%</td>
</tr>
<tr>
<td>Total of All Costs</td>
<td>$49.1M</td>
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</tr>
</tbody>
</table>

### c) Transaction Costs on Other Sites

Unfortunately, these figures are not unusual. The Office of Technology Assessment estimates that $.44 out of every dollar spent by the government on Superfund goes to administration, litigation and related expenses\(^{200}\), $.16 goes to site studies, leaving only 40% of the funds expended by the **government** for actual cleanup.\(^{201}\)

#### Figure III-5

![Funds Spent by Government](image)

A Rand Corporation study found that 88% of Superfund expenditures made by insurance companies, and 34% of Superfund expenditures made by five large industrial PRPs were for transaction costs, i.e. costs incurred in resolving disputes about who is responsible for cleanup.\(^{202}\) These results are shown in the following figures.
These statistics indicate fundamental problems with the procurement strategy implementing Superfund. The status of major Superfund sites throughout the nation has not substantially changed in over a decade, while approximately half the assets dedicated to cleanup by EPA, PRPs, and interest groups are spent on transaction costs that do not clean anything.\textsuperscript{203} Cleanup moves forward slowly, if at all, in a dispute ridden process, while nature inexorably works to disperse hazardous waste through groundwater and atmospheric mechanisms. PRPs have no opportunity to control their financial liability for response costs through unilateral voluntary remediation. Full control of each PRP's financial exposure rests with EPA.\textsuperscript{204}
These events have combined over the last decade to create an atmosphere of mistrust and conflict among public interest groups, Congress, PRPs, and the EPA, which in turn continues to put upward pressure on Superfund transaction costs.\textsuperscript{205}

\textit{d) One National Company's Experience As A PRP On Numerous Large, Multi-Party, Complex Sites}

The experience of a major U.S. manufacturer of household items\textsuperscript{206} is consistent with that at Industri-plex. This company is a PRP on 49 different Superfund sites. The number of PRPs on these sites range from two to four digits. The Company describes the Superfund process as a never-ending conflict among agencies, individuals, companies, consultants, and attorneys over every aspect of the site, from the identity of PRPs to the final implementation of the remediation alternative.

3. Results

The result has been a disaster, by whatever measure, and for all participants. CERCLA created undefined obligations and rights which neither Congress nor EPA have been able to manage since 1980. The scope of work to be done is established not by statute, not by regulation, and not by contract, but through the discretion of local EPA officials\textsuperscript{207} in the complex circumstances of citizen groups, PRP's, and federal courts peculiar to each site. Overshadowing the procurement aspect of the program, that is the cleanup of sites, is the litigation associated with how expenses are to be allocated among PRP's.

\textit{a) Perverse New Paradigms for PRPs}

CERCLA has created a perverse new paradigm of action and reaction among PRPs, agencies, and public interest groups, which begin with a wide disparity in the economic power of PRPs and is fueled by statutory imposition of full liability without regard to the relative contribution of PRPs at the site. Many PRPs simply cannot afford to pay, or will not pay their portion of either transaction costs or cleanup costs incurred at Superfund sites. Those PRPs who go out of business, declare bankruptcy, or are bankrupt by the time EPA issues its Record of Decision are called "Orphans" in the trade. The liability of "Orphans" under CERCLA is largely illusory. Solvent PRPs have learned through experience that high cleanup and transaction costs produce Orphans, who are not able to make any practical financial contribution to site study or cleanup. The remaining solvent PRPs are fully liable for Response Costs, and must cover these so-called "Orphan Shares" without the possibility of reimbursement.

Joint and several liability causes other aberrant conduct by a second group of PRPs, known as "Weed Sitters." Weed Sitters are PRPs who try to
remain bystanders throughout the Preliminary Assessment and RI/FS phases of the Superfund process, neither incurring nor contributing to transaction costs. Since EPA tends to "ask" large PRPs to "lead"208 these studies, many small to medium sized PRPs are able to ignore the process, without making any financial contribution to pay their proper share of transaction or cleanup costs. Weed Sitters further shift the burden of transaction costs to a few large PRPs on each site.

Since EPA has tremendous authority under CERCLA Section 106(c) to issue orders to one or more PRPs to take specific remedial actions, large PRPs are under tremendous pressure to comply with EPA "requests" to "lead" PRP groups and to pay transaction costs incurred. While the opportunity exists for large PRPs to bring private suits against other culpable PRPs,209 such actions, which could involve hundreds of suits, cross-suits, and claims, are now viewed by large sized PRPs as further escalation in transaction costs and further vehicles to convert "Weed-Sitters" into "Orphans".210 Large PRPs believe that the Superfund process has become little more than an "auction", in which a few PRPs will pay as much or as little is required to stop the continuous flow of transaction and cleanup costs.

Those PRPs who are Orphans (or can be made to appear so) quickly disappear from view, as EPA, state agencies, and public groups focus on a few large PRPs to conduct studies, prepare designs, and implement remediation schemes with their own resources. Weed-Sitters come in and out of view, depending upon their particular interests at the time. Those PRPs who are Cities or Towns211 are frequently permitted by the EPA to remain Weed Sitters throughout the study and design phases. Large, solvent PRPs are identified by EPA as Lead PRPs, and "requested" by EPA to conduct studies and/or remediation on behalf of EPA and the remaining PRPs. To minimize unreimbursed Response Costs, Lead PRPs frequently file contribution suits against all PRP'S, seeking contribution for transaction costs and remediation costs as they are incurred and seeking an allocation of responsibility among PRPs from the Court as the basis for a potential future settlement or Consent Decree with EPA.

b) Paralysis In Local EPA Decision-Making

The Superfund "process" - that is, the specification of what studies and reports are to be done, by whom, for whom -- is well-developed. But, local decision-making by EPA is paralyzed by competing statutory and regulatory policies, polarized groups of PRPs and citizens, and liabilities that are sufficiently large to make individual positions firm and unyielding. There are numerous participants in the process, including (a) citizens groups212, (b) EPA design oversight consultants, (c) EPA staff, and (d) their state counterparts. Each reviews and comments upon each and every submission by PRPs on the site, including the Preliminary Assessment (PA), the
Remedial Investigation /Feasibility Study (RI/FS), various Design Reports, and the Contractor Work Plan. Comments upon design and remediation plans never appear to end, and require continuous adjustment in construction planning and field implementation. These adjustments, in turn, cause frequent increases in design (a "transaction cost") and in construction (a "cleanup cost").

The studies by Rand and the Office of Technology Assessment ("OTA") confirm substantial expenditures by EPA, public interest groups, and PRPs on competing and conflicting studies of the site, critiques of such studies, and proposed remedial actions. Decisions on remediation schemes are not being made affirmatively by anyone, as local EPA officials await a consensus to emerge from competing technical studies, lengthy litigation, and "transaction-cost weary" participants. EPA is simply hesitant to make final, binding decisions as to remediation schemes. This hesitancy has pervaded the implementation of the Industri-Plex remediation at each stage. Even now, during construction, each and every procedure and work plan is "cleared" through EPA, DEP, and citizen groups. The delays caused by these clearances, and the impact of such delays on the cost of ISRT's firm fixed price construction contract with Chemical Waste Management appears not to be understood by EPA's local staff, who have little experience with construction procurement methods or systems. This is not EPA's fault, as the agency has neither the funds nor the staff to prepare and make its own judgments regarding remediation alternatives and requirements at thousands of sites. A system, grounded in specific Congressional policy, is required.

c) No Effective Incentives For Cost Efficiency

CERCLA creates wrong-headed incentives with respect to cost efficiency at Superfund sites. These incentives have doubled the liability of solvent PRPs, fueled largely by CERCLA's definition of "Response Costs". Response Costs are any costs incurred "not inconsistent with the National Contingency Plan." This definition removes the nature and extent of costs incurred from scrutiny by PRPs, since there is no effective method for PRPs to contest these costs. The NCP is merely a collection of guiding principles for the EPA in implementing CERCLA, and courts have consistently and unceremoniously rejected claims challenging EPA charges to PRPs for "response costs." From the perspective of solvent PRPs, the drawer of the cash register is open, money is continually being taken out by competing interests, and PRPs are required to keep replenishing the drawer. Provided there are solvent PRPs with substantial assets at a particular Superfund site, neither citizen groups nor EPA have much incentive to economically analyze and agree upon a remediation alternative. Delays and conflicts over data, alternatives, and solutions increase Response Costs to all parties, but at least in theory, the solvent PRPs, not EPA, will pay these costs.
On the other hand, PRPs have little incentive to take a true leadership role in the remediation of hazardous waste. The least expensive resolution for PRPs may be to let EPA or citizen groups raise questions with the PRPs and respond in the minimal manner possible. From the perspective of PRPs, "Weed Sitting" may be the best strategy to avoid (a) new issues, (b) delays in implementation, and (c) increases in the scope and cost of implementation.

The effort to develop and apply new technology in the remediation of Superfund sites puts further pressure on transaction costs. Through programs such as the Superfund Innovative Technology Evaluation Program ("SITE"), EPA seeks to employ emerging or innovative technology to clean Superfund sites. The SITE program is a laudable effort to authoritatively prove the engineering basis for remediation decisions made by local EPA officials. However, these technologies are still in the research and development stages. Characterized as "Response Costs", PRPs are paying research and development expenses to investigate, study, develop, and implement new technologies for general later use by EPA and the nation at large. This aspect of Superfund represents a large expenditure of transaction costs, by private entities, that is simply obtained by the government for the general benefit of the public.

\[ d) \quad \text{Transaction Costs Create Orphans and Increased Liability For Solvent PRPs} \]

Transaction costs are being routinely incurred at levels which create Orphans. At the Industri-plex site, the Mark Phillips Trust, the Developer whose excavation of hides led to the site's listing in the NPL, has ceased to function as a business. As part of the Consent Decree, all of the assets of the Trust, including adjoining land not contaminated in any way, were contributed to the Industri-plex Site Remediation Trust (ISRT) to defray the Phillips Trust's share of Response Costs. There are no other assets to take from the Phillips Trust -- all assets have been taken and applied against Response Costs. Eighteen other PRPs at Industri-plex are individuals. None are believed to have sufficient assets to pay any substantial portion of the $20.0 M in transaction costs incurred to date by Monsanto and Stauffer. The individual PRPs, along with the MBTA, Boston Edison, and the City of Woburn are responsible for 5% of the Response Costs. Several individual PRPs have not been able to pay their pro-rata share of Response Costs to the ISRT, and are now Orphans.

Whether Orphan shares are created by normal cessation of business or by forced insolvency through Superfund, the liability for Orphan Shares is simply transferred to the remaining solvent PRPs. The statutory assumption that solvent PRPs can recover Response Costs, pro rata, from Orphans is, by definition, illusory.
e) Complex, Multi-Party Litigation Is Simply A Better Alternative

Depending on how a large solvent PRP analyzes two competing principles applicable to Superfund cleanups, that PRP may well conclude that complex, multi-party litigation is a better alternative to compliance with EPA "requests" to become a Lead PRP without litigation. The first principle is the extraordinary power given to EPA in CERCLA to force one or more PRPs to undertake studies and actual remediation, in EPA's full discretion. Such orders require the identified PRP(s) to expend transaction costs alone, without any contribution from other PRPs. Once disparate liabilities of multiple companies are combined by EPA in a single Superfund "site", this single liability is only allocable among the PRPs through litigation (or compromise). The second competing principle is a legal one - the concept of contribution. The law of contribution has been recognized for centuries in English and American common law. Contribution is the right of one person who has discharged a common liability of a group of persons to reimbursement from other liable parties, each to the extent of their proportionate share. This concept is confirmed in CERCLA, and permits any PRP who pays Response Costs (including transaction costs) in excess of its proportionate share, to recover the excess paid from any other PRP or group of PRPs. Because the federal courts are available to determine each PRP's proportionate share, there is no reason for one PRP to incur more than its proportionate share of Response Costs. A typical strategy for those PRPs singled out by EPA to be Lead PRPs is to promptly commence suit against each and every PRP for contribution.218

D. Consequences of the Quadrant IV Procurement Strategy

The continued attempt to implement Quadrant IV procurement processes to large, complex infrastructure projects219 without federal financial backing is reminiscent of the decade prior to the development of the Erie Canal, in the early 1800's. Citizen groups along the proposed route of the Erie Canal urged a delay in the state's plan to finance the project itself, hoping that the cost of the project could be "exported" to a larger tax pool, i.e., the federal government. The possibility of federal funding, it was urged, was sufficient to delay the project, since federal funding would take a smaller bite out of New Yorker's pocketbooks.220 Just as in 1808, Congress no longer has the capacity to fund infrastructure development, renewal, and replacement using Quadrant I procurement methods.

1. Infrastructure Has Become An End, And No Longer A Means.

Locked in the Quadrant IV paradigm, infrastructure has become an end, rather than a means to reach other strategic goals. The extensive, lengthy "process" that is required just to administer this segmented process

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confirms its ascendancy. Quadrant IV segmented procurement requires executive capital budgeting, legislative appropriations, a competition and negotiation to hire an A/E, agency review and approval of completed plans and specifications, agency assembly of bidding documents for construction, and agency contracts (or more budgets and appropriations) for maintenance and operations of facilities throughout the life of the project. Each and every one of these processes require exchange of information, reviews, and approvals among government agencies and between government employees and each of the separate contractors who design, construct, maintain, and operate facilities for the government.

In a procurement system where infrastructure development is the end, and not a means, interstate highways can be substantially over-built in rural areas and constructed through large urban areas. States which obtained federal interstate highway financing for rural interstate construction are subsidized by other taxpayers to unnecessarily overbuild rural interstate highways.

In a procurement system where infrastructure development is the end, and not a means, adjacent cities and towns throughout Massachusetts received substantial 90:10 grants from the EPA to design and build waste water treatment plants and incinerators far in excess of local needs. Cities and towns which applied and built first were subsidized by other taxpayers whose governments failed to accept federal dollars before funding was reduced.

2. Rudderless Expenditures of Public Moneys

Congress. Throughout much of the history of the United States, Congress identified key political or economic strategies, and facilitated the development of paths for the private sector to fill those strategies. There are numerous examples. For example, one of the urgent reasons to connect the Pacific coast by rail with the Mid-West was a strategic one, to improve the ability of the United States to defend California, which was then of real concern. Congress concluded that development of the Falls at St. Mary’s (Sault Ste. Marie) was of strategic importance in opening the resources of the upper Great Lakes to emerging industrial cities like Detroit and Cleveland.

Congress needs to return, once again, to a strategy making role. The rudderless allocation of too few dollars across too many infrastructure needs through an extraordinarily expensive process no longer serves anyone. What strategy Congress should develop is not attempted here. Congress might begin by comparing the quality and effectiveness of key infrastructure services in the United States with other countries. Strategic initiatives might be identified to encourage replacement of American facilities which are clearly inferior to America’s competitors. Other strategies might be aimed at (a) reductions in the cost or time for movement of goods in and out of US ports
and airports or (b) reducing the capital stock of facilities owned, operated and maintained by the government through increased use of build to lease and other procurement mechanisms which meet federal needs but do not require federal ownership. The nation would also benefit from a viable, practical strategy to complete environmental cleanup, allowing contingent liability reserves to be put to productive use elsewhere in the economy.

*States and Regions.* Having been caught up in federally funded, 90:10 programs for highways, transit, and waste water treatment, states, too, have forgotten their capabilities to set regional strategic goals and to pursue them vigorously. Like the citizens in upstate New York in 1808, states are paralyzed by the lack of current federal funds, and mesmerized by the doubtful prospect that more federal money might yet come in the future. In the meantime, competitors in other markets and countries are investing heavily in infrastructure development for the strategic purpose of becoming more effective competitors in world markets.

3. **Innovation Disfavored**

Quadrant IV processes do not reward or encourage innovation, because the segmented process is structured in a way which prevents effective use of new processes, new designs, and new construction techniques. Designers are precluded from discussing innovative construction techniques with potential contractors in advance by conflict of interest rules. Contractors who possess innovative knowledge and skills have no opportunity to offer these innovations to the segmented process nor any way to be paid for these skills. Instead, innovations are offered in the private construction market, where private owners can evaluate and reward such skills. Equipment suppliers are discouraged from bringing innovations to public designers because of "or equal" requirements and because of conflicts of interest rules.

The segmented process produces one engineering and architectural design, undoubtedly by a competent, registered professional. This single design, however, is limited by the knowledge and experience of the design team, and may or may not represent the best, or even close to the best, combination of capital cost, operation and maintenance cost, quality, and time of delivery for a public owner. The current segmented procurement process assumes that the selected A/E perceives, implements, and describes the most effective combination of quality, time, and cost in his/her single first effort, without input from potential bidders for construction as to how these elements might be combined differently to improve value to the owner.

4. **A Process Designed to Be Adversarial**

Quadrant IV is built upon the notion of an adversarial process between the public owners and contractors, and in which the A/E owes professional allegiance to the owner over the contractor. Quadrant IV processes assume
that a complete, proper set of plans and specifications are made available, not by the A/E, but by the public owner to competing contractors. The public owner, not the A/E, is responsible to the successful contractor for the completeness and accuracy of these plans. In the event a dispute is decided against the public owner and in favor of the contractor regarding these plans, the A/E may be secondarily responsible to reimburse the public owner for additional costs caused by the A/E’s negligence in producing the plans and specifications.

Quadrant IV processes repeatedly demonstrate that the “photograph” of project design that is included in the bid packages for construction bidders is rarely, if ever, complete or entirely accurate. Nor could they be expected to be, in the real world of complex construction. The result, however, is that the relationship among a public owner, an A/E, and a general contractor is fundamentally one of conflict, in which incessant comparison between this “bidding snapshot” and actual construction produces a steady diet of change order litigation between owner and contractor, and negligence litigation between owner and designer. Quadrant IV processes inspire these disputes by adopting the “snapshot” model, and establishing the fundamental three party conflict relationship among owner, A/E, and contractor.
IV. Forgotten American Paradigms for Infrastructure Development: 1780 to 1933

We are currently “locked” into the segmented, direct procurement process that describes Quadrant IV, but the “lock” was voluntarily installed, not imposed. A number of questions are raised by this chapter, not in the abstract, but from the unique perspective of early American history. Is Quadrant IV so ingrained that we cannot move back to Quadrants I and II? If federal budget constraints continue, can we afford to remain committed to Quadrant I? Can procurement be structured, yet flexible enough to meet the individual needs of economic units smaller than the entire nation, i.e., metropolitan areas, states, or regions? Can an economic strategy be developed in which infrastructure development is an implementing tool, rather than the strategy itself?

The focus of this chapter is on procurement techniques used by government between 1780 and 1933. In modern “learning” these 150 years are simply ignored, or forgotten. Procurement techniques used between 1780 and 1933 are not known, considered, or discussed in connection with modern infrastructure planning in the United States. Our collective “lack of memory” is an extraordinary mistake. The history of American infrastructure development is the story of America - full of interesting examples of the ingenuity and resourcefulness of generations past, both inside and outside government. The results surrounds us.

Over seven hundred acts of Congress and two hundred infrastructure projects were reviewed as part of the research supporting this chapter. Until 1933, American procurement strategy for infrastructure development was creative, flexible, and diverse -- the antithesis of the monolith of procurement laws and regulations that define today’s federal paradigm.

A. Four Principles of Infrastructure Procurement From 1780 to 1933

Four principles governed procurement processes for infrastructure development in the period from 1780 to 1933: first, cooperation between public and private entities to develop infrastructure in aid of private economic activity; second, recognition that infrastructure is best provided through a combination of public means, private means, and often a mixture of both; third, constant search for different, more effective ways for government to encourage the assistance of private entities in infrastructure development; and fourth, almost exclusive reliance on a system approach (Quadrants I and II) for delivering infrastructure. Each of these principles is discussed briefly below.
1. Public and Private Cooperation

Throughout the period from 1780 to 1933, infrastructure projects are consistently directed at creating opportunities and advantages to be pursued by settlers, tradesmen, manufacturers, and other private people and entities. The Illinois Central Railroad, the Erie Canal, the Illinois and Michigan Canal, the Pacific Railroads, together with thousands of other projects supported in whole or in part with public resources or grants, were all intended to produce settlement, farming, business, or other opportunities that individual citizens could pursue on their own private initiative.

How particular projects would be used by citizens formed no part in the process of infrastructure development. Who crossed the bridge over the Mississippi River at Saint Louis, how often, and for what purpose was never considered to be a function of government planning. Rather, in encouraging construction of such a river crossing, the federal government was focused upon creating opportunities to cross the Mississippi, to be used as travelers saw fit.

2. Diverse Procurement Approaches: Private, Public, or Mixed

a) Purely Private and Purely Public Projects.

Between 1780 and 1933, it was assumed that infrastructure projects might best be delivered in one of three ways: (a) privately, (b) publicly, or (c) through some combination of public and private support. The vast majority of all infrastructure projects between 1780 and 1933 fall into the third category, i.e. a combination of public and private support, if government incentives and subsidies are described as “public support”.

Few projects during the period were developed with absolutely no government assistance, either by direct cash contribution, or indirect incentive or subsidy. These “purely” private projects were pursued when an early return on investment was likely. Similarly, very few projects were developed purely by federal public means. One well known example is the National (or “Cumberland”) Road, the only significant direct federal undertaking of a national transportation project between 1780 and 1860. The history of the Cumberland Road demonstrates that a federal legislative consensus on purely public projects was difficult to achieve and hard to maintain over a lengthy construction period.

b) Mixed Public and Private Projects.

Between 1780 and 1933, American infrastructure development is the story of how the government and private sectors continuously assembled and reassembled different combinations of private capital, private expertise, public
interests, and public incentives or funds to produce infrastructure, one project after another, and one at a time. The mechanisms used to identify what contributions were required from the public and private sectors were crude, and many times, non-existent. By today’s standards, Congress had little practical knowledge or experience in the art of conducting competitions for public work or in selecting winners as a result of such competitions.

Some projects required a great deal of support, both directly and indirectly, from the federal, state, or local government in order to attract private participation in infrastructure projects of interest to government. Others did not. Three basic reasons developed for government to offer assistance to infrastructure projects prior to 1933: implementing economic strategy, distribution of purely public benefits, and capital formation for large projects.

*Implementing Economic Strategy.* First, public assistance was offered as part of a broader economic development strategy that used particular infrastructure projects as “loss leaders” to promote economic growth. These projects were expected, once economic growth occurred, to “re-pay” both capital and operating costs after the fact. In these circumstances, infrastructure was supplied in advance of demand on a “speculative” basis, indeed, in the expectation that it would generate demand. Both public and private contributions to these kinds of projects were based on an allocation of this development risk between the government and private sectors.

*Public Benefits.* Second, government assistance was also offered purely as a public benefit. Where future demand would be insufficient to repay either capital or operating costs, government incentives were used to lower the cost to private operators, thereby inducing them to cost share with the government. A number of local infrastructure projects were developed in this way, including bridges, road, and ferries. The Pennsylvania turnpike system was developed in the first two decade of the 1800’s with liberal subscriptions by the state to the stock of hundreds of small turnpike, ferry, and bridge operators.

This rationale was not limited to local projects, however. The Erie Canal is an example of a purely public project, where government made the decision to use general revenues to entirely fund the canal because it concluded that the canal would provide greatly increased land values, business receipts, and cost reductions throughout the state to individuals other than those who paid tolls on the canal. New York concluded that the gains to be realized from the canal were so diffuse that they could not be measured or allocated among residents.

*Capital Formation.* Third, government assistance was frequently rationalized on the basis that particular projects were so large that only the tax base of government was large enough to provide sufficient capital formation.
The cash subsidy provided to the Union and Central Pacific Railroads is one example of this principle.

3. Constant Repackaging/Reassessment of Private and Public Contributions

Throughout the period from 1780 to 1933, government and the private sector were constantly in search of different, innovative way in which public and private contributions could be formulated, allocated, and used in connection with infrastructure development. Nine of these packages are described as case studies at the end of this chapter. A handful of the most successful patterns were used over and over again, such as the checkerboard land grants first used in the Ohio Land Sales Act of 1796. Along the way, however, literally hundreds of different combinations of private and public cash and incentives were developed, showing the ingenuity of both government and the private sector in moving infrastructure projects to completion. With the benefit of hindsight, some of these choices were more successful than others. On balance, however, the results were extraordinary.

4. Near Exclusive Use of System Procurements (Quadrants I and II)

More than seven hundred (700) acts of Congress were reviewed and categorized by quadrant. Throughout the period, Congress indicated a clear preference for systems procurement in Quadrants I and II and for a variety of policies to induce the private sector to provide infrastructure facilities in Quadrant II.226

a) The Vast Majority of Statutes Reviewed Favored System, Not Segmented, Procurements

Over ninety percent (93%) of the statutes reviewed between 1780 and 1933 were categorized as system procurements in Quadrants I and II. Only 7% of the statutes reviewed in the same period were categorized as segmented procurements in Quadrants III and IV.
b) The Majority of Statutes Reviewed Favored Indirect, Not Direct, Procurements

Over sixty percent (62%) of the statutes reviewed between 1780 and 1933 were categorized as indirect procurements, that is procurements in Quadrants II and III. Less than forty percent (38%) of the statutes reviewed in the same period were categorized as direct procurements in Quadrants I and IV.
The preceding two figures demonstrate that segmented procurement systems were little used in the fifteen decades between 1780 and 1933. During the period from 1780 to 1860, the frequency of segmented procurements was even lower, because architectural and engineering services were almost never segmented by statute from construction services. Beginning in the 1890's, a few statutes authorize federal agencies, if they wish, to compete separately for architectural services. Toward the end of the 1860 to 1933 period, statutes begin to require approval of complete plans and specifications for public buildings by agency heads before appropriations are authorized to be use for construction. Segmentation of design from construction is beginning to become the rule, rather than the exception.

c) Three-Fifths of Statutes Reviewed Favored Indirect/System Procurements

The next figure, which considers each quadrant separately, shows the predominance of Quadrant I and Quadrant II. Thirty-one percent (31%) of the Congressional Acts reviewed were classified in Quadrant I, sixty-two percent (62%) in Quadrant II, essentially none (0.1%) in Quadrant III, and approximately six and one-half percent (6.5%) in Quadrant IV.
5. "Room for Improvement" in Pre-1933 Procurement Processes

Throughout the period, the government was committed to an active, but not exclusive, role in infrastructure development. The federal government's cash resources were limited, while its land holdings were extensive and its right to control navigable rivers, harbors, and lakes was undisputed. Franchises for transportation facilities over public lands, over navigable waters were frequent mechanisms employed by the federal government to spur infrastructure development in advance of economic development.

Sole-source procurements. Congress generally did not use competition to shape the content of major transportation projects, to obtain best value, nor to obtain price and quality comparisons among proposers. Throughout the period from 1780 to 1933, with a few exceptions toward the end, Congress awarded franchises for such projects to companies, to individuals, and sometimes to municipal or state governments, not on the basis of competition, but on the basis of who asked first. In today's parlance, these procurements were unsolicited proposals awarded on a sole-source basis.\textsuperscript{227}
The result was occasional scandal which was frequently blamed on the franchising model, rather than the absence of broad competition among independent proposers.

*Short Term Competitive Advantage v. Long Term Compatibility.* Throughout the period, there was substantial tension among government (at three levels) and private sector participants in infrastructure development. State-city rivalries, state to state rivalries, and company-state rivalries caused the American "stew" of infrastructure projects to "boil" on a number of occasions throughout the period.

**The B&O versus the C&O.** The competition between the Chesapeake & Ohio Canal Company and the Baltimore & Ohio Railroad for federal stock subscriptions is a classic example. The C&O canal had been heavily funded by the State of Maryland, who was a large shareholder, and by the federal government, who also was a shareholder. The B&O was heavily financed by the City of Baltimore, itself a large shareholder in the B&O. The competition between the canal and the railroad was intense. Both were attempting to bring Appalachian coal to the Atlantic seaboard through Georgetown (C&O) and Baltimore (B&O). Both sought to connect the trade of the Ohio river valley to these same eastern markets.

In 1830, a bill was filed in Congress to give aid to the Baltimore and Ohio Railroad through a federal stock subscription. If passed and signed into law, Congress would be in the position of investing in the stock of two competing ventures for coal transportation from the eastern slope of the Alleghenies. The conflict between the Chesapeake and Ohio Canal and the B&O Railroad was now apparent, as the canal also sought further stock subscriptions or other federal aid. A Senate committee favored the stock subscription to the B&O. In the House, however, Representative Mercer was both the President of the C&O Canal and the Chair of the House Committee on Roads and Canals. There, the bill suffered a quick defeat. Mercer drew the conclusion that it was impossible to convince the Senate to discard its "delusion" that railroads were preferable to canals. The rivalry between the C&O and the B&O continued into 1832, when a court had to determine which company had the prior claim to control a narrow valley along the Potomac above the Point of Rocks, where there was hardly enough room to build both a canal and a railroad.

Mercer may have made a "miscalculation" that canals represented the future of transportation in America. Congress, however, made a bigger mistake by investing cash in projects which pitted political and economic interests of states and cities against one another.

**New York's Canals v. Pennsylvania's Canals.** Imitation is the sincerest form of flattery, but flattery get Pennsylvania nowhere when its legislature decided to compete with New York City's route to the Ohio River Valley with
a Pennsylvania system of state funded canals to the west. Providence had given New York an existing cut through the Appalachian mountains along the Mohawk River, a strategic advantage Pennsylvania could not copy. Yet, alarmed at the competitive advantage produced for New York City in lower transportation cost and time, Pennsylvania attempted its own publicly-funded canal from Philadelphia to Pittsburgh. The result was a financial and technical disaster, which could not effectively compete with the Erie canal, but compounded Philadelphia’s inability to compete with New York as a transshipment point because public investment in the Pennsylvania canal system substantially delayed construction of a more effective reply to the Erie Canal – the Pennsylvania Railroad.231

The pattern of seeking short term competitive advantage over long term compatibility was as prevalent in the period from 1780 to 1933 as it is today. Both government and private companies were engaged in it. The result was political resistance to change and politically based protection of previous public investment. For example, to protect the Erie Canal from railroads, New York state law, until 1844, prohibited the conveyance of freight on railroads from Albany to Buffalo except when the canal was frozen. Until 1848, New York law required railroads running parallel to the canal to pay canal tolls as if they were operating on the canal.232 Similar short term choices were made at the operating level. To “protect” New York bound commerce on the Erie Railroad from attack by Pennsylvania, the gauge of the Erie was made wider than the Pennsylvania,233 a decision that, eventually hurt, rather than helped, the Erie Railroad as further connections were made into Chicago.

Two, of just many other examples, include:

a. the National (Cumberland) Road, funded in fits and starts by the federal government, and the Pennsylvania Road, supported by the state of Pennsylvania and in many ways the equal to the National Road; and

b. the Middlesex Canal Company, a private franchised company to connect Lowell with Boston by canal, and the Boston and Lowell Railroad, a franchised private railroad that quickly put an end to already weak revenues on the Canal;

These competitions pitted one government against another, and frequently the companies they supported against one another.234 In a wider context, however, inter-government competition created substantial confusion and delay in how needed infrastructure development would be packaged.235

B. Prevailing Procurement Methods
During the period from 1780 to 1933, Congress was clearly not "locked" in the segmented, direct procurement processes of Quadrant IV. Indeed, Congress only rarely (7%) required a segmented procurement process in either Quadrant III and IV. Infrastructure was planned, designed, built, maintained and operated as a system in virtually all instances (93%). Whether Congress funded these system procurements directly (Quadrant I – 31%), and therefore controlled, particular projects, or induced private individuals to do so indirectly (Quadrant II – 62%), the concept that infrastructure development could be divided into segments was almost never applied. Congress' strong preference was a procurement strategy based on system procurement in Quadrants I and II.

A variety of approaches were developed over the period, with mixed levels of success, but which focused upon how infrastructure could be flexibly provided using Quadrant I and II processes. This section describes a number of these approaches as applied in particular instances, not as an exclusive list, but as an indication of how diverse and creative these approaches had become throughout the nineteenth century and well into the twentieth century.

1. **Indirect**

Congress employed a number of indirect mechanisms to encourage infrastructure development, including subsidies, income streams, franchises, and other incentives designed to induce private investment of time or money in infrastructure. Although a detailed description of incentives employed by the Congress is presented in Appendix A, a few examples of indirect mechanisms illustrate the point here, that procurement systems used by Congress in this period were by no means "locked" in Quadrant IV.

a) **Subsidies**

*Land grants.* Land grants were used throughout the period to support a number of infrastructure facilities and projects. Early canal development in Ohio, Illinois, Indiana, and Michigan was subsidized through the familiar checkerboard land grants provided by the federal government. These same land grants supported the drainage of swamp lands along the Mississippi and Ohio River (and later all rivers of the United States), as well as the expansion of railroads throughout the territory west of the Appalachian Mountains.

b) **Income Streams**

*Post roads.* The post roads, constructed and maintained in small segments throughout the 19th century by individuals, were based on the expectation of a steady stream of income both from the collection of postage and increased commerce along postal routes.
c) Franchises and Build-Operate-Transfer

**Turnpikes.** During the period, Congress authorized a number of federal franchises to private companies to construct turnpikes and bridges in and around Washington, D.C. Under the provisions of these franchises, the turnpikes reverted back to public ownership at the close of the franchise period. Examples include a franchise to The Washington Bridge Company, authorizing construction of a bridge over the Potomac,\textsuperscript{237} and franchises to the following companies to build, operate, and maintain similar turnpikes and bridges. These companies included: The Washington and Alexandria Turnpike Company,\textsuperscript{238} Georgetown and Alexandria Turnpike Road,\textsuperscript{239} the President, Directors and Company of the Columbia Turnpike Roads,\textsuperscript{240} the Alexandria and Leesburg Turnpike Company,\textsuperscript{241} the Georgetown and Leesburg Turnpike Company,\textsuperscript{242} the Columbia Turnpike Road Company,\textsuperscript{243} and the Rockville and Washington Turnpike Road Company.\textsuperscript{244}

**Steamboat Mail Delivery.** In 1819, Congress authorized the Post Office to conduct a competition to hire steamboats to carry the mails between Louisville and New Orleans over four year terms, with rates for carrying the mail not to exceed the rates charged on post roads.\textsuperscript{245} The act indirectly subsidized steamboat construction and operation on the Ohio and Mississippi by guaranteeing income streams to successful competitors for the franchise.

**Other Steamship Mail Routes.** Congress indirectly supported the development and operation of American steamships by providing for long term mail contracts for the delivery of mail to Europe, to other American ports, to South America, and to Asia. Postal contracts provided steady income streams to assist in defraying the cost of building, operating and maintaining steamships capable of moving on the navigable waters of the United States.

**Piers.** In 1798, Congress approved a Massachusetts statute granting a charter to build, maintain, and operate a pier at the mouth of the Kennebec River in Maine and to collect a toll/duty for use of the pier.\textsuperscript{246}

**Bridges.** In 1836, Congress authorized the Shenandoah Bridge Company to erect a bridge across the river Shenandoah on federal lands at or near the town of Harper's Ferry, and to connect the bridge by a sufficient road or passageway between the existing road on the east side of the river and the main street of Harper's Ferry.\textsuperscript{247} The company was authorized to erect a toll house adjacent to the bridge on federal lands. The actual site of the bridge was to be submitted in advance to the Secretary of War for approval.

In 1805, Congress authorized the President to permit construction of a private bridge across a marsh at the Brooklyn Navy Yard, on the conditions that no toll would ever be charged to US goods or personnel and that US property will never be damaged as a result of operation of the bridge.\textsuperscript{248}
d) Stock Subscriptions.

Canals. In several instances where infrastructure projects were in financial trouble, Congress offered cash assistance in the form of stock subscriptions paid into the treasuries of private corporations to continue construction or operation. Examples include the Chesapeake and Ohio Canal, the Louisville/Portland Canal, and the Dismal Swamp Company Canal.

2. Direct

Congress also used a number of direct mechanisms to encourage infrastructure development, including design build, direct contracting, purchase of stock, and purchase of technology. A few examples of these direct mechanisms illustrate the point here, that while Congress used direct procurement in this period, these mechanisms were by no means "locked" in Quadrant IV.

a) Design-Build

Design/build by direct contract with the federal government was frequently used by the Congress in the construction of early lighthouses and navigational aids, such as buoys, lights, and markers.

The National Road. The design/build model was used to construct the Cumberland (or National) road, discussed in more detail below.

Military Roads. Military roads were routinely constructed using design/build processes, including roads between Fort Hawkins, Georgia and Stoddard, Alabama, the reopening of the King’s Road between Georgia and St. Augustine, Florida, and numerous others.

b) The Three-Commissioners Model

A number of federal roads were built in the territories using a "Three Commissioners Model". Two examples are the Missouri to New Mexico road and the Detroit to Chicago road. This model was also used in connection with the Cumberland (National) Road, the Chesapeake and Ohio Canal and other projects where an apolitical route or site selection was required to be taken.

In this model, Congress authorized the President to hire three disinterested commissioners to lay out the proposed road or canal, to be paid directly by the government. Congress would specify the general nature of the work to be done by the Commissioners, which typically involved surveying, trail blazing, map preparation, and the preparation of a report to the President. The report to the President was required to include maps,
recommendations, a construction plan, and an estimate of cost. Congress authorized the President to either accept or reject the report in its entirety. If the President accepted the report, the route was that established by the Commissioners. If the President rejected the report, no route was established.

The Act authorizing laying out of a road from Missouri to New Mexico Act used three commissioners, who were required to explore, survey, and mark, in the most eligible course, a road from the western frontier of the state of Missouri to the boundary of the United States, in a general direction toward Santa Fe, Mexico. The Act gave the commissioners authority to treat with the Indians for the un molested construction and use of the road by citizens of the US and of Mexico. Congress appropriated $20,000 to pay the commissioners and to treat with the Indians. $10,000 was appropriated toward making the road.

The Act authorizing laying out of a road from Detroit to Chicago also used three commissioners, who were required to explore, survey, and mark, in the most eligible course. Congress appropriated funds to pay the commissioners and $3,000 toward making the road.

c) Federal Take-Over of Stock Companies

The Washington Canal. Another direct mechanism used by Congress was to acquire the assets of stock companies previously chartered to build infrastructure facilities. Congress did this in 1832, when it transferred title to all the assets of the Washington Canal Company and to the City of Washington.258 Earlier acts of Congress establishing the Washington Canal Company, in 1802, and amendments in 1809, 1812, and 1826 were repealed.

d) Federal Investigation and/or Purchase of New Technology

Lewis Patent Rights. Yet another direct mechanism used by Congress was the purchase of new technology for use by the federal government in infrastructure development. For example, in 1812, Congress authorized the President to purchase Winslow Lewis' patent rights to a new method and apparatus to improve the light emitted from lighthouses.259 Congress also suggested the procurement method the President should use to upgrade all American lighthouses. In the Act, Congress authorized the President to contract with Lewis. The terms of the contract would be these: Lewis was to install and maintain his new device in every lighthouse in the United States for a period not less than seven years. At the end of this seven year period, Lewis was required to deliver the lighthouses fitted with his invention in good repair. Lewis would warrant his invention for seven additional years after the end of his contract. The contract amount could not exceed $60,000, which was the sum then annually appropriated by Congress for oil fuel using
the old lighting system. In 1816, Congress appropriated another $16,000 to complete the refitting of American lighthouse with Lewis’ improvements.260

*The Telegraph.* A second well-known example is the testing of the telegraph, described briefly above. In 1843, Congress authorized $30,000 to be spent to test the capacity and usefulness of the system of electro-magnetic telegraphs invented by Samuel F. B. Morse, of New York for possible use by the government.261 The money was to be used in constructing a line of telegraphs, under Morse’s supervision, of such length to fully test its “practicability and utility”.

*Methods of Clearing Streams.* At other times, Congress appropriated money for government officials to test inventions which might prove useful in infrastructure development. One such example was an 1845 act authorizing the Secretary of War to appoint a Board of three officers to examine and test a machine invented and patented the Dr. James R. Putnam of New Orleans for the removal of obstruction and bars in rivers and harbors.262

C. Case Studies - 1780 to 1933

Presented below are nine (9) case studies describing particular projects during the period. In most of these cases, cooperation between government and private citizens, risk-taking by both the government and private citizens, and innovative Quadrant II methods were key elements of the procurement plan. Rather than “shunning” risk, both parties to these procurement transactions embraced it as a variable to be used by both parties in developing a Win:Win procurement package to be applied on a particular project.

In the case of the Erie Canal, state government took on the task of building the project after two private attempts had failed and after sectional rivalries in the Congress eliminated the prospect of federal assistance.

Additional mini-case studies are presented in Appendix B, which aid in a further understanding of the extensive use of Quadrants I and II processes prior during the period from 1780 to 1933.263

Case Study IV-1

1. Ebenezer Zane's Post Road -- Quadrant II.

One of the most interesting projects in the period was the post road built by Ebenezer Zane, in 1796, between the mouth of Wheeling Creek, in [what is now West] Virginia and Limestone, Ohio Territory (now known as Maysville, Kentucky.
Zane was a settler who had migrated from Fort Pitt (now Pittsburgh) to the mouth of Wheeling Creek in Virginia, on the Ohio River, blazing a trail along the way. At the mouth of the Wheeling Creek, he founded a town first called Zanesburg, and now known as Wheeling. Mr. Zane now proposed to extend his trail into the Ohio valley along an old Indian trace, which crossed the Muskingum, the Hocking, and the Scioto rivers and returned to the Ohio River at what is now Maysville, Kentucky. In 1796, Zane petitioned Congress for federal assistance, asking for landing sites at each of the three river crossings, and money to survey the route. Zane received the landing site he requested, but not the cash. Congress' proposal to Zane was an interesting one, which Zane accepted and completed to the mutual advantage of the government, Zane, and many thousands of settlers and travelers through the Northwest Territory.

Congress' response was a counterproposal in two parts: first, a conditional grant of land in three tracts one mile square. These tracts were to be located at each of the three river crossings over which Zane proposed to build his road. The second part of Congress' proposal was a franchise which required Mr. Zane to establish and operate toll ferries at each of the river crossings. The first tract was on the Muskingum river, the second on the Hocking river, and the third on the north bank of Scioto river. The federal grant of land was on several express conditions: (a) that Zane conduct his own survey of the route, at his own expense, (b) that plats describing the results of his survey be returned to the government, and (c) that by the first day of January, 1797, Zane produce satisfactory proof that the road was open, and that ferries were established across each of the three rivers for travelers. Once each of these conditions were met, and Zane provided sufficient security that the ferries would be maintained during the pleasure of Congress, the statute authorized a "patent" to issue for the land.

The statute provided that the tolls charged at the ferries were to be set by any two judges of the Northwest Territory. Zane's road opened the interior of Ohio to settlement and commerce, and rewarded Zane with substantial grants of land, as well as an income stream from the operation of ferries at Zanesville, Lancaster, Chillicothe, and Maysville. The path taken by Zane's Road established Wheeling as a transportation hub for the settlement of the Ohio River Valley, which was confirmed only a decade later with Wheeling's designation as the first terminus on the Ohio River of the National (Cumberland) Road. Zane's route is shown below.
Case Study IV-2

2. The Erie Canal – Quadrant I.

The Erie Canal broke new ground in two ways beyond the physical movement of earth. The project was the first effort in the Americas to build an independent canal, rather than to attempt to improve a pre-existing waterway. Second, the canal represents the first significant effort by a state to construct, maintain, and control a major public works projects, rather than to permit private construction, maintenance, and control.268

Groundbreaking for the canal took place on July 4, 1817, but the history of the canal began much earlier.269 The first conceptual plan for the Erie Canal was to divert water from Lake Ontario, by canal, to the upper reaches of the Mohawk River, near Rome, New York.270 An abundant supply of water would maintain water levels in the canal and connect New York City with Albany, Rome, and with Lake Ontario. An Indian trail already existed on this route. The major problem with this route was that Niagara Falls prevented easy connections to the other Great Lakes. Only a canal which connected to
Lake Erie would bring the commerce of the Northwest Territory through New York State to New York City.

The geography of New York was unique among the original American states with land on each side of the Appalachian Mountains. Only New York's Mohawk River connected both sides of the mountains naturally. Pennsylvania and Virginia had no water connection through the Appalachians, and Maryland's routes could only hope to approach, but not traverse the Cumberland Gap. In New York City, supporters of the Albany to Buffalo canal route were focused largely on the opportunity the Canal provided to divert commerce from the Ohio River valley and both Baltimore and Philadelphia and to compete with shipping points inside the Ohio territory itself. Before completion of the canal, the towns on the Big Beaver, Muskingum, Scioto, and Miami rivers were supplied from Philadelphia at an expense of $8.50 per 100 pounds. Supporters of the canal estimated that transportation charges from New York City, over the canal, would be $6.50 per 100 pounds. Estimates comparing transportation costs from Ohio to New York, Montreal, Quebec, New Orleans, and Baltimore, all indicated that New York City would be the cheapest destination once the canal was completed.

In addition to debate over the effect of the canal on New York's commerce vis a vis that of other states, a similar debate occurred within the state over the effect of the canal on intrastate commerce. In New York, this debate raged between 1808 and 1817, when construction finally began. Western New York was a strong supported of the Albany to Buffalo route, because it was booming, in terms of population, commerce, agriculture, and manufacturing. Population increases in western New York were shifting political power away from New York City toward Buffalo. Western farmers, buoyed by the successful development of new fertilizers in Wilkes-Barre, Pennsylvania needed better and cheaper transportation to get surging volumes of their crops to mills in Buffalo and Rochester. These same large flour mills needed easy access to Europe and to the large population of New York City to distribute their products.

Northeastern New York had already established trade routes to Montreal. Existing roads were already well established compared to other parts of the state. Northeastern New York did not want a route to Lake Erie, which would divert existing trade, and instead favored a canal to Lake Ontario, which, in the short term would consolidate and strengthen Northeastern New York's commercial ties with these Canadian cities. Approximately $400,000 had already been spent by private investors and the State in support of the Western Inland Lock Navigation Company's effort to connect the Mohawk River northward through Lake Oneida to Lake Ontario. This was the route favored by this section of the state.
Because the canal was of national significance, and had been specifically named in Albert Gallatin's 1808 report on internal improvements necessary to open commerce among the states, and in particular, the Ohio River valley, New York sought help from the federal government to build the canal. The state's efforts to obtain federal assistance were rebuffed in 1808 by President Jefferson. New York was left to either build the canal itself with state funds or look for another franchisee to complete the work already underway.

DeWitt, then governor of New York, began pressing for the canal in 1810. Clinton, too, was thinking strategically, arguing that New York needed an interior route to the Great Lakes to exploit growing western markets and to protect against possible British invasion from Canada. In 1811, at DeWitt Clinton's urging again, the state legislature authorized a commission to study the project. On March 2, 1811, the Commission's report was given to the NY legislature, recommending that the canal be a state-owned enterprise, not a private concern. By 1812, the Commissioners were authorized to purchase all of the works of the Western Inland Lock Navigation Company. However, the War of 1812 put a stop to plans to raise money from the state's treasury. Clinton's estimate in 1815 of $20,000 per mile ($6,000,000) and ten years to build was quite close to the actual cost of $7,000,000 and eight year construction period. After a good deal of political in-fighting, fueled in part by concern in New York City that the canal would, on balance, hurt rather than help the City, the New York legislature passed "An Act for Improving the Internal Navigation of This State" on April 15, 1817, and the canal was off to a start, with direct state funding. Financing for the project involved series of loans which were made almost entirely by the citizens of New York state. When the financial success of the canal seemed assured, based on the collection of $1,000,000 in tolls even before the full length was completed, larger investors in New York City and then in London became interested in further loans.

When completed and opened on October 25, 1825, the canal was 363 miles long, forty (40) feet wide at the top, twenty eight (28) wide at the bottom, with an average depth of water of four feet. The day after the canal opened, Governor Clinton boarded the Seneca Chief and Buffalo bound for New York City on the canal. Arriving on November 4, he poured water taken from Lake Erie into New York harbor. The Seneca Chief carried flour, whitefish, butter, potash, maple, red cedar from Western New York, Pennsylvania, Ohio and Michigan to New York City use in the city and for transshipment elsewhere. The cost of hauling goods from Buffalo to New York City was reduced from $100 per ton to $10 per ton and the time for shipment was slashed from 26 to 6 days. Revenues taken in by the canal exceeded cost many times over. The Erie canal brought large numbers of settlers to the throughout the Ohio valley and the areas surrounding the Great Lakes. Commercial traffic in goods was extraordinary, totaling over 185,000 tons in 1825 alone.
Between 1825 and 1865, the Erie Canal kept New York in the forefront of the country's economy. For example, by 1860, one-third (1/3) of country's imports and two-thirds (2/3) of country's exports passed through the Port of New York.\textsuperscript{283} Seventy percent (70\%) of the 5,458,000 immigrants to the United States that arrived between 1820 and 1860 came through the port of New York.\textsuperscript{284} Volume on the Erie began to rival the entire volume of the Mississippi and Ohio River traffic. After two toll reductions prior to 1836, the annual operating profit from the Erie and Champlain canals was in excess of $1,000,000.\textsuperscript{285} The Erie canal connection to the upper Great Lakes indirectly supported the growth of Chicago, first as a port, and later as the rail hub of the Midwest.

When the Canal first opened, the entire population of New York was located at the southern-most tip of Manhattan. The city was thickly settled, but compact, with 166,086 inhabitants. The Village of Harlem had a few people, and was served by a Post Road running the length of the island, but there were no bridges connecting Manhattan with any surrounding community.\textsuperscript{286} The island was surrounded by salt water marshes. Between 1820 and 1840, the City’s population doubled, and doubled again between 1840 and 1860. Between 1860 and 1890, population doubled yet again, and by 1900, New York’s population, as reported in the US census, was 3,437,202.\textsuperscript{287}

Case Study IV-3

3. The Illinois and Michigan Canal -- 1836 Quadrant I

In the 1700's, the distance between the headwaters of the Chicago River, which drains into Lake Michigan, and the headwaters of the Illinois River, which drains into the Mississippi, is two or three miles in the vicinity of a swamp known as "Mud Lake". In the rainy seasons, waters collected in Mud Lake fed both the Des Plaines River (tributary to the Illinois) and the South branch of the Chicago River. For centuries, this flat, but important continental divide, has allowed “native Indians, European adventurers, traveling through the region, [to] easily traverse the water gap by portaging, or carrying, their canoes across it.”\textsuperscript{288}

The portage route was thus, well known to French fur trappers who used during the French and Indian Wars to pass around British fortifications in the Ohio River Valley and reach the Mississippi. The British claimed control over the land now called Illinois from 1763 to 1783, when the treaty ending the Revolutionary War ceded British claims to the United States. Fort Dearborn was established by the Americans in 1803 for the purpose of controlling the mouth of the Chicago River and this important transportation corridor.

If the short gap between the headwaters could be traversed by a canal, and each of the rivers made navigable, Lake Michigan would be connected
directly to the Mississippi at Grafton, Illinois, just above Saint Louis, Missouri, as shown in the figure below. As the project developed, 100 miles of canal would be built from Chicago to a site west of Ottawa, in many cases alongside the Des Plaines River and the Illinois River.

Figure IV-5

The first proposal to build a canal across the portage was made to Congress by Peter B. Porter in 1810, but Congress did not become interested in the project until after the War of 1812 with Britain, which increased the strategic importance of a water connection between the Mississippi and Lake Michigan. Congress had the project in mind in 1816, when Illinois was admitted to the union. Before admission, Congress moved the proposed boundary of Illinois northward to include the Chicago portage within the State of Illinois.

In 1822, Congress made its interest in the project express through a conditional land grant land along a canal route to the State of Illinois. The 1822 act authorized Illinois to survey and mark the proposed route of the canal through federal public lands within three years of the date of the statute. The statute reserved from sale a right of way between the Illinois river and the southern bend of Lake Michigan up to ninety (90) feet on each side of the route surveyed by the State. No federal commitment was made to fund construction of the canal, and any grant would require that the canal be and
for ever remain a public highway for the toll-free use of the government of the United States. The grant would be effective if the State completed the survey and returned a complete map of the proposed canal route to the Treasury Department, within three years, and completed a canal along the route which was suitable for navigation, within twelve years of the act.

Congress' first attempt to induce Illinois to arrange for the construction of the canal failed. In 1827, Congress made a second offer, which was pursued. The 1827 statute offered the State of Illinois alternating sections of land within five miles on either side of the surveyed route. Sales of the land, to be made by the State for not less than $1.25/acre, were to be used to fund construction of the canal. Five percent (5%) of the proceeds from sales of the land reserved to the United States would be paid by the federal government in Illinois 5% fund for internal improvements. In effect, the federal government joined with the State in speculating that the value of the holdings along the canal route would more than double as the canal was developed. Land granted to the state was subject to disposal by the State Legislature, on condition, however, that work on the canal be commenced within five (5) years, and completed within twenty (20) years. If this condition was not met, the state would be required to return to the United States all unsold land plus all receipts for sales of land granted for construction of the canal.

To implement the 1827 act, the State appointed successive commissions to survey the route and present financial proposals for building the canal. The 1829 commission commenced sales of odd numbered sections granted by the federal government, but not until June, 1836, when the sale of 375 lots at the Chicago end of the canal netted $1,355,755, was the rate of land sales sufficient, in the commission's opinion, to break ground. Construction commenced on July 4, 1836, and a professional canal engineer was hired by the commission to supervise contractors employed to build the canal. The work was completed in 1848, connecting Lake Michigan to the Gulf of Mexico.

The effect on the region was significant. The towns of Ottawa and Chicago were designated by the 1829 Canal Commissioners as town sites under the terms of the Ohio Land Sales Act, and each town immediately prospered. Until the opening of the canal, Saint Louis drew farm produce, wheat, and other grains from Illinois farms. After the opening of the canal, Chicago, not St. Louis controlled the region's commerce. Lumber and goods from the East moved westward to markets along the canal all the way to the Mississippi. Goods from New Orleans, grain, wheat, and produce moved eastward to Chicago for processing and onward to the East.
Case Study IV-4

4. The Illinois Central Railroad – 1850 Quadrant II

In 1847, U.S. Senator Stephen Douglas, Democrat of Illinois, introduced a bill in Congress make a direct grant of land to Illinois for constructing a first class railroad from Cairo, at the junction of the Ohio and Mississippi Rivers to Galena, at the northwestern corner of Illinois, and to Chicago. With little support from either the South or the East, Douglas's bill failed in the House of Representatives. The Illinois legislature remained interested in the project, and on February 10, 1849, reincorporated the Great Western Railway Company and awarded it a 200 foot right of way from Cairo to Galena across state lands. The charter to the Great Western also awarded the company any rights the state might receive in the future in support of such a railroad from the federal government. The Great Western was required to spend at least $200,000 per year until the railroad was completed. Before work commenced, Senator Douglas arranged for the charter to be voluntarily suspended while another attempt was made to obtain a federal grant for the complete Cairo to Galena to Chicago routes. Assembling a new coalition of western and southern representatives and senators, by expanding the project to include land grants for both a central Illinois railroad and a railroad from Cairo, Illinois to Mobile, Alabama, the legislation became much more interesting to the Southern states.296

In September, 1850, Congress authorized the land grants for the Chicago to Mobile railroad, and the President signed the bill into law on September 20, 1850.297 The act granted a 100 foot right of way on each side of the railroad, plus a checkerboard pattern of alternate sections of federal land six miles on each side of the proposed right of way to the states of Illinois, Mississippi, and Alabama to construct the road from Chicago to Mobile. Land was granted to the states on the condition that the road be completed within ten (10) years. If it was not completed, (a) all unsold lands would revert to the federal government, and (b) the states would pay the preempted price of $2.50 per acre for all lands already sold by the states. The act also doubled the minimum sales price for retained federal lands along the right of way. Congress was again speculating that the railroad project would cause the land to more than double in value. Approximately three and one half million (3,500,000) acres of land were included in the grant. Free passage was guaranteed for federal employees, goods, and troops. Congress also established the new railroad, once completed, as a post road, and reserved the right to establish the price to be paid by the government for carrying the mails.298

After passage of the Act, a controversy arose over who would build the road. After receiving several proposals locally, a group of investors from
Boston and New York, led by Robert Rantoul, offered the following proposal, in its entirety:

"The Legislature should create a corporation and surrender to it the Federal land-grant. In return the incorporators agree to build a railroad equal in all respects to the railroad running between Boston and Albany, with such improvements thereon as experience has shown to be desirable and expedient; to complete the road by July 4, 1854; and to pay the state [_________]% of gross receipts for the land." 299

The legislature agreed to this arrangement and the Illinois Central was incorporated in March, 1851.300 Rantoul’s original plans was to sell bonds to European financiers using the land grants transferred to the company from the state of Illinois as security. At first efforts to place the bonds in Europe failed. Not until $4M in proceeds from bond sales was received in the United States and $2M in bonds were sold to the Michigan Central Railroad for the right to enter Chicago over the company’s track, that $5M in 6% bonds with subscription rights were sold in London.

Construction was more difficult than anticipated, and repeated cash calls were made on shareholders during the period from 1852 through 1857. The road was completed, however, in five years from 1851 to 1856, with capital raised on the security of land granted in the 1850 act. In total, over $26,500,000 was spent, of which $21,000,000 represented the cost of construction.301 The Illinois Central was the first land grant railroad to be completed in the United States, opening the entire southern part of Illinois to economic development, and linking lower Illinois to Chicago by convenient, cheap transportation.

The route of the Illinois Central is shown below.
Case Study IV-5

5. The South Pass Navigation Works -- 1879 Quadrant I

One of the innovative procurement strategies used during the entire period from 1780 to 1933 arose out of a bitter, yet learned, dispute between senior officers of the United States Army Corps of Engineers and James B. Eads, a retired army officer, gunboat captain during the Civil War, and designer of what came to be known as the "Eads" bridge in St. Louis. Efforts to keep navigable channels open through the Mississippi River delta had been made since 1726 by the French, all without long-term success. Precipitation of silt as the river slowed over the delta continually caused bars to form, frequently closing the port of New Orleans to ocean-going vessels. As other obstructions throughout the Mississippi, Missouri, and Ohio River valleys were removed or overcome, keeping the port of New Orleans open to the Gulf of Mexico grew in importance.

After the Civil War, pressure was put on the Corps of Engineers to either design and implement a permanent fix, or to build a canal through the delta. After great internal debate, upon which there was no consensus, the
Corps presented a plan to Congress in 1873 proposing a canal. Eads, in the meantime, had submitted a competing proposal to the Congress for construction of a series of jetties which would cause the River to scour its own channel for shipping. The Senate favored Eads' proposal, while the House adopted the Corps recommendation and passed a bill funding a canal. A new commission composed of both civilian and military engineers in 1875 recommended that Eads scheme be tried in an obscure, currently useless channel through the delta, at South Pass.

Eads proceeded with his plan with the most unusual contract terms. Eads agreed to be paid in increments over a twenty (20) year period, contingent upon his creation and maintenance of a clear, deep-draft channel of the widths and depths specified in the contract. Eads would only receive the full contract amount if his jetty system created and kept the channel clear to the required minimum depths and widths for the full twenty year period. Work began on June 14, 1875, and was substantially completed on July 8, 1879.

Eads' adversaries remained skeptical throughout the twenty year operations period. Surveys conducted by the Corps which confirmed that Eads was meeting the performance requirements of his contract were withheld by the Chief of Engineers from both Eads and the public. A number of statutes continued appropriations for payment to Eads and for surveys by the Corps of Engineers to determine whether further payments were owed. The Secretary of War eventually order the Chief of Engineers to publish these surveys.

Eads' jetty system worked, the channel remained clear for the full twenty years, and substantial funds were saved by not building a canal. Furthermore, the port of New Orleans remained opened throughout this period, and has remained so ever since. The port continued to grow over the ensuing century, and is now the third largest in the world.

Case Study IV-6

6. The Brooklyn Bridge — 1883 Quadrant II

One of the most famous construction projects in the world, the Brooklyn Bridge is a spectacular example of procurement in Quadrant II. The idea of a suspension bridge between Brooklyn and lower Manhattan was first shown in a plan sent by John A. Roebling sent to newspaperman Horace Greeley in March, 1857, and published that same month in the New York Tribune. After a lengthy period of discussion and maneuvering, the New York Legislature voted a charter to the New York Bridge Company on April 16, 1867 to design, construct, maintain, and operate the bridge shown in Roebling's sketches. The charter provided that the Company was to complete the bridge in approximately three and one half years, that is, by January 1, 1870. John Roebling was hired as "Engineer" for the structure by
the Company. Because the bridge spanned navigable waters, in 1869, Congress confirmed the legislature’s act incorporating the New York Bridge Company to construct and maintain the bridge, and declared it would be a post route, once completed.\textsuperscript{307}

The New York charter gave the company the power to buy any land necessary, to set tolls, and to raise up to $5,000,000 in capital stock, at $100 par value per share.\textsuperscript{308} Thirty percent (30\%) of the stock, which was non-voting, was purchased by the City of New York ($1,500,000) and fifty percent (50\%) of the stock, also non-voting, was purchased by the City of Brooklyn ($3,000,000). The remaining stock of the company was voting stock, held by private investors in the New York Bridge Company.\textsuperscript{309}

John A. Roebling and a small team of engineers prepared a general design for the structure as employees of the franchisee, the New York Bridge Company. Before construction commenced, however, in July, 1869, Roebling died from lockjaw, following a freak accident at the site in which one of his feet was crushed by a ferry at the Fulton dock.\textsuperscript{310} Roebling’s son, Washington, was named Chief Engineer in his father’s place, and ground was broken for the project on January 3, 1870. Separate contracts were competitively awarded by the Company to Webb & Bell, a New York marine company, to build the Brooklyn and New York caissons on in October, 1869 and October, 1870, respectively. Work proceeded with difficulty on the caisson foundations because of the depths of the excavation below the level of the East River. Caisson’s disease was as yet an unsolved mystery, and several workers died of it.

By 1872, massive corruption in New York City contracts and services, orchestrated by Tweed and Tammany Hall, was exposed, and Tweed had been indicted. Tweed’s stockholdings in the New York Bridge Company were disclosed, which prompted two changes in the management of the Company. First, on June 5, 1874, the legislature amended the company’s charter to give the cities of Brooklyn and NY representation on the Board of Directors. In May, 1875, the legislature required the cities to buy out all the private shareholders of the Company by returning their stock subscriptions with interest. At the same time, control of the board was transferred to a Board of Trustees, who were political appointees.

Construction of the bridge proceeded under Washington Roebling’s supervision. The Brooklyn Tower was completed in June, 1875, the Brooklyn anchorage in November, 1875, and both the New York Tower and anchorage were done in July, 1876. The project was ready for receive over 7,000 miles of wire rope, which would comprise the two main cables. In 1876, the competition for wire rope began. At the time, John A. Roebling’s Sons produced 75\% of all the wire made in the United States. The president of company was Washington Roebling, also the Chief Engineer for the project.
Demonstrating a unique sense of poor judgment about when conflicts of interest might adversely affect progress on the bridge, the Board of Trustees voted,\textsuperscript{311} on September 7, 1876, the following resolution, at the instance of Board Member Abram Hewitt, a future Mayor of the City, but then now a U.S. Congressman running for re-election in 1876,\textsuperscript{312} a wire supplier himself and potential bidder:\textsuperscript{313}

\begin{quote}
RESOLVED, that bids from any firm or company in which any officer or engineer of the Bridge has an interest will not be received or considered; nor will the successful bidder be allowed to sublet any part of the contract to any such person or company.
\end{quote}

A curious series of events followed. Wire rope manufactured by John A. Roebling's Sons had created the suspension bridge market in the United States. Its products carried virtually all the major suspension bridges in the United States at the time, including the Allegheny Bridge in Pittsburgh, the suspension bridge at Niagara Falls, and the Cincinnati Bridge over the Ohio to name a few. Roebling did not object to competition for the wire supply contract on the basis of price, quality, or both, but he could not understand why the nation's largest, proven, financially-sound supplier of wire should be precluded from submitting a price.\textsuperscript{314} Roebling apparently knew that political influence was again at work in selecting a wire supplier, because he warned the Chairman of the Board of Trustees about a connection between Mr. Hewitt and a third potential bidder, "Mr. Haigh of South Brooklyn."\textsuperscript{315}

Washington Roebling offered to resign as engineer so that his company could compete, but the bridge trustees convinced him that his resignation would endanger completion of the entire project. He then resigned as President of John A. Roebling's Sons and sold his stock in the company. The company, now "independent" from Roebling, submitted a bid, along with several other wire manufacturers, including the "Mr. Haigh of South Brooklyn".

\begin{table}[h]
\centering
\begin{tabular}{|l|}
\hline
Correlative Note IV-1
\hline
The "franchise" previously awarded to the New York Bridge Company had been replaced with a publicly owned, managed, and funded agency. The conflicts of interests analysis had changed, too.
\hline
\end{tabular}
\end{table}

The Specifications required "3,400 tons or wire of superior quality steel, with a tested strength of not less than 160,000 pounds per square inch". Nine bids were opened on December 4, 1876. The table below reproduces the relevant information contained in the bids.
Table IV-1

<table>
<thead>
<tr>
<th>Rank</th>
<th>Bidder</th>
<th>Price</th>
<th>Type Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>John A. Roebling’s Sons</td>
<td>$0.0675 per pound</td>
<td>Bessemer</td>
</tr>
<tr>
<td>2</td>
<td>J. Lloyd Haigh</td>
<td>Higher</td>
<td>Crucible</td>
</tr>
<tr>
<td>3</td>
<td>John A. Roebling’s Sons</td>
<td>Higher</td>
<td>Crucible</td>
</tr>
<tr>
<td>4-8</td>
<td>Three Europeans &amp; One Other</td>
<td>Higher</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Worcester Supplier</td>
<td>$0.14 per pound</td>
<td></td>
</tr>
</tbody>
</table>

John A. Roebling’s Sons was low, and after tests conducted on samples verified that each of the three lowest bidders met the strength requirements, the Board of Trustees voted to award them the wire contract. Before the decision was published, however, newspapers reported the views of other engineers that only crucible steel would due, that the specifications were deficient in not requiring this, and that the Bessemer steel offered by John A. Roebling’s Sons would make the bridge unsafe. After a sharp battle in which Washington Roebling’s views were ignored or overruled, the Board of Trustees awarded the contract to Haigh by a one vote margin.316

During Roebling’s supervision of the spinning of the wire supplied by Haigh, Roebling discovered and proved in July 1878 that Haigh had attempted to bribe the wire inspectors, had substituted inferior steel for the crucible steel he had bid, and had arranged for rejected wire to be shipped to the construction site with inspection tags from a small quantity of good wire that was repeatedly offered for inspection.317 Roebling’s solution was to require Haigh to supply additional “good wire” for the cables, at his own expense. Later that same year, the contract to Haigh was quietly terminated by the Board, and John A. Roebling’s Sons award the balance of the contract for wire.318 Fifteen (15) months later, the Lloyd A. Haigh company was bankrupt.319 The structure was completed in the Spring of 1883, at a total final cost of over $15,000,000. This was more than twice the cost estimated in 1867, when the first charter was granted and construction completion sought before 1871.

Case Study IV-7


Quadrant II

The Sault Ste. Marie Hydroelectric Project is another example of electric power generation in Quadrant II during the period prior to 1933. For one hundred and twenty years, trappers, settlers, and shippers had attempted to
develop more efficient and effective ways to navigate through the falls at Sault Ste. Marie in order to connect Lake Superior and Lake Huron. The focus was simple — to traverse the falls. A canal had been developed by franchise with the help of a federal land grant to the State of Michigan totaling 750,000 acres in 1837, which was completed in 1855. Federal funds had been appropriated for a federal takeover and improvement of the canal in 1871. By 1884, tolls had been eliminated on the canal, and the transportation problem solved.

A more important infrastructure development occurred at Sault Ste. Marie in 1902, when Francis Clergue became interested in the falls as a source of power. After obtaining financial in New York City, Clergue arranged to buy franchise held by the Ontario Sault Ste. Marie Water, Light, and Power Company who had already commenced an effort to finance, build, and operate a power canal on the Canadian side of the river. By 1895, Clergue had assembled enough capital to buy the rights to develop a power canal on the Michigan side as well. The opportunity presented by the Falls was tremendous. Clergue clinched the financing arrangements for his power canal by matching the needs of an emerging local company for power with the low cost electricity his power plant would produce, once completed. In an unusual arrangement for the time, Clergue signed a contract with Union Carbide to supply all of the electric power the company needed to produce massive quantities of calcium carbide, which was valuable as an illuminating gas. The power purchase contract assisted in arranging construction financing for the project, which was designed and built between 1896 and 1902. The project is the largest low-head hydroelectric power plant in the United States, providing 50% of the power used in the Upper Peninsula of Michigan in 1988.

Case Study IV-8

8. New York Subway Contract No. 1 — 1904 Quadrant II

In 1888, (then) Mayor Abram S. Hewitt proposed that New York City construct a "state of the art" rapid transit railroad from, similar to the one that had opened in London in 1863, which would be government owned and financed, but privately constructed managed and operated by franchise. This so-called Hewitt plan was inconsistent with the prevailing procurement practice of awarding franchises for private companies to build, finance, and operate transportation facilities for periods of years.

Hewitt’s purpose in proposing a subway was based on a long-term economic strategy for the City of New York. Hewitt believed the subway was required to retain New York City’s position as the dominant metropolis in North America. With its surging population in lower Manhattan, and with large open areas on the Upper West Side, in Harlem, and in Washington Heights, Hewitt believed the City needed cheap, fast,
transportation between these open areas and lower Manhattan in order to protect the City's economic future. Hewitt believed that building a subway would greatly expand the city's tax base through new home and industrial construction. This, in turn, would provide tax revenues to fund improvements to wharves, docks, shipping channels, and city streets to maintain the City's supremacy over rival seaports. Hewitt believed the seaport created a "vital edge" to those engaged in commerce in New York.\(^{328}\)

After a series of false starts between 1888 and 1894, the New York Legislature produced real movement toward construction of the subway when it enacted the Rapid Transit Act of 1894, signed into law on May 22, 1894. The act provided for government investment in the proposed subway and gave control of rapid transit planning to the New York Chamber of Commerce through a Rapid Transit Commission (the "RTC"). A November, 1894 referendum by New York City voters approved of the Act of 1894 by a margin, 132,647 to 42,916.\(^{329}\) In 1895, the RTC adjusted the route of the proposed system in order to increase the chance the total costs would be less than $50,000,000 as required by the Act of 1894. Some sections were converted to an elevated line, which saved money, and other sections were made more direct to reduce overall mileage. Land speculators who had purchased land along previously planned routes for the system complained bitterly, and the RTC failed to obtain the consent of fifty percent of value of assessed land along the new route, which was one means of obtaining local approval of the route, as required in the 1894 act.\(^{330}\)

The RTC then failed to obtain approval for the new route by a second means provided in the 1894 act. Although it succeeded in obtaining the approval of a Citizen Review Panel, Justice Charles H. Van Brunt, of the New York Appellate Division, refused to confirm the plan by making his own conclusion that the system would cost more than $50,000,000. The RTC went back to the drawing boards, scaled down the system still further and repeated the Citizen Review Panel process and approval by the Court. But it was not until March, 1898, four years after the Rapid Transit Act of 1894, that the approval requirements set by the Legislature were completed. Eighteen (18) months later, a proposed contract laying out the routes, providing minimum requirements, and containing information about the conditions likely to be encountered were assembled by the RTC and issued as a request for proposals to build, equip and operate the railway for 50 years, renewable for 25 more years. The solicitation required that the successful proposer post a $7,000,000 bond with the City Controller promptly after award of the contract. Bids were returned and opened on November 13, 1899.\(^{331}\) The proposals received were not based solely upon an evaluation of the lowest construction price. One of the proposal offered a higher price, but a percentage of the profits from operating the subway over the life of the franchise, as described below. The RTC chose to avoid risk and select the lower priced bid.\(^{332}\)
August Belmont, a wealthy New Yorker, who headed his own investment house and acted as the American agent for the Rothschild houses of London and Paris, executed the formal contract with the RTC to build, equip, and operate the railway for 50 years, renewable for 25 more years. The terms of the contract required the City to pay Belmont the lump sum of $35,000,000 for construction (irrespective of the actual cost), which the RTC raised by selling bonds. The RTC also was required to pay $1,500,000 for purchasing land for subway stops and terminals. Belmont agreed to furnish, install, and maintain the subway cars, signal systems, and other equipment from his own funds. To reimburse the City for the cost of construction, when the subway opened, Belmont was obligated to pay an annual “rent” to the RTC which was equal to the interest payments the RTC was required to make on its bonds, plus an additional amount to establish a sinking fund for the RTC.

To implement his side of the franchise agreement, Belmont formed two companies, one to construct the system, and a second to operate it. McDonald was contracted as a subcontractor to construct the works for his quoted price of $35,000,000. The structure is shown below.
Construction commenced and proceeded under the overall supervision of a young engineer employed by the Rapid Transit Commission as Chief Engineer, William Barclay Parsons.\textsuperscript{35} The geology of Manhattan included two major faults across the island, large formations of Manhattan Schist of varying hardness. Tunnel construction was difficult and, frequently, dangerous.

Parsons chose electricity to power the New York subway system, based on his own report of a trip through Europe in the 1890's which introduced him to European innovations in rapid transit.\textsuperscript{35} Parsons also chose to build the IRT using a shallow cut and cover method wherever possible, which sped construction, avoided massive ledge excavation at large depths, minimized the need for air handling and exchange equipment, and provided more safety to workers through soil/rock transition zones.\textsuperscript{36}

On October 27, 1904, the subway opened for service, with trains operating at the astounding speed of forty (40) miles per hour.\textsuperscript{37} The line ran from the Brooklyn Bridge north to 145th street and Broadway in Manhattan. The effect upon New York City was dramatic. The Bronx and Northern Manhattan were quickly settled. The way in which New Yorkers traveled was fundamentally altered. The average number of rides per New Yorker reached 274 in 1904 and 343 by 1914.\textsuperscript{38} Almost immediately the IRT was forced to adapt, by extending the lengths of platforms and the number of cars per train, by modifying cars to provide three doors on each side of the train instead of two, and by improved signaling systems to reduce headway time between trains.
A subway frenzy hit New York. Forgotten were the lengthy delay in obtaining legislation, approvals, bids, financing, design and construction of the initial IRT routes. In 1905, only one year after the IRT opened, the Rapid Transit Commission proposed nineteen (19) additional lines, with 165 new route miles, and going to every borough except Staten Island. The estimated price for the new lines was $250,000,000.339

From Belmont’s point of view, a massive extension of the system one year into his 50 year franchise was not a happy prospect, reminiscent, surely of the decision of the Massachusetts Legislature in 1828 to permit a second bridge alongside the Charles River Bridge. Belmont was opposed to additional subways, particularly to far-away low-revenue places, that would either raise his operating costs or produce competition.

In a move that was widely viewed in New York as “preventing competition”, Belmont moved to protect his fifty-year revenue stream, by purchasing the Manhattan Railway in 1902 and merging its elevated routes into the IRT. In December, 1905, Belmont purchased the Metropolitan Street Railway, creating a new holding company for his new acquisition and the IRT.340 Belmont had won his first battle with the RTC, but lost the war. In 1907, the Page-Merrit bill was passed by the New York Legislature, creating a public utility service commission for New York City, with the power to set rates, order schedule changes, and conduct investigations. The relationship between Belmont, as franchisee, and the Rapid Transit Commission was over, and a new, expressly adversarial system was installed in its place.341

| Correlative Note IV-2 |

The RTC’s decision to introduce “competition” for Belmont’s IRT one year after it awarded a 50 year franchise through competitive proposals was misplaced. Introducing “competition” against its own franchisees is entirely at odds with a franchise strategy. Creating a public utility commission to regulate fares, as was done in New York City did in 1907, destroyed any opportunity to implement a franchise procurement strategy in Quadrant II.

Case Study IV-9

9. Keokuk Power Plant and Dam – 1914 Quadrant II

The wing dam, power plant, lock, and dry-dock constructed at the base of the Des Moines Rapids, at Keokuk, Iowa represents a classic example of infrastructure development in Quadrant II.342 There are numerous similarities between procurement methods used at Keokuk and those used today in Hong Kong, which are highlighted in this case study.343
The history of the Keokuk project is tied to the Des Moines Rapids, located on the Mississippi just above the point where the Des Moines River joins the Mississippi at the Iowa-Missouri border. An Army engineer's survey of the rapids in 1836, conducted by then Lt. Robert E. Lee, reported the vast amount of water power available from the rapids to the War Department. The rapids represented the steepest drop in river elevation along the Mississippi, twenty-three (23) feet in twelve miles, which had carved a narrow channel, with unusually high walls, through hard blue limestone, an ideal base for a dam. Glaciers had blocked the original course of the Mississippi further to the west, creating a new cut which became the Des Moines Rapids. Similar to the Falls at Sault Ste. Marie, the first problem associated with the Des Moines Rapids was how to navigate around or over them. Rivers and harbors bills passed by Congress throughout the 1800's consistently appropriated funds to improve the rapids through construction of a canal and lock system. Congress also made several specific appropriations to maintain and expand these works, with which river transportation could not reach into Iowa, Wisconsin, and Minnesota. In 1856, over the President's veto, $200,000 was specifically appropriated to improve the Des Moines Rapids, under the superintendence of the Secretary of War. In 1871, $341,000 was appropriated to expand the locks and canal at the rapids. In the Rivers and Harbor Improvement Act of 1874, over $5,000,000 was appropriated for miscellaneous river projects, $400,000 of which was earmarked for the Des Moines Rapids improvements. Congress had provided a means for ships to circumvent the rapids, but no effort had yet been made to harness the enormous water power that was available.

The development of commercial electrical energy by Thomas Edison created an entirely new technology to develop the Des Moines Rapids. In 1878, the Edison Electric Light Company was formed, opening its Pearl Street power plant in New York City. Edison quickly began to commercialize his invention by franchising a number of plants across the nation for the installation and use of his innovative K-type dynamo, which could power machinery, paper mills, streetcars, and lighting systems. In September, 1882, the first hydroelectric plant in the United States was opened in Appleton, Wisconsin, an industrial town thirty (30) miles west of Green Bay, Wisconsin. By 1892, the General Electric Company had been formed from the merger of Edison General Electric Company with its biggest rival, the Thomson-Houston Electric Company. The nation's interest in creating electrical energy from water power was building quickly, electrical energy had been successfully transmitted over long distances, and plans for power development at Keokuk soon evolved.

In 1894, Congress granted a franchise to the Des Moines Rapids Power Company, an Illinois corporation, its successors and assigns, to erect, construct, operate, and maintain a canal along the east bank of the Mississippi River, in Hancock County, Illinois, and a power station and wing dam
projecting up to five hundred (500) feet into the Mississippi River from the Illinois side.\textsuperscript{353} The company was also authorized to make other improvements it deemed appropriate for the development of water power at the site and for the generation, use, and transmission of electric energy. The federal charter required the company not to interfere with the water channel over the Des Moines Rapids, and further required that prior to constructing any of the works, plans must be submitted to the Secretary of War for his review and approval. The company was unsuccessful in its efforts to construct these facilities and the federal franchise lapsed.

In July, 1899, a group of businessmen from the Hamilton, Illinois and Keokuk, Iowa area formed the Mississippi River Power Company for the purpose of building and operating a power plant at Keokuk for the production of cheap electrical energy on both sides of the river. The group obtained a franchise from Congress in 1901 to construct and operate a wing dam and canal at Keokuk for the purpose of generating electrical energy from water power.\textsuperscript{354} The wing dam approach proved to be too expensive for the amount of power generated. By 1905, a different approach was settled upon, to dam the entire river, and to construct a canal/lock system to replace that previously developed by the federal government. This proposal was presented to the Congress in 1905, and a new franchise approved.\textsuperscript{355}

The Company hired Hugh L. Cooper as chief engineer for the project, and design commenced in 1905. In order to obtain approval for the project by the Secretary of War, the Company designed a new lock to replace the existing federally owned lock, which reduced transit time by over two hours. In addition, a dry dock was designed at the request of the government. Both the lock and the dry dock, along with perpetual electric power to operate them, were agreed to be constructed and given to the federal government free of charge.

Financing was difficult during the recessions of 1907 and 1908, but Cooper was able to arrange a contract between the Company and the United Railways Company, Laclede Gas Company, and Union Electric for the sale of electric power to the St. Louis area. Thirty-percent (30\%) of the power to be generated by the dam was sold, in advance of construction, to supply the St. Louis area with electric. After several other power contracts were made, contingent on the completion of the project, Stone and Webster Engineering Corporation of Boston invested in the company as a shareholder and was engaged to supervise the overall construction effort. Edwin S. Webster of Stone and Webster was made President of The Mississippi River Power Company, as the entity was called. Site work began in January, 1910 and the project was entirely complete in June, 1913. Current was first delivered to the St. Louis area through transmission lines on the night of June 30 - July 1, 1913. Together with the governors of Iowa, Illinois, and the Lt. Governor of Missouri, 50,000 people attended the official opening of the works in August,
1913. When opened, the Keokuk Dam was the largest hydroelectric dam in the world, and the first dam to cross the Mississippi River.

The effect of the dam on the surrounding area was significant. Cheap, abundant energy supplied by the dam spurred industrial growth around Keokuk. The Mississippi River Power Company sold the entire plant to the Union Electric Company in the 1920’s. Union Electric still operates the plant, which continues to provide power throughout the region.
V. Infrastructure Development in Context: 1780 to 1933

Between 1780 and 1933, a profound change occurred in the nature and extent of the nation's infrastructure. During the Revolutionary War, the nation's small volume of trade was conducted between seaports on the East coast. Food crops were grown and consumed within a few miles of local farms, because there was no practical means, either roads or canals, for transporting goods at speeds and at prices that could support commercial markets. The country's tiny manufacturing base faced similar problems, making manufacturing strictly a local enterprise.\(^{356}\) The first eighty (80) years, from 1780 to 1860, represent a Herculean effort to create not only markets, but entire industries in food production, textile production, and hardware manufactures. The growth of these markets relied upon steadily improved transportation and communications systems, which in turn, increasingly permitted Americans to specialize in trades or businesses, confident that infrastructure would connect them to markets for both the sale of their goods and the purchase of the goods of others.

Between 1780 and 1860, Congress set the stage for infrastructure development in the United States with a number of programs aimed at settlement and expansion of the American economy. Beginning in 1850, the growth of railroads throughout the United States greatly increased the capacity of the nation to move goods, people, and information in support of settlement and economic expansion. Between 1860 and 1910, a massive expansion occurred in rail, river, and port facilities. Instead of just one or two routes to the West coast, or one or two routes from the Great Lakes to the South, numerous railroad trunk lines were built, with heavy subsidy in the form of federal land grants and federal right of ways over public lands. Included in these grants were the right to build stations and depots, and the right to take stone, earth, and timber from public lands in support of railroad construction. While these massive roads were being built, river and harbor improvements were funded directly by the federal government to permit larger and larger ships to travel throughout the Great Lakes system, and throughout the Ohio and Mississippi river system.

During this same period, telegraph systems, supported by government franchises, were installed to connect major population centers of the United States. Through the use of underwater cable, the United States was connected to Europe, South America, and Asia.

Beginning in the late 1800's, the attention of the federal government turned to development of arid and semi-arid lands in the West, and more
specifically to land reclamation through irrigation. Compacts among the states which allocated water flows on the Colorado, the Rio Grande, the South Platte, and the Columbia River, together with passage of the Reclamation Act of 1902, led to extensive projects to regulate flow on these rivers with dams, and to irrigate desert lands throughout much of the far West and the Southwest. Bureau of Reclamation projects dovetailed easily into a massive effort to generate ever-increasing quantities of electric power, the need for which has remained insatiable to this day.

The purpose of this Chapter is to provide a more general picture of the role Congress played in aligning its interests in settlement and economic expansion with infrastructure development.

A. The Northwest Territory Ordinance and Free Navigation -- 1787

In 1787, there was little capital available in the United States for private investment in infrastructure and little experience with managing such projects. Rather than await for capital markets and local management skills to develop, Congress embarked on a plan to induce infrastructure development, settlement, and economic growth through federally sponsored incentives. The first important statute designed to pursue this strategy was the Northwest Territory Ordinance of 1787, which established federal territorial jurisdiction over what would become the states of Ohio, Illinois, Michigan, and Indiana. The "Ordinance" adopted a number of principles which would be repeated many times over as the number of states grew from thirteen (13) in 1787 to thirty-three (33) in 1860, and forty-eight (48) by 1933. The ordinance declared that the navigable waters draining into the Mississippi and the St. Lawrence rivers [and the carrying places between them], "shall be common highways, and forever free . . . to the inhabitants[,] . . . to the citizens of the United States, and those of any other States . . . without any tax, impost, or duty therefor." The key principle was supreme federal control over all navigable waters. Navigable waters were to be open, free, common "highways" not within the taxing jurisdiction of the states which might be created in the Northwest Territory. Procurement processes were clearly locked in Quadrant I and II.

B. A Postal System Built From the Ground Up -- 1790 to 1870

In the 1790's, Congress was primarily focused upon improving post roads, piers and wharves in eastern ports, and navigational aids on the Atlantic seaboard. To induce post road construction, in 1792, the Congress established a system for delivering the mails which was almost entirely dependent on private sector activity. Exercising the power given to Congress in Article I, Section 8 of the Constitution "To establish Post Offices and post Roads", the act created the postal system. Contracts to carry the mail were required to be let, after advertisement, to private individuals for up to eight year terms. The act identified and established particular roads as federal
"post road routes", which were required to be used exclusively by the system. One of these routes established the post road from Wicasset, Maine to Savannah, Georgia. Postage fee revenues were to be split between the successful bidder along a particular route and the United States. Congress picked the initial post roads, and subsequent extensions, based upon the traveling condition of the road and the postage fees proposed to be charged along the route. The practical effect was to subsidize local development of roads, bridges, ferries, taverns, and lodging along post road routes. For areas not yet served by post roads, the system offered the prospect of such subsidies to those who could clear and establish viable new routes for the delivery of the mails. With these incentives, the postal system expanded rapidly, which led to the establishment of the "Post Office of the United States" as an executive agency in 1799.360 Throughout the period, the postal system was expanded and improved as citizens built and improved routes to be selected by Congress as new post roads.361

C. Early Federal Improvement of Navigation -- 1797 to 1870

In order to induce the construction of piers and wharves on navigable waters of the United States, Congress offered franchises to local citizens to build such facilities and collect charges for use, on a sole source basis. These procurements are Quadrant II processes.

To provide navigation aids such as lights, buoys, markers, Congress appropriated funds for design and construction, in Quadrant I. Frequently, these contracts were advertised in advance. Early in this period, Congress assumed direct responsibility and control over improving the navigable waters of the United States, beginning with seaports on the East Coast, but rapidly expanding to the navigable rivers and lakes throughout the interior of the nation. Since 1797, when the Congress first appropriated funds for construction of certain buoys in Boston harbor,362 Congress has consistently used direct procurement processes to develop infrastructure in support of navigation throughout the navigable waters of the United States. Congress' second363 and third364 acts in support of navigation added other states as recipients of federal money for improving harbors and rivers. By 1827, Congress had "refined" the political logrolling process to the point that each time Congress agreed to improve rivers and harbors, the list of funded projects usually included sites in all states.365

D. Incentives to Settle the Northwest Territory - 1796

The Ohio Land Sales Act366 of 1796 (known as the "Ohio Act") established the pattern by which the federal land which comprised the Northwest Territory would be sold and settled. With this statute, an entrepreneurial government embarked on a bold strategy aimed at inducing settlement, commercial expansion, and infrastructure development of the northwest at no "cost" to the government. The Ohio Act provided that a
Surveyor General survey the entire tract of the northwest territory, i.e. all the lands that were to become the states of Ohio, Michigan, Indiana, and Illinois. The entire tract was divided into six mile square townships, based on north and south running lines and across meridians. The government kept one half of these townships for itself, in an alternating “checkerboard” pattern, and also kept mines, salt licks, salt springs, and mill-seats, wherever located. The remaining townships were for sale under the Act. Each township was divided into thirty-six sections, each one-mile square, to be sold to the highest bidder following public advertisement in major newspapers. In each of these townships, though, the center four sections were to be held for future disposition by the federal government. No sales were to be made for less than $2 per acre, or twice the value of acreage prior to the Ohio Act. Easy payment terms,367 combined with tough forfeiture provisions368 made the Ohio Act a bold, spectacular government investment in land. In simple terms, the government was subdividing and surveying the territory, holding half the land, and selling the rest in an initial offering aimed at doubling the overall sale price of that portion of the land being sold.

Through the Ohio Act, the federal government created a market in land, and a win-win strategy for both settlers and the government. Land prices were low by eastern standards, and settlers were anxious to participate in the government’s new market. Millions of settlers who purchased these lands with their own money were taking substantial risks -- that the land could be farmed or used for manufacturing, that infrastructure would be available to transport goods to and from markets. Congress was taking an extraordinary risk as well -- that the overall value of the retained federal land would more than double as the territory was settled.

The resulting pattern is shown in the following figure, a familiar one throughout the Mid-West.
Ohio Land Sale System (1796)

E. The Admission of Ohio and the 5% Fund for Internal Improvements.

Surveying under the Ohio Land Sales Act proceeded apace. By 1802, when the State of Ohio was carved out of the Northwest Territory and admitted into the Union, Congress had developed even more specific means to induce infrastructure development. The Act admitting Ohio required an advance commitment by the new state to use 5% of the federal proceeds from land sales in the state after June 30, 1802 to lay out and public roads leading to Ohio and within Ohio from the navigable waters emptying into the Atlantic Ocean and the Ohio River. The act also granted Section 16 in each and every township to the inhabitants thereof solely for the use of schools. The pattern of checkerboard federal land sales, federal grant of Section 16 to settlers for schools, and the reservation of the centers of townships and natural resources such as mines, springs, salt licks, and mill seats was set in the act admitting Ohio to the Union.
F. The Louisiana Purchase and the Admission of Sixteen More States -- 1803 to 1860.

Between the admission of Ohio in 1802 and the secession of South Carolina in December, 1860, the entire land area which now comprises the lower 48 states was assembled and incorporated into the United States. The same policies set forth in the Ohio Acts were now applied to the remaining territory of the United States, as one by one, sixteen additional states were admitted to the union: Louisiana (1812), Indiana (1816), Mississippi (1817), Illinois (1818), Alabama (1819), Maine (1820), Missouri (1821), Arkansas (1836), Michigan (1836), Texas (1845), Florida (1845), Iowa (1846), Wisconsin (1848), California (1850), Minnesota (1858), Oregon (1859). A steady stream of additional states joined the union, each based upon federal surveys, a checkerboard sales pattern in which government and settlers were joint speculators in land, each relying on the other.

The Oregon, Utah, and Washington Territories were also established during the period from 1780 to 1860, continuing the pattern of federal survey, land sale, land grants, and internal improvements originally established in the Ohio Land Sales Act of 1796. These policies promoted infrastructure development through valuable incentives for settlers to settle and for new states to build infrastructure connecting these settlements to navigable rivers and lakes.

G. The Federal Government’s Relatively Small “Cash” Contribution to Infrastructure Development -- 1780 to 1860

Between 1780 and 1860, the federal government played a largely symbolic role in infrastructure development, at least as far as “cash” was concerned. There were no “grant in aid” programs for highways, ports, rivers, or bridges. A number of federal buildings had been constructed in and around the District of Columbia, and a number of customs houses had been built at major ports. Most of these buildings were procured in Quadrant I, usually on a design/build basis. Most other federal building were leased, not owned. The federal government’s total cash contribution to infrastructure development has been estimated by Goodrich at $7,000,000 during the period from 1800 to 1860, spent primarily on the National Road and on the federal government’s stock subscriptions in the Chesapeake and Ohio Canal, the Dismal Swamp Canal, and the Louisville/Portland Canal. Goodrich also estimates that approximately $425,000,000 was spent by state, local, and the federal governments on infrastructure during the same period, $70,000,000 in New York and $50,000,000 in Virginia alone. In context, the federal government’s cash contribution was insignificant.

Slicing the pie a different way, Goodrich also estimates that this $425,000,000 represents approximately 70% of the cash funds contribution by both the public and private sectors to infrastructure during the period from
Less than one third of the capital raised prior to the Civil War for infrastructure came from private investors.

The federal government contributed some cash for infrastructure through receipts from the 2% fund established in the Ohio Land Sales Act. However, the real federal contribution to infrastructure early in the nineteenth century was from gifts of alternating sections of surveyed public lands to the states, to veterans of the Revolutionary War, the War of 1812, and to union soldiers from the Civil War.

H. The Race Over the Appalachians -- 1815 to 1861

Gallatin’s dream of large, nationally funded improvements to infrastructure was carried out by states and local governments, often in cooperation with companies established for particular infrastructure purposes. The federal government took on the indirect role or surveying public lands, surveying potential routes for canals, roads, and railroads, laying out territorial and military roads, granting federal franchises, and providing other indirect incentives for others to develop infrastructure. This indirect role was one with which the federal government became comfortable through the 1800’s.

The states took on the task of overcoming the Appalachians. New York successfully developed the route of the Erie Canal. Pennsylvania developed the connection between the Susquehanna and Allegheny Rivers with railroad connections from Philadelphia to the Susquehanna and the Portage Road from the upper reaches of the Susquehanna to Johnstown, and then to the Allegheny and Pittsburgh, although as described above the route was never a success. Maryland completed the Potomac River connection to Cumberland, Maryland, with help from the Federal government and early help from Virginia. Virginia subscribed to stock of improvement companies seeking to connect the James River with the Kanawha on the other side of the Alleghenies, successfully tying Virginia’s farms to Williamsburg and Norfolk, but never succeeding to get over the mountains. Georgia achieved results similar to Virginia in its effort to connect either the Savannah or Santee river to the Tennessee River.

Goodrich describes these efforts to overcome the Appalachians as a competition among eastern seaboard states and capital cities for the commercial advantage which would come from the first, most practical, and cheapest connection with the Ohio River valley and the Great Lakes.

Correlative Note V-1

Infrastructure as a Tool, not an Economic Strategy. The “competition” over the Alleghenies is a wonderful example of how infrastructure was viewed as a tool to achieve strategic economic ends, rather than an end in and
of itself. The competition for commerce with the Ohio Valley did not end with the construction of the Erie canal. Pennsylvania was not deterred by the economic failure of the Pennsylvania Mainline Canal system, turning to the Pennsylvania Railroad to get back in the contest with New York, and revoking all rights of way for the Baltimore and Ohio Railroad to traverse Pennsylvania on its way to the Ohio River. New York's mis-step with the wide gauge Erie Railroad caused all shipments from Chicago to break cargo at the Erie railhead, giving an advantage to the Pennsylvania. Steady federal efforts to improve navigation on the Ohio and Mississippi Rivers and to connect Chicago to the Mississippi River by canal created new competitors for New York City, Philadelphia, and Baltimore -- i.e. New Orleans, St. Louis, Cincinnati, Louisville, and Chicago. The Garfield Act, which requires competing railroads to make connections with one another, changed the competition once again. The industrialization of parts of the Ohio River Valley changed it yet again, as the trade needs of the Ohio valley evolved. The development of the airplane, the phone, the fax, and the computer has changed the competition once again, eliminating, in most commercial settings, the Allegheny Mountains as a barrier.

The Allegheny competition illustrates how fleeting infrastructure facilities and policies really are in the economic growth of the United States. By definition, infrastructure development and renewal is a tool to implement strategic economic planning, not an end.

Is economic development more dynamic than the ability of our infrastructure procurement processes to respond? Are there economic strategies for New England, for Massachusetts, for metropolitan Boston, which do not involve "protection" of existing infrastructure facilities and services, but rather the elimination of barriers to the movement of people, goods, and information in the 21st century?

I. Efforts To Ride on New York's Coattails -- The Boston to Hudson Canal -- 2/25/1825

In February, 1825, the Massachusetts Legislature, greatly concerned over the completion of the Erie Canal, the Farmington (Conn.) canal, and the Blackstone Canal, created a commission to determine the feasibility of constructing a canal, first, from Boston to the Connecticut River, and then to a point on the Hudson River near the junction of the Erie Canal. The study was part of an effort by Boston merchants to stop the flow of Western Massachusetts goods down the Connecticut River or the Farmington Canal to Hartford, and to stop the flow of Central Massachusetts goods down the Blackstone River/Canal from Worcester to Providence. Goods from Hartford and Providence were typically transshipped through New York City, and Boston merchants were increasingly concerned that New York's port would grow larger and become more important than the port of Boston. The
Commission was headed by Loammi Baldwin, the engineer who supervised the completion of the Middlesex canal. Baldwin’s 1826 report estimated the expense of building a canal from Boston to the Connecticut River at $3,000,000 and estimated the cost of extending the canal to the Hudson from the Connecticut at $3,023,172.

The estimated cost of the Boston to Albany Canal was high, and the technical difficulties of crossing the Berkshires with a canal of equal concern. The Massachusetts legislature moved slowly on the Commission’s proposals. By 1829, news of successful experiments in England with railroads created even more momentum to connect Boston to Albany, not by canal, but by rail. In February, 1829, citizens in Boston passed a resolution by a vote of 3000 to 60 favoring legislation authorizing the construction of a railroad to the western line of the State, with the State subscribing one-third (1/3) of the stock. A charter was granted to the Western Railroad Company, but nothing was done with it until the Boston and Worcester Railroad opened on July 6, 1835. At this point, Worcester was no longer interested in extending the road to Albany, preferring to be the terminus of a road connecting to Boston, rather than a stop on the way to New York. Continued state subsidies to the Western Railroad Company resulted in twenty (20) years of bitter fighting over two independent segments of railroad, which should have been a single road between Boston and Albany. The connection was eventually made, but not before other ports had erased Boston’s potential advantage. The result is summarized by MacGill, this way:

Boston, deprived so long of a united and continuous line connecting her with the West, was not able to compete successfully with New York, Philadelphia, and Baltimore, which were much sooner [supported] by the Erie, the Pennsylvania canal and railroad system, and the Baltimore and Ohio Railroad, respectively.

Boston (and the whole of Massachusetts) missed its chance to take advantage of the completion of the Erie canal to use the railroad to more favorably compete with New York City, Philadelphia, and Baltimore as a port.

J. The Steamboat and Indirect Federal Support for Technology -- 1813 to 1933

On August 11, 1807, Fulton’s steamboat The Clermont made its maiden trip to Albany from New York in thirty-two (32) hours, averaging about 5 miles per hour. Fulton’s trip was the beginning of the age of steam in American infrastructure development, which powered boats and railroads for almost the next century. In 1810, Fulton and his partner Livingston authorized Nicholas J. Roosevelt to descend the Ohio and Mississippi Rivers from Pittsburgh to New Orleans in order to determine whether steamboat
travel might be possible between these two cities. Roosevelt conducted his
survey down the rivers and arranged to stockpile coal along the river banks
for his second trip down the Ohio and Mississippi, this time with a steamboat.
Fulton and Livingston authorized Roosevelt to build a new boat at
Pittsburgh, which cost $38,000. He steamed down the Ohio to Louisville,
where he had to wait one month for the river to rise sufficiently to traverse
the Ohio falls. While waiting at Louisville, he took a number of citizens on a
trip up the river to Cincinnati and back to demonstrate that the steamship
could travel both up and down the Ohio. Roosevelt reached New Orleans in
1811. By 1817, Fulton had so improved his engine and ships that the
Washington, one of Fulton’s ships made the round trip between Louisville
and New Orleans in 41 days.

Fulton’s initial commercial success with the steam engine and the
steamboat was in part assured through “exclusive franchises” issued by
several state governments. New York, for example had granted to Fulton the
exclusive privilege of navigating all New York waters with boats moved by
fire or steam. Louisiana had granted a similar franchise for steamboat traffic
on the Mississippi River. Unlike the franchise for a bridge, a turnpike, or a
particular ferry route, both the New York and Louisiana franchises to Fulton
purported to exclude all others from operating steamboats in New York
waters or in Louisiana.

The reaction of states and territories that were upstream of Louisiana
was immediate and intensely adverse. The monopoly granted by Louisiana
had effectively monopolized all steamboat traffic on the Mississippi and Ohio
Rivers between Louisville and New Orleans. Attention turned to pending
litigation over who was entitled to the benefits of being the inventor of the
steamboat. Ohio and several other states passed retaliatory legislation to that
of New York, forbidding any ship using Fulton’s invention from landing on
the Ohio shores of Lake Erie.

Meanwhile, in New York, Fulton’s heirs had assigned his New York
franchise rights to a man named Ogden, who attempted to enforce this
privilege against a man from New Jersey named Gibbons. Gibbons owned
two steamboats with coasting licenses from the federal government. Ogden
obtained a court injunction in New York preventing Gibbons from operating
his ferry routes to New York City.401 The injunction was finally determined to
be invalid in 1824 by the Supreme Court of the United States in Gibbons v.
Ogden. The Court held that the New York franchise must give way to the
federal coasting license given to Gibbons, and that Congress’ power to regulate
commerce among the several states superseded individual states rights to
grant exclusive franchises to steamboat operators on navigable rivers and
harbors. Fulton’s monopoly was over and the steamboat industry developed
rapidly.
Throughout the period, the federal government provided indirect support for the commercial use of new technology. In 1813, Congress provided a substantial indirect boost to the steamboat industry by specifically authorizing the postal service to contract for steamboats to carry the mail.\textsuperscript{402} Not long after the first transatlantic crossing of a steamship from Charleston, South Carolina to Europe, Congress appropriated postal service funds to carry the mails of the United States by Ocean Steamers.\textsuperscript{403} In similar fashion, Congress indirectly supported the development of railroad technology by authorizing, and on certain routes, requiring, the mails to be carried by railroad.\textsuperscript{404} On May 26, 1819, the first transatlantic steamer left Savannah, Georgia, bound for Liverpool, and arrived 25 days later. A more reliable connection had been made between British markets and those of the East Coast, subsidized in part by the U.S. Postal Service.

This pattern was repeated in 1864, when, at Congress' request,\textsuperscript{405} the Post Office advertised for proposals to carry the mails between the United States and Brazil, making a minimum of 12 round trips per year between a U.S. port north of the Potomac River and Rio de Janeiro. Congress authorized the Postmaster to match payments with Brazil for the service up to a total U.S. payment of $150,000 per year. Proposers would required to provide "first class American sea-going steamships" weighing at least 2000 tons. The statute required that the awardee be of undoubted responsibility, possessing ample ability to furnish the steamships required, and offering good and faithful sureties for faithful performance of such contract. Once so qualified, award was required to be made to the lowest responsible bidder for term of ten years.

In 1865, a similar contract was let for twelve (12) round trips between San Francisco and the Chinese Empire,\textsuperscript{406} again providing a healthy subsidy of up to $500,000 for American merchants carrying the mails.

This trend continued right through 1933, with indirect federal support for transcontinental cable service in the 1860's, inter-continental cable connections throughout the rest of the century, and beginning in the 1920, leasing of public lands for airfield construction. For example, in 1867, Congress granted a non-exclusive franchise to the American Atlantic Cable Telegraph Company of New York for 20 years to run a cable along the Atlantic coast of the US and to cross the Atlantic via Bermuda and the Azores.\textsuperscript{407}

**K. Build-Operate-Transfer: Federal Turnpike Franchises -- 1813 to 1830**

Congress has had a great deal of experience with build operate transfer mechanisms to produce infrastructure facilities. Franchises for turnpike construction was not a new idea,\textsuperscript{408} but Congress adapted existing models in Virginia, Pennsylvania, Massachusetts, and other states to suit its need in and around the District of Columbia.\textsuperscript{409} Over the span of a decade, a flurry of
federal turnpike building occurred in the District.\textsuperscript{410} Just one of these is described here.

In 1813, Congress followed the practice of a number of states\textsuperscript{411} by issuing a federal franchise for turnpike construction in the District of Columbia.\textsuperscript{412} The franchise granted to the Georgetown and Leesburg Turnpike is just one instance where the federal government arranged to meet particular infrastructure needs by inducing private individuals to take risk in the hope of making a reasonable profit. Congress authorized a number of citizens to form the "Georgetown and Leesburg Turnpike Company" and to receive subscriptions for capital stock, in shares of $50 each, not to exceed $10,000. The charter provided that the Company was to open, gravel, and improve a road from Falls Street and Water Street in Georgetown to the boundary line of the District of Columbia, in the most direct route possible. Stock was to be publicly sold. The company was authorized to select its route and to acquire needed land by private right of eminent domain.\textsuperscript{413} If a purchase price for land along the right of way could not be agreed upon between the owner and the Company, a sales price was to be determined by three independent citizens appointed by the local Court. The statute also contained an outline specification for the road, and established the tolls which could be charged by the company.\textsuperscript{414} The statute required that the project be completed before the collection of any tolls, and that the turnpike would become toll-free once the company's capital investment plus 12% interest per annum was returned to the Company. Shares in the company were transferable and issued upon receipt of a cash deposit of $10.

L. Federal Repudiation of a Direct Cash Role for Infrastructure – 1830

The Jacksonian Democrats, including Jackson himself, did not believe there was any role for the federal government to apply federal money in support of national improvements. As Congress turned its last bit of attention away from direct funding of large scale improvements, states and local governments provided the major funding sources for regional transportation improvements. Massachusetts provides a good example, supporting the private development of the Middlesex Canal, the Blackstone Canal from Worcester to Providence, and early radial railroads from Boston to the north, west, and south with direct state financial assistance. In Ohio, an elaborate dual system of canals in eastern and western parts of the state were built to extend and complement Ohio's connection with the Erie canal. Ohio contributed capital and some of its 2% funds to this effort, which was also supported by extensive federal land grants along the route of the canals. A similar effort by Indiana was not so successful. Illinois attempted to connect the city of Chicago to the Illinois River through construction of the Illinois and Michigan canal. Federal support for this project was first given in 1827, through a grant of alternating sections of land along the route of the canal to

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the state which were to be sold to finance construction. Construction was intermittent, state funding irregular, and progress sporadic on the project until it was completed 1848.

Beginning in 1830, federal support for infrastructure followed a few patterns. Infrastructure was promoted indirectly through incentives such as franchises, land grants, rights of way, and other means to induce states, local governments, and private companies to share in the cost of infrastructure expansion. Congress promoted infrastructure directly through specific legislation primarily aimed at improving the navigable waters of the United States, a role which was both not controversial and extremely productive. Beginning in 1830, the federal government was to focus first, on opening navigable rivers throughout the United States, including the Great Lakes and the Mississippi Valley, to unobstructed navigation, second, on flood control, and third, on irrigation and power generation. This was a role created by a unique aversion to the federal government duplicating the role of states in providing transportation and a unusual consensus that navigable waters were best improved by the federal government.

M. State Franchises in Question: The Charles River Bridge Case -- 2/12/1837

In 1837, the Supreme Court of the United States decided Charles River Bridge v. Warren Bridge, a suit commenced in 1828 between two private corporations, each of which had received franchises to build bridges across the Charles River. The decision is of continuing importance, because its concerns the reliability of rights conferred by legislative franchise. In the Charles River Bridge case, the rights conferred on the first franchisee were construed more narrowly than private investors in infrastructure franchises had expected. The state’s grant of a second franchise to the Warren Bridge Company, was approved, even though it had the effect, at the end of the short franchise to the Warren Bridge, of destroying the toll income received by the first franchisee. A strong undercurrent in the decision implies that corporations holding franchises to perform public services must have, as their main object, the interest of the public, and not the interest of the corporation and its shareholders.

The dispute had its origins in 1640, when the General Court of Massachusetts gave Harvard College the right to operate a ferry across the Charles River between Boston and Charlestown. Harvard operated the ferry continuously through the Revolutionary War, often through subcontract. In 1785, the Legislature chartered the “Proprietors of the Charles River Bridge” to replace the ferry with a bridge and to pay Harvard two hundred (200) pounds annually for the next forty (40) years, when final compensation would be made to Harvard. John Hancock and numerous other leading citizens of Boston were investors and directors of the new bridge company.
The Charles River Bridge opened on July 17, 1786, and began to collect tolls and pay Harvard College.

Within a few years, a second bridge was needed connecting West Boston to Cambridge. A franchise to construct and operate this second bridge was given by the General Court to a group led by Francis Dana on the condition that this second Company pay an annuity to Harvard as compensation and the Charles River Bridge extend its annual payment from 40 years to 70 years. The West Boston Bridge opened on November 23, 1793, and began to collect tolls. Harvard College was now receiving annual payments of over four hundred pounds, based on the original ferry charter issued in 1640. Between 1786 and 1805 the value of the 150 shares of stock in the Charles River Bridge Company had risen from $333 dollars to $1,650. Between 1786 and 1827, the Charles River Bridge collected $824,798 in tolls.

In 1828, Jackson was elected President of the United States. In Boston and Cambridge, political pressure for a “free” bridge grew so strong that the Legislature chartered a third private company, the “Proprietors of the Warren Bridge” to build a third river crossing in the same general area as the Charles River Bridge. The franchise authorized the Warren Bridge to collect tolls until the cost of construction plus five percent (5%) had been recovered, after which no tolls would be collected. The charter also required that could not be collected for more than six (6) years. The Warren Bridge company was to pay one-half of the annuity then being paid to Harvard by the Charles River Bridge Company until the Warren Bridge became toll-free.

**Correlative Note V-1**

Note that the public clamor for a free bridge did not extend to the appropriation of state tax moneys to build one. The procurement mechanism used to build the Warren Bridge was in Quadrant II, a System/Indirect approach. Not until the private company who designed, built, financed, operated and maintained the bridge was reimbursed with a 5% profit, was the bridge to be “toll-free”.

Even before construction began on the Warren Bridge, the Charles River Bridge sued, unsuccessfully seeking an injunction to prevent it from being built. Harvard’s position was essentially this: by franchising a third crossing, the Commonwealth had breached the obligations in the original charter to Harvard promising that the ferry franchise would be “exclusive”. The Charles River Bridge would be valueless as soon as the Warren Bridge became “toll-free”, and the courts ought to protect Harvard’s annual income of $1,333 per year and the value of the Charles River Bridge stock, then worth approximately $300,000. Then, as now, litigation proved not to provide a ready solution to either company or to the state. The case was argued in 1831 before the Supreme Court, but not decided until 1837, after several of the
 justices had died and been replaced by President Jackson. The case was reargued before the new Court. In the meantime, the Warren Bridge opened on December 25, 1828. Toll paying commuter traffic between Cambridge and Boston was so high that the bridge paid for itself plus the 5% profit within two years. The litigation pending in the Supreme Court now posed a problem for everyone. The state refused to take the tolls of what should have been a “toll-free” Warren Bridge because of the possibility of a judgment against the state in favor of Harvard and the Charles River Bridge. Each year until 1836, the state extended the tolls on the Warren Bridge, while requiring the proprietors to conserve toll receipts and to only spend money on maintenance and repairs. The Charles River Bridge simply closed, awaiting the outcome in the courts.

In 1837, the Supreme Court held that since the original charter to Harvard College did not surrender the Commonwealth’s right to promote other forms of cheap transportation within the state, that right could not be surrendered by implication. Massachusetts was free to authorize another river crossing without violating the terms of the Harvard ferry charter and the Charles River Bridge charter. The Court concluded that every franchise was presumed not to be “exclusive” unless the Legislature specifically and unambiguously said otherwise.419

The decision sent shock waves through the investment community. How valuable were state, local, or federal franchises if these same governments were permitted to authorize competing franchises for roads, bridges, or ferries right next door?

N. State Repudiation of Financial Aid to Improvement Companies – 1840 to 1860

The economic recession from 1837 to 1839420 affected the progress of numerous state sponsored infrastructure improvements, including the Chesapeake and Ohio Canal and the Baltimore and Ohio Railroad. The scenario of work stoppages, unpaid bills, failed contractors, escalating costs, and substantial delays in completion was repeated on numerous projects in which states governments had financial interests, often through stock subscription. The response from state legislatures and constitutional conventions in many of the states was predictable: most state constitutions were amended, and in the case of new states, drafted, to preclude direct state aid to companies or individuals engaged in infrastructure improvements. Maryland’s constitution was amended in 1842, Iowa in 1846, Illinois in 1847, Wisconsin in 1848, Michigan in 1850, Minnesota and Pennsylvania in 1857.421 Notable exceptions were Virginia, which increased its stock investment in improvement companies to 60% during the 1840’s,422 Massachusetts, and the southern states.
The federal government continued to directly support improved navigation on navigable waters, including the tributaries to the Mississippi and Ohio rivers.

Investment by local governments in railroads continued to expand as communities sought, through stock subscriptions to influence the location of railroad lines. Pennsylvania provides an early example of community contributions to purchase railroad stock for just such a purpose.\textsuperscript{423} Goodrich provides a stark example of the pressure on emerging towns to be served by rail.\textsuperscript{424}

\emph{Resolved:} That Johnson County donate half a million dollars rather than this Rail Road should be made twenty miles east or west of us.
\textit{A public meeting in North Liberty, Iowa, 1865.}

O. Drainage of Swamp Lands along the Mississippi and Levee Construction – 1850 to 1900

Numerous acts of Congress between 1780 and 1933 were aimed at improving navigation throughout the Mississippi, Ohio, and Missouri River valleys. Direct federal appropriations were made for navigation aids and for particular improvements along these routes, but swamp and overflowed lands along the Mississippi posed real problems to reliable water levels and boat traffic. In 1849, Congress arranged yet another indirect means to get local assistance to improve navigation. Congress passed an "Act Granting Drainage Lands to the State of Louisiana", which provided as follows:\textsuperscript{425}

"To aid [Louisiana] in constructing the necessary levees and drains to reclaim the swamp and overflowed lands therein, the whole of those swamp and overflowed lands, which may be or are found unfit for cultivation, shall be, and the same are hereby, granted to [Louisiana]."

The act provided that a survey of all swamp lands would be done under the direction of the Secretary of the Treasury, but at the expense of Louisiana. All moneys received by the state from the sale of land identified as "swamp" under the act were to be applied exclusively to the construction of levees and drains to keep such lands dry. Congress, in effect, made an appropriation of "swamp" land to the state of Louisiana in exchange for the promise from the state, that as swamps were drained by levees built along the Mississippi, moneys from Louisiana's sale of reclaimed land would be used reimburse the state. To the extent reclaimed land sold for more than the cost of draining it, Louisiana was entitled to keep the profits.

In 1850, Congress extended the provisions of the 1849 act to all the states.\textsuperscript{426} The 1850 act granted all federal "swamp" land to the States, provided
that the proceeds of state sales of reclaimed land were applied to drainage and levee construction. Swamp lands were defined as those subdivisions of surveyed federal land in which more than 50% of the area was “wet and unfit for cultivation”. Congress had numerous objectives in passing the drainage acts, including improved navigation, the construction of river channels along the Mississippi, increased settlement of river lands, and appreciation in value of remaining federal lands. These objectives were achieved with private funds provided by purchasers of the reclaimed land and by federal grants of swamp land that was then of little or no value.

P. Subsidy On A Grand Scale: 1850 to 1875

Mid-century marked a major change in the level of indirect support provided by the federal government for infrastructure development. Direct federal cash outlays had proven problematical and extremely controversial with respect to the National Road, federal stock subscriptions to particular canals, and federal refusal to participate in other projects, like the Erie Canal. Direct state support for individuals and private companies, frequently in the form of stock subscriptions, was also under attack in most states.

The federal government had been successful in encouraging settlement of the Northwest Territory using the formula in the Ohio Land Sales Act of 1796 of granting alternating section of lands to states for state sale. Not only had the method produced revenues for the territories and states, it had more than doubled the value of the federal land retained, and produced further cash subsidies to the states through the 5% funds in each state.

1. Special Incentives for Railroad Construction

The advent of the railroad as a viable means of commercial transportation quickly caught the attention of Congress. To promote the extension of railroads throughout the states of the Ohio and Mississippi River valleys, Congress embarked on a larger program of land grants aimed at producing bigger, more effective infrastructure. Illinois was the beneficiary of the first of the new, mega-grants.

In 1850, an elaborate coalition of Southern, Western, and Mid-Western senators and representatives was assembled by Sen. Stephen Douglas of Illinois. Over the objection of representatives and senators from the Northeast, Douglas’ coalition passed an act which granted land in aid of a railroad from Chicago and Dunleith, in Illinois, south through the center of Illinois to Cairo, at the mouth of the Ohio River, and then south through Mississippi and Alabama to Mobile. Under the provisions of the act, a checkerboard pattern of alternate sections of federal land six miles on each side of the proposed right of way was granted by Congress to the states of Illinois, Mississippi, and Alabama to construct the road from Chicago to Mobile. Land was granted to the states on the condition that the road should
be completed within ten (10) years and that if the road was not completed, (a) all unsold lands would revert to the federal government, and (b) the states would pay the preemption price of $2.50 per acre for all lands already sold by the states. The act also doubled the minimum sales price for retained federal lands along the right of way. Once again, Congress was engaged in “checkerboard” grants of relatively useless land in the expectation that the land retained would more than double in value as a result of the railroad project. Approximately three and one half million (3,500,000) acres of land were included in the grant.

The federal land grant to the state of Illinois for the Illinois Central Railroad was the beginning of a flurry of railroad building based on similar grants. Members of Congress were disposed to repeat for one another the benefits conferred upon Illinois, Mississippi, and Alabama in the 1850 act. Twelve (12) similar land grants comprising over 24,000,000 acres of federal land were made to other Western and Southern states in the next seven years in support of railroad construction.430

Where Congress did not wish to give away land to the states, its frequently granted rights of way over federal public lands, together with the right to erect stations and depots and the rights to earth, stone, and timber from land along the right of way. The frenzy to support the quick expansion of railroad service throughout the Mississippi Valley culminated in omnibus legislation by Congress granting general rights of way for railroads, roads, plank roads, and macadamized turnpikes over public land anywhere in the United States consistent with the general rights described above.431

2. Grant Subsidy for Projects Other Than Railroads

The new form of grand federal subsidy was not only available for railroad construction. In 1852, the State of Michigan was given a 750,000 acre grant of alternating sections of federal lands in aid of the construction of a canal around the Falls at St. Mary’s (Sault Ste. Marie). The canal was commenced in 1852, completed in 1855, and connected the vast mineral wealth surrounding Lake Superior to the rest of the Great Lakes.

In 1868, Minnesota was given an alternating checkerboard grant of 200,000 acres in aid of the construction of a lock and dam at Meeker’s island in the Mississippi River, which would facilitate navigation of the river between mouth of the Minnesota River and the falls of St. Anthony. This grant was to be administered by the Secretary of Interior.432

In 1862, in order to induce the states to conduct research on agricultural improvements and to better educate students in the agricultural and mechanical arts, Congress granted 30,000 acres of federal land for each senator and representative serving in Congress to each loyal state.433 The condition of the grants were that schools had to be established which emphasized

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agriculture, engineering, and the mechanical arts. Many of the "land grant" colleges and universities still exist today, including Texas A&M, Oklahoma State, Cornell, University of Maine, and many others.

Another grant, in alternating sections of 200,000 acres of land, was made to Michigan in 1865 to aid in the construction of a breakwater, harbor, and ship-canal through the neck of land on Lake Superior known as "The Portage" on a one thousand feet wide strip on the bank of Lake Superior. The statute required the resulting shipping canal to be at least one hundred feet wide with a water depth of at least 13 feet, and also required completion within two years or the grant would be void. The act also required the state to reduce tolls to a break-even level once the state is reimbursed for all funds advanced for construction, repairs, operations and legal interest, tolls reduced to break-even point.

Q. A Decade of Railroad Subsidy – 1860 to 1872

The pace of land grants for Mississippi Valley railroads increased during the 1850’s, and continued right through into the 1860’s. Wisconsin was given grants of land to assist developing a railroad from Appleton to Green Bay. Minnesota was given another land grant in 1864 to assist in the construction of a RR from St. Paul to the head of Lake Superior. A second grant was made to Wisconsin in 1866 in support of a railroad from Fond du Lac to Lake Superior, identical to the Minnesota Act. Iowa received a similar grant to assist with a line from Sioux City, Iowa to the southern border of Minnesota. Minnesota received a second grant of lands to assist in railroad construction generally throughout the state in 1866, with the same general requirements. Kansas, too, received two of these same type grants in 1866, one for the use and benefit of the St. Joseph and Denver Railroad and Telegraph Company, and the second to aid the construction of the Kansas and Neosho Valley Railroad Company. Also in 1866, Congress made a grant directly the California and Oregon Railroad Company to aid in the construction of a railroad and telegraph connecting the Central Pacific Railroad with the City of Portland, Oregon.

Attention turned, however, to a larger and more speculative project: a transcontinental road of rail and telegraph. During the 1850’s, several procurement options were explored, including direct federal funding (Quadrant I), military construction using Army troops and engineers, and a variety of private company options with different levels of land grants as incentives and direct cash support. In 1853, Congress allocated funds to the US Corps of Topographical Engineers to conduct the surveys for the RR, which were completed in 1856. Just before the Civil War, there was significant controversy over which of several routes were best suited for the transcontinental railroad to follow. At the time, the focus was on a Southern route, which the Gadsden Purchase of 1853 was intended to protect. One of
President Buchanan’s cabinet members, Jefferson Davis, completed a study which concluded that the southernmost route would be best. Other interests, particular Chicago, favored the route through Omaha, Colorado, and Utah to Sacramento. Still others favored a northern path to Puget Sound and Oregon. In the end, the outbreak of the Civil War simplified a determination of the route, since Southern Congressmen were no longer present to press their views.

In 1862, the government chartered the Union Pacific Railroad Company and the Central Pacific Railroad Company, and named the members of the governing boards. A franchise was given to each company to finance, build, and maintain each and of the road, and to raise capital privately through stock subscriptions. In addition to the franchises to each company, 100,000,000 acres of federal land was granted in the familiar alternating, checkerboard pattern, and $65,000,000 in government bonds were promised to be paid as each of the roads progressed. No competition was conducted in connection with the award of the franchise.

The Union Pacific Railroad Company was authorized by the statute "to lay out, locate, construct, furnish, maintain, and enjoy a continuous railroad and telegraph, from a point on the one hundredth meridian west from Greenwich (between the south margin of the valley of the Republican River and the north margin of the valley of the Platte River) to the Western boundary of the Nevada Territory. Authorized capital was 100,000 shares at $1,000 each, with the limitation that not more than 200 shares were to be held by any one person. Section 2 of the Act provides a 200 foot ROW to the railroad with the accompanying right to take earth, stone, timber, and other materials for construction. Section 3 of the act provided land grants of five (5) alternate sections per mile on each side of the road. Section 4 of the Act provided that patents for the land granted to the railroad would only issue as packages of forty (40) miles of railroad and telegraph were completed and accepted.

Congress made minor changes to the 1862 act two years later, including changing the stock price to $100 per share and increasing the number of shares authorized by a corresponding factor of ten. The Union Pacific was given a private right of eminent domain. Further amendments were made in 1865, allowing bonds to be paid 100 miles in advance of construction and accepting the assignment of a portion of the Central Pacific’s route to the Western Railroad Company, and, in 1866, when Omaha was established as the eastern terminus.

**Correlative Note V-2**

How many acres in land grants would be necessary to induce private companies to build and operate such a road? How much direct financial
support would be required, if any? Congress did not structure a procurement process in which competing schemes to finance, design, construct, maintain, and operate the road were received for comparison and evaluation. If it had, Congress might have received answers to these questions, or at least an understanding of how a number of independents analyzed these questions and the overall project.

After the road was completed, widespread rumors of corruption in the construction of the road, led Congress to being an investigation. In 1869, Congress required that a special board of "eminent citizens" be appointed to ascertain the status of the Union Pacific Railroad and the Central Pacific Railroad. These citizens were to have no interest in either road, and were to examine the books and the project, and to report what sums, if any, would be required to complete each road, over the entire length, as a first class railroad. The 1869 act authorized the President to withhold subsidy bonds from each railroad in an amount sufficient to secure the full completion of the road. The act also authorized the President to require the railroads to post collateral, if it appeared there were insufficient funds to complete the project.

As it turned out, prices paid by the Union Pacific Railroad Company to its general contractor, Credit Mobilier, amounted to approximately $90M. Payments by Credit Mobilier to its subcontractor were approximately $51M, a profit margin of 80% to the Credit Mobilier. The fact that those controlling the board of the Union Pacific also controlled and owned the shares of the Credit Mobilier was the subject of wide public outcry after the road was completed in 1869, during a Congressional investigation of the entire matter in the 1870's. Connections between the company and members of Congress were discovered, including investment by Congressmen in the Credit Mobilier.


Following the Credit Mobilier "scandal", Congress stopped granting lands in aid of railroad construction. During the decades which followed, rights of way only over public land continued to be offered in support of railroad construction, bridge construction, and roadways. Attention turned once again to consolidating the gains that had been achieved through twenty years of national subsidy on the grandest scale. In New York during this period, 300 towns contributed $33,000,000, mostly in subscriptions of stock, to support extension of the railroad system to their centers. Illinois towns made similar contributions of $18,000,000.

The last half of the nineteenth century also witnessed a tremendous growth in the ability of the private sector to raise capital for infrastructure development. Goodrich has estimated that $10 billion was raised by
American railroad companies between 1861 and 1890, a feat that would have been considered impossible only a few years before. From the early 1870's forward, private contribution to infrastructure development far outstripped public contributions by federal, state, and local governments combined.

S. Dual Operations: Franchising in Quadrant II and Direct Procurement in Quadrant I -- 1870 to 1930

The sudden availability of private capital produced a frenzy of activity by both private companies and the federal government in separate spheres of infrastructure development.

1. BOT Projects – A Franchise Frenzy in Quadrant II

Literally hundreds of franchises were granted during the period from 1870 to 1920 for the design, construction, maintenance and operation of numerous railroad and road bridges across the Mississippi, the Ohio, the Missouri, the Arkansas, the Illinois, the Tennessee, the Red Rivers (of the north and south), the Snake, the Hudson, the Colorado, the Columbia, and many of their tributaries. There are literally hundreds of examples of such franchises for railroad bridges and roads.

By the turn of the century, franchises were also being granted to construct dams for electric power generation on navigable waters throughout the United States. Many franchises for bridges and dams were granted by Congress. In 1871, an omnibus act was passed by Congress standardizing the terms under which franchised bridge construction would be conducted over the Ohio River. In 1906, separate omnibus statutes were passed setting the general terms under which both bridge and dam franchises were to be authorized, including the specific requirements that must be met as a pre-condition of construction either bridges or dams on navigable waters. The act regulating dam construction was modified in 1910.

In the territory of Hawaii, Congress turned to franchising to arrange for the quick installation of gas, electric light, power, telephone, railroad, and street railway companies.

2. Direct Federal Procurement in Quadrant I

River and Harbor Improvements. Throughout the period, the federal government took over an increasing burden to fund, design, and build substantial river and harbor improvements. Beginning in 1869, federal appropriations for improvements to rivers and harbors increased substantially, and continued to do so through 1933. The 1869 appropriation for rivers and harbors exceeded $2,000,000, and rapidly grew to tens of millions of dollars per year by the close of the nineteenth century. Congress kept the federal government firmly in a lead position to develop
transportation on the navigable waters of the United States by a steady stream of legislation for particular projects, usually wrapped up in the annual rivers and harbors appropriations, but sometimes separately enacted for particular projects. These projects were undertaken by the Secretary of War under the supervision of the Chief of Engineers for the Army Corps of Engineers.

Congress formed the Mississippi River Commission in 1879 to develop surveys, plans, and estimates for continued improvement of infrastructure facilities throughout the valley, under the supervision of the Chief of Engineers. Annual appropriations of millions and millions of federal dollars were directed to major water structures, such as the Falls at Sault Ste. Marie, the locks on the Ohio River at Louisville, and the locks around the Des Moines Rapids on the Mississippi. Substantial projects were undertaken in most of the major harbors of the United States, including removal of obstructions at Hell Gate in the harbor of New York City, and the opening of the South Pass of the Mississippi using an ingenious jetty system developed and implemented by James Eads, the designer of the first major bridge to cross the Mississippi at St. Louis. After a federal takeover of the Louisville/Portland Canal in the late 1870’s, Congress abolished all tolls through the canal, and began to appropriate moneys for the Corps of Engineers to operate it. In 1881, the canal at Sault Ste. Marie, too, became toll free when the entire project was purchased by the federal government. New York followed the federal government’s lead in 1882, removing all tolls on the Erie canal, in an effort to provide increased competition to keep railroad freight rates for bulk cargo down.

Roads. During the same period, the government was directly supporting road construction, particularly in the territories.

An early example is the Mullan Road from Fort Walla Walla, Washington, to Fort Benton, Montana. “Mullan” was an 1852 graduate of West Point who volunteered, in 1853, to participate in the exploration and survey of a potential railroad route from the Mississippi to the Pacific. During this exploration, Mullan discovered a pass suitable for a wagon road. On March 18, 1859, the War Department assigned $100,000 for the building of a military road from Fort Walla Walla, Washington, to Fort Benton, Montana, a distance of over 600 miles, along the route Mullan had discovered and appointed him as officer in charge of construction (OINCC). The road was built between June, 1859 and August, 1860 by Mullan, 100 enlisted men, and 100 civilian workmen, including a few surveyors and engineers.

Another example is the system enacted by Congress in 1905 to quickly establish roads and trails in the Territory of Alaska. Congress established a separate fund of all the money collected for liquor, occupation, or trade licenses in Alaska, known as the “Alaskan Fund”. The 1905 Act required that 25% of the fund be used to establish schools. Five (5%) of the fund was
required to be used to care for the insane, and all of the balance of the fund, i.e. 70%, was to be used to construct and maintain wagon roads, bridges, and trails in the Territory. A Board of Commissioners was established by the act to locate, lay out, construct, and maintain wagon roads and pack trails from points on navigable waters to towns, mining or other camps, and between them. The Board was required to produce maps of all the trails and roads built, and required to award contracts to the "lowest responsible bidder, upon sealed bids, after notice" if any project's cost was expected to exceed $5000.

T. Expanding Definitions of Infrastructure -- 1900 to 1933

Beginning in 1900, with the commercial success of the telephone and electric power generation, and the need for means to settle the desert lands of the Western states, the scope of the term infrastructure expanded significantly. Electric power generation and distribution, water storage and distribution, and telephone installation were added to the menu of infrastructure services to be supplied throughout the United States.

In the arid and semi-arid states, Congress combined two of these functions by creating the Bureau of Reclamation in 1902. The Reclamation Act of 1902 was unusual in that Congress enacted a process by which the selection, design, and construction of irrigation projects would be delegated to an executive agency. The Bureau of Reclamation was intended to act as a financier/developer of irrigation projects for the West, inducing settlement, farming, and income from users of federal projects which were supposed to more than sufficient to break even. Once capital, operating, and interest expenses had been recovered the Reclamation Act provided that individual irrigation projects would be turned over to settlers in the irrigation districts served. This was Build-Operate-Transfer, but in reverse, with the government acting as developer. During construction of the Teddy Roosevelt Dam on the Salt River in Arizona, the Bureau discovered that on-site power generation during construction was an economical way to supply power. Thereafter, Congress added power generation as a prime goal of Bureau projects, with the proceeds of power sales to be used to defray capital expenses. Interstate compacts allocating water on the Colorado, Columbia, Rio Grande, and South Platte Rivers during the 1920's provided the basis for the Bureau to proceed with water storage, flood control, irrigation, power generation, and power distribution projects well into the 1970's.

U. Federal Highway Aid, Growth of Segmented Procurement, and the Evolution of Congressional Programs -- 1916 to 1933.

In 1916, Congress passed legislation to provide federal aid to State Highway Departments for the development of rural post roads. The statute provided for 50% federal cost sharing cash payments with state highway departments upon the completion of rural road projects in accordance with federal guidelines for the program. Included in the requirements of the
program, was advance approval by the federal government of a complete set of plans and specifications for each project. Segmented procurement in Quadrant IV had officially arrived. Federal aid for “rural post roads” steadily expanded as Congress loosened the requirements over time. Pressure for federal cost-sharing for rural highways continued as increasing numbers of Americans abandoned streetcars and railroads for the individual convenience of the automobile.

Toward the end of the period, Congress was increasingly interested in programs to manage the development of infrastructure in the United States. The Bureau of Reclamation was to implement the federal program for water resources in the West. The Federal Water Power Commission was coordinate a program of government and franchised development of water power, water storage, and navigation improvements. The Bureau of Public Roads was implementing a program of federal aid to rural highway development. The Secretary of the Treasury was implementing a system for construction of federal buildings. The Corps of Engineers was to implement the federal program for controlling floods on the Mississippi. The Wagner Act, passed in 1931, required the federal government to systematically approach the planning and implementation of infrastructure projects.

Approval of Complete Plans Before Construction. Up until 1893, federal procurement had not been segmented between the design and construction phases. In that year, Congress permitted federal agencies to separately procure the services of architects to prepare plans and specifications or to assist federal employees in doing so. In 1926, Congress authorized the Secretary of State to build and remodel facilities in foreign countries for the use of the government, including the option to contract for special architectural and technical services not in excess of 5% of the cost of construction. The movement toward segmented procurement took a big step forward with another enactment of Congress in 1926, the Omnibus Public Buildings Act. The statute applied to federal building construction in the District of Columbia and elsewhere, requiring that before construction begins, plans and specifications must be approved by the heads of departments. The work of preparing designs and other drawings, estimates, specifications, and the awarding of contracts is required to be performed by the Office of the Supervising Architect, except that whenever the Secretary deems advantageous, he may procure floor plans and designs by contract with architects, may employ advisory architects to help with design, and may employ architects after competition to help supervise construction.
VI. Conclusions and Recommendations

A. The Current System for Infrastructure Development in the United States is "Broken"

In a number of significant respects, the current system for public infrastructure development in the United States is "broken". The public need for infrastructure projects, including environmental remediation, wastewater treatment, improved transportation facilities, ports, airports, public schools, and other public buildings far exceeds available public cash resources. The "shortfall" in federal infrastructure spending is dramatic, with no indication that circumstances will change in the foreseeable future. Federal funding appears destined to fall both as a percentage of federal outlays and in real terms. Congress has "painted itself" into Quadrant IV, in futile reliance upon appropriations which are simply insufficient to keep pace with infrastructure needs.

Surprisingly, federal strategy has not adapted. Instead, the steady decline in federal infrastructure funding has been accompanied by increased reliance on Quadrant IV. Federal statutes and regulations require the separation of financing, design, construction, maintenance, and operation from one another in the development process. This trend has been followed closely by state governments.

Rather than attempting to fill current shortfalls in public appropriations with private sector investment, Quadrant IV procurement processes expressly prohibit such investments. "Competition" is constantly sought over smaller and smaller pieces of infrastructure projects – i.e., among architects, engineers, soils engineers, contractors, subcontractors – not for the purpose of producing systemic best value to the government, but in order to allocate inadequate federal appropriations among "qualified" designers and "low-priced" contractors. Administration of this "process" is cumbersome, time consuming, and expensive. Quadrant IV is not a means for fulfilling strategic societal needs, but the "end" goal of current federal procurement strategy for infrastructure development. Indeed, the process of administration is so resource and time intensive that infrastructure development can no longer be successfully used as an implementing tool to strategic societal ends.

"Competition", as defined in Quadrant IV, is so detailed and so segmented that government has destroyed any opportunity to generate real competition on a system wide basis, the kind of competition which encourages, rather than discourages, innovation in the ways in which project elements are combined.
The segmented process in Quadrant IV obscures the government’s interest in competing for the most effective integration of design, construction, and operations of infrastructure facilities over extended life cycles by blurring and confusing the responsibilities of designers, construction contractors, and facility operators with government’s responsibility for design approval and contract administration.

B. Systematic Change is Needed

Systemic, not cosmetic, change is needed over the long term in order to enable public resources to be leveraged through private sector re-investment in infrastructure development. The nation’s traditional commitment to BOT and DBO processes in Quadrants I and II needs to be expressly renewed and established through statutory changes which signal a long term, stable commitment to broaden private sector participation in infrastructure development.

In connection with these changes, we need to fundamentally rethink how competition is conducted for large infrastructure projects by broadening the scope of competition, conducting competition later in the procurement process after government’s needs have been clearly defined, and by packaging projects over longer terms to include maintenance and operations, thereby aligning private and public sector interest: time and cost savings, and in high quality. Procurement processes can and must be structured to attract rather than repel innovation and private investment.

Governments need to reestablish their traditional role as a packager and facilitator for large infrastructure projects, remaining focused upon clearly defining public infrastructure needs and creating a stable, competitive atmosphere, with incentives where appropriate, in which public infrastructure can be supplied, in cooperation with the private sector, through competitively established arms-length transactions.

C. Recommendations

Eight recommendations are offered to begin the long process by which the systemic changes described above are implemented.

1. Incentive-Based Procurement in Quadrant II Should Become an Integral Part of Infrastructure Development Strategy

Quadrant I and II processes produced most cost and time effective infrastructure, expanded opportunities for the government to select best value from a number of proposed infrastructure packages, encourage high quality, and assist in fiscal management through stable budgets for maintenance and
operations. There is no logical reasons to continue to prohibit their full use to leverage limited public funding to meet growing public infrastructure needs.

2. Quadrant II Processes Should Be Used to Increase the Pace at Which Public Infrastructure Needs are Met.

Rather than simply replacing public expenditures on infrastructure with private investment in Quadrant II, governments should at least maintain current expenditures in Quadrants I and IV. Quadrant I and II processes can and should be used to increase the pace at which public needs are met. The figure below shows schematically how the additional of Design-Build, Design-Build-Operate, and Build-Operate-Transfer mechanisms might be used to move infrastructure development along, without cutting current federal, state, or local budgets in Quadrants I and IV.

Figure VI-1

![Indexed Expenditures for Public Infrastructure](image)

3. "Competition" Must be Restructured to Cover the Project Life Cycle and to Produce Best Value to the Government

Compete Over Full Project Life Cycle. We are competing over an incomplete scope of work. BOT and DBO processes offer the opportunity to obtain competitive prices, not just for the cost of construction, but for the cost of financing, designing, constructing, maintaining, and operating major infrastructure facilities over an extended period of time, typically 20 to 30 years.
Compete Later in Project Development. We are competing at the wrong time — that is, too early in project development. In the current American paradigm, government does very little at the initiation of an infrastructure project other than the most general description of its needs. This meager description is, however, sufficient to conduct a Brooks Act competition for professional engineering or architectural services. Typically, the government’s real needs are first described by the A/E, whose contract includes the development of this description as part of Schematic Drawings. In the BOT and DBO processes proposed here, government produces the description of needs which comprise Schematic Design. The Request for Proposals issued by the government then includes this Schematic Design and solicits independent proposals which develop this schematic design to a point sufficient for proposers to make binding commitments to finance, complete design, construct, maintain and operate the project over a long franchise term. The figure below compares how key elements of typical projects would be grouped differently in Quadrants IV and II.

Figure VI-2

**Build Operate Transfer and Design Build Operate**

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**Quadrant IV -- Sequential Design then Construct**

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**Key**

- A Identification of Government Need
- B Schematic Design
- C Design Development (30% Design)
- D Valve Engineering
- E Alternates
- F Financing Package
- G Franchise Proposals
- H Construction Documents
- I Construction
- J Maintenance and Operations

A number of advantages flow from competition conducted later in project development, most of which have been described previously. Several, however, have not. Value engineering (VE) occurs before a
franchisee is selected, and takes place in a competitive environment in which
the results of each team’s value engineering process often determines the
successful proposer.\footnote{Teams have a real incentive to improve quality while
keeping both capital and M&O prices down and time of delivery short. This
represents a major improvement over the current American practice in
Quadrant IV, which never presents unified, life cycle responsibility for
quality, price, and time to the private sector for competitive proposals. The
current VE procedures in federal construction contracts allow only the
successful contractor to submit such proposals to the A/E and Owner after
contract award. VE clauses provide that the government and the contractor
are to share in any cost savings, which has engendered controversy and
disputes among the government, the contractor, and the designer. The
frequency of Value Engineering change orders on federal construction
projects is very low.

Another advantage in moving the competition point later in project
development is a reduced need by government engineering staff to supervise
project development activities directly. A significant portion of project
development work is conducted within the proposing teams, without the
participation of government staff.

**Compete on the Basis of Best Value to Government.** In Quadrant II,
competition must be conducted based upon the government’s determination
of best value, and not on any one, incomplete indicator of value, such as
price, time, or quality. A mix of evaluation factors produces a corresponding,
different combinations of quality, price and time for the government to
consider in evaluating different proposals. This mix of evaluation factors is
necessary, and must include price (capital, maintenance, and operations),
quality (of equipment, function, and features), time of delivery, as well as the
technical and financial strength of the proposing team.\footnote{487}

4. **The Design Build Operate Process Should Be Extensively
   Applied to Environmental Remediation Projects**

The United States, and Massachusetts in particular, finds itself in the
position of being able to offer world-class expertise in the analysis, design, and
construction of solutions to environmental problems and issues around the
world.\footnote{At the same time as American expertise is being solicited and
provided abroad, we are unable to move effectively and decisively to conduct
and complete environmental cleanups at home. The toll on the American
economy is “transaction costs”, representing approximately one half of the
total cost of cleanup. Whatever estimate of environmental remediation costs
is assumed to be correct,\footnote{50% is still an impressive amount to be spent on
the adversarial process associated with environmental cleanups. In addition
to the direct cash drain caused by transaction costs, the uncertainty caused by
lengthy disputes over remediation sites has an incalculable secondary effect}
on land values, on the ability to sell, purchase, or lease land, and in contingency funds held on the corporate balance sheets of thousands of companies.

Fifteen years of experimentation with CERCLA in Quadrant III has demonstrated that a procurement system which relies upon the adversarial system to establish the scope of work, to determine acceptable levels of cleanup, and to determine who will pay and who will not pay for the cost of studies, cleanup and associated litigation, defines itself as a system that will be, and is, paralyzed in litigation. CERCLA’s segmented, indirect process also runs against the grain of 200 years of procurement experience in Quadrants I, II, and, since 1933, Quadrant IV. CERCLA’s procurement strategy has not, will not, and cannot work, unless Congress red defines success to be the expenditure of 50% of project funds on “project/ litigation development” and 50% on project design and construction.

Long term DBO franchises, competitively awarded, to remediate sites to achievable, EPA-specified standards can move cleanup forward. Congress should return to incentive strategies to get the work done, and end this perverse, expensive search, usually in court for perfect solutions for environmental problems that don’t really exist.

5. Public Projects in Urban Areas Should, Whenever Practical, Be Jointly Developed

Government at all levels should carefully consider how to structure public procurement in urban areas so that both public and private development can proceed alongside (on top of, of integrated with) one another. This type of joint development offers to the government and to private sector mutual benefits of subsidizing the cost of each element of the project. To ensure best value to the government, competitive award procedures would be used to select among competing joint development proposals. Joint development options are most likely to occur in urban areas where population is of sufficient size to support joint development of infrastructure and commercial or residential projects.

For example, rather than simply building the stand-alone concrete garages and transit stations that comprise the Alewife and Quincy stops on the Red Line of the MBTA in Cambridge and Quincy, Massachusetts, these transit projects could have jointly been developed with commercial office buildings that now surround these sites. The BOT process could have been used to produce a number of innovative and creative ways of integrating commercial and public space, while meeting or exceeding the MBTA minimum requirements for the design and operation of the subway station. Savings in capital costs from the combination of these functions, together with income from retail commercial space, might have helped both the
MBTA and commercial landlords reduce overall capital, maintenance, and operations expense.  

6. A Stable, Predictable Climate for Implementation Must Be Provided

Statutory Authorization for Quadrants I and II. A statutory adjustment is required to change the mix of infrastructure procurement methods clearly and unambiguously to include Quadrant I and II processes, and specifically DBO and BOT. The advantages of permitting Design Build Operate in Quadrant I and Build Operate Transfer in Quadrant II are many. The most important of these advantages are independent, multiple verifications of project feasibility, and the opportunity for government officials to select best value from among different combinations of quality, price, and time of delivery. DBO and BOT encourage the use and application of state of the art technology and offer substantial savings in the time required for project delivery, which savings typically translates into capital costs savings. DBO and BOT processes also reduce the need for large temporary additions to public engineering staffs. DBO and BOT, if structured properly, encourage private, not public, financing of the capital costs associated with large infrastructure projects, which greatly leverages public contributions made to such projects. DBO and BOT procurement methods eliminate public expenditures for maintenance and operations during the franchise period, and permit reliable budgeting and financial management of public expenditures for infrastructure. These processes also eliminate ambiguous questions of conflicts of interest by aligning the interests of franchisees, designers, constructors, and financiers for BOT and DBO projects. The owner’s interests are protected by checking engineers, its own staff, and by bonds and guarantees of sufficient magnitude and reliability to ensure compliance with all franchise requirements. These arrangements also serve improve government’s ability to manage project risk by placing it on the franchisee, the party in the best position to insure or otherwise protect against it.

The Role of Government in Infrastructure Development. Congress, as well as state legislatures, can contribute most effectively to the development of public infrastructure by determining and defining public needs. Two hundred years of experience indicates that Congress has been extraordinarily resourceful in facilitating infrastructure development once it has determined the public need to be met. Zane’s Post Road in the late 1700’s and hundreds of franchises and rights of way for water supply, water power, locks and dams, bridges, roads, and railroads demonstrate that incentives can be effectively applied to facilitate procurement of infrastructure needs in the private sector.

Legislatures and government agencies have proven to be less effective in naming the most timely, cost-effective, high quality means for meeting
these needs. For example, having identified the need for the Pacific Railroads in 1862, Congress went further and chose the means of providing it -- incorporation of a few individuals accompanied by the award of a franchise, land grants, and government bonds to construct the road, all without competition. There are numerous other examples. In the 1820's, Pennsylvania identified the need to cross the Alleghenies to compete with New York's Erie Canal, but went further, choosing to do so with its own canal over the mountains ("the Portage Road"). In the 1870's, the Corps of Engineers fought with Captain Eads for twenty (20) years in an effort to "prove" that Eads' South Pass Navigation Works would not and could not self-scour the Mississippi River Delta.

This distinction -- between the identification of public infrastructure needs and selection of the means to fulfill them -- is the logical breaking point upon which a more effective procurement strategy can be constructed. The Figure below shows this breaking point by a horizontal line. As legislatures and executive agencies add requirements below the line, the scope of competition narrows and the opportunity for the government to receive the broadest possible range of alternatives narrows as well.492 The more Congress and agencies write below the line, the smaller the range of options the procurement system can and will produce. Congress and administrative agencies can more effectively meet public infrastructure needs with patience, and by resisting the temptation to restrict competition too early in the process by naming agency preferences or by structuring evaluation systems which value these same preferences too highly.
Figure VI-3

Legislatures

Identify and Describe Public Needs
Provide a Competitive Path to Fill These Needs

The Procurement System

Conduct Competition and Manage The Results

The Private Sector

Approach A
Approach B
Approach C

The goal of an effective procurement strategy is to facilitate and create a competitive environment, with incentives if necessary and appropriate, which generates timely, cost-effective, high quality proposals to meet public needs. From among these proposals, that which offers "best value" to the government is selected and an arms-length bargain struck.493

Consistency and Stability. One of the keys to Hong Kong's success in BOT processes lies in the fact that the government remained consistent in its application of the process to large, complex, self-funding infrastructure projects. The Hong Kong government announced and stuck with its original policy of using BOT processes only on such projects. Over a period of almost twenty years, the procurement procedures used in Hong Kong to solicit and evaluate BOT proposals have been stable and predictable. The engineering and construction industry, as well as the financial community have become comfortable with the process, which, produced additional opportunities for BOT projects in Hong Kong, and recently, throughout the Far East. The introduction of the Design Build Operate method for environmental projects in Hong Kong is a natural extension of BOT principles, and offers a more secure financial investment for the private sector, since the risk associated on BOT projects with toll revenues is replaced with government or used paid processing or tipping charges.
The elements required for use of BOT and DBO processes already exist in the United States -- established financial markets and a highly competitive, well qualified engineering and construction industry. For BOT and DBO processes to become a successful long term element of American procurement strategy, however, government must commit itself to these processes and remain committed over a long term. Consistency is a key element in building confidence in financial markets that private investment in infrastructure is stable and competitive with other possible investments.

7. States Will Have the Next Significant Opportunity to Implement Long Term Strategic Infrastructure Development

Two hundred years of experience demonstrates that states and regions cannot rely on Congress to provide a steady stream of funds for projects of local or regional significance. Congress turned New York down when it sought funds for the Erie canal. Federal funding for the National Road was one of the most contentious issues facing the Congress between 1806 and 1838, and funds were turned on and off repeatedly. Funding for the C&O canal was cut off by Congress. Despite howls of protest, the EPA construction grants program was shut down by Congress only a few years ago. Funding for the Interstate Highway program has been capped, and Boston’s Central Artery and Boston Harbor projects proceed under “clouds” with respect to future federal funding. Since 1980, programs like CERCLA have imposed unfunded mandates on states and private citizens in Quadrant III -- requiring state and private sector spending under federal control without federal funding.

In the current climate of restricted federal budgets, states appear to have little or no choice but to adopt a matrix procurement strategy for obtaining infrastructure facilities, which allows the private sector to help meet public needs through BOT and DBO mechanisms. Viewed in the context of history, this is not an unfamiliar role for state government. Prior to the 1870’s, states were prolific supporters of indirect procurement methods for infrastructure development. American history is replete with examples. Massachusetts, for example, was an early leader in franchising bridges and roads throughout the Commonwealth.

Hong Kong has achieved the kind of success that can be expected of states in the USA. Now the largest international port in the world, Hong Kong took its first step toward port expansion by awarding a long term BOT franchise to Sea Land for a container terminal in the port. Since the original franchise, eight additional franchises for containers facilities have been awarded. The port, which produces a extraordinary secondary impact on the economy of Hong Kong, was developed at private expense, but in accordance with needs identified by the government for implementation through a competitive procurement strategy. Major elements of Hong Kong's new
airport at Chek Lap Kok are being developed using BOT processes, which has lowered overall public expense for both public and private portions of the project.\textsuperscript{497}

States typically face a more difficult first question: what is the state's long term economic strategy? Once again, Hong Kong's experience is an instructive one. Faced, in 1987, with the reality of re-unification with the People's Republic of China, Hong Kong conducted an extensive strategic planning process which resulted in a broad consensus on a vision of Hong Kong's future in the political, social and economic climate of Southern China and Southeast Asia.\textsuperscript{498}

These same issues were raised for Massachusetts in the context of New England, the Northeast, and Western Europe, in Correlative Note II-3.\textsuperscript{499} The most compact, workable method I have seen for developing this kind of state economic strategy is contained in Professor Michael Porter's 1980 book, \textit{Competitive Strategy: Techniques for Analyzing Industries and Competitors}.\textsuperscript{500} Although the book was written for application in the business community, portions of it would be remarkably relevant to a governor, an economic development cabinet secretary, a legislative committee, or the executive director of a port authority, in developing a workable economic strategy for a state, a large metropolitan area, or region. Three generic strategies are described, along with a number of analytical tools that may be of use in settling upon and describing a long range vision of how, for example, the Commonwealth of Massachusetts will protect and expand its existing economy, adapt its investment in infrastructure, and at the same time operate effectively in the context of a regional, national, and world economy.

In both Hong Kong's experience and in Porter's work, long term economic strategy is considered separately from the means to implement that strategy.\textsuperscript{501} For Hong Kong, infrastructure development was always identified as a critical tool to implement Hong Kong's long-range strategy. Sequencing remains of importance. Good infrastructure projects are identified as a result of the development of a broad economic strategy based upon political consensus, not the other way around.

8. Financial Constraints Are A Symptom of the Need to Change, Not an Excuse For Failure

In recent years, the United States has grown accustomed to an infrastructure development process that is little more than a competition among an inexhaustible supply of projects for an inadequate share of insufficient public funds. The need for infrastructure rehabilitation, replacement, repair, and extension is a continuous one, which does not vary with the financial condition of governments. Financial constraints have prevented every American Congress from meeting all of the public's
infrastructure needs. Early Congresses, faced with no credit abroad and neither industry nor infrastructure at home, consistently operated to fulfill public infrastructure needs on a dual track, by (a) providing what infrastructure it could directly (in Quadrant I) and (b) facilitating the rest indirectly (in Quadrant II).

Given access to today's established financial markets and highly skilled engineering and construction industry, these same early Congresses would already be proceeding with infrastructure development programs in Quadrant II.\textsuperscript{502} Consensus that there is inadequate federal and state funding for infrastructure development is merely a signal that the procurement structure to meet these needs requires adjustment to once again include processes in Quadrants I and II.

Current restraints on direct procurement methods in Quadrant I are a symptom of a need to change how procurement is conducted, and not an excuse for failing to respond to urgent public infrastructure needs.
VII. Appendices

A. Incentives Offered by Congress From 1780 to 1933

Every statute, regulation, or rule divides, classifies, and discriminates. By definition, government action "separates" -- it separates people into groups, it distinguishes one form of behavior as "better" than another, or picks one policy "over" another. The incentives offered by Congress to promote infrastructure development separated people into groups, preferred certain behavior over other behavior, and picked some policies to the exclusion of others.

Presented below is a sampling of the kind of incentives Congress offered to promote settlement, to expand the economy, and to encourage infrastructure development. Indeed, more than half (60%) of the Congressional programs reviewed in the period from 1780 to 1933 involved some type of incentive provided by Congress in support of a Quadrant II procurement process. Before reaching any conclusions about whether incentives are a good idea, and, if so, what kind of incentives are appropriate, it is useful to examine what Congress did in antiquity.

1. Waiver of Duty/Tax Free Import of Infrastructure Items

Frequently, Congress arranged for duties to be waived or for new technology to be imported tax free, when this appeared to be in the interest of economic expansion, usually synonymous with infrastructure development. For example, in 1832, Congress eliminated the duty on rail iron imported for use in the construction of any railroad or inclined plane by any state or incorporated company. The Secretary of Treasury was authorized to make the determination whether such iron has been actually and permanently used for a railroad or inclined plane. If this determination is made, a "drawback" is paid on the duty already paid.

In an effort to assist in the introduction of iron steamboats to America, Congress authorized Gazaway B. Lamar, of Savannah, in 1834, to import an iron steamboat in detached parts with all the necessary machinery, tools, and utensils to test the potential of iron steamboats for the navigation of shoal waters. Pleased with the initial results of Lamar's experiments, Congress acted again, in 1838, to authorize a group of individuals in New Orleans to import an iron steamboat in detached parts with necessary machinery, tools, and utensils for building and operating a steamboat, but not including the steam engine. The 1838 statute also authorized Mr. Lamar to import iron materials for the construction of two more iron steamboats, duty free.
A number of corresponding acts followed, duplicating these same incentives for the New York and Harlem Railroad, the Baltimore and Susquehanna Railroad, the New Castle/Frencktown Railroad, and the Philadelphia, Wilmington, and Baltimore Railroad.

2. Incentives For Experimental Items

During the period, Congress was willing to reduce the cost of using experimental devices which might be helpful in improving infrastructure. For example, in 1845, the South Carolina Railroad Company imported experimental pipes to test the use of atmospheric pressure as a propelling power on railroads. To assist in the experiments, Congress waived the import duty on a quantity of pipe sufficient for one mile of test road bed, including all the machinery required to be connected with the experimental pipe.

In 1847, in order to encourage the development of gas lighting systems, Congress authorized a different sort of test to be conducted in Washington, D.C. A resolution authorized the Secretary of the Senate and the Clerk of the House to contract with one James Crutchett to light up the Capitol and the Capitol grounds with gas light, pursuant to reasonable contract terms.

In 1900, Congress awarded a franchise to the Seneca Telephone Company to construct and maintain specified telephone lines throughout the Indian Territory (now the state of Oklahoma), subject to guidelines as to location and minimum construction requirements. Congress reserved the right to regulate the tolls or charges of said telephone lines constructed in the territory.

3. Incentives for the Application of New Technology (Patented Items)

a) Waiver of Residence Requirements for Inventors

During the period, federal patent laws required patent holders to be residents of the United States. Congress frequently waived these requirements whenever it appeared that particular inventions might assist in the nation’s economic or infrastructure development. Residence requirements were waived for the discovery of new means for constructing iron bridges, a new method of manufacturing charcoal using puriformous acid, a new machine for clearing land, a method for combining mechanical powers to produce or increase the velocity and power of machinery, and to communicate this velocity to various kinds of machinery requiring projectile, reciprocating, or rotary motion, a new engine for propelling vessels without the aid of steam, and an improved sounding machine for use in river clearing and navigation.
b) Payment for Patent Rights

Congress also decided, on occasion, to take a much more active role in bringing new technology to use in connection with infrastructure. In 1812, for example, Congress authorized the President to purchase Winslow Lewis' patent rights involving a unique way to illuminate the beacons emitting from lighthouses.\textsuperscript{522} Having a substantial investment in the design, construction, and operation of virtually all the existing lighthouses in the nation, Congress brought this improvement directly to use in American facilities by acquiring a license to use the device. The President was authorized to contract directly with Lewis to install and maintain all lights in all lighthouses of the United States using the new invention, which is described above.

c) Congressional Issuance of Promising Patents

Congress also acted directly to give inventors patents on devices which appeared useful in settlement, economic expansion, and infrastructure development. For example, in 1828, Congress authorized the Secretary of State to issue patents to Simeon Broadmeadow for his improved method of exhausting, condensing or propelling air, smoke, gas, or other “aeriform” products; also, for his pneumatic engine; and also for his improvements in the steam engine.\textsuperscript{523} Other similar acts relate to improved methods for welding shovels, spades, and scythes of iron and steel,\textsuperscript{524} improved machinery for propelling ships and other vessels,\textsuperscript{525} and for improved methods for blasting rocks.\textsuperscript{526}

4. Federal Surveys

One of the most effective incentives provided by Congress during the period involved federally funded surveys, which produced maps and records leading to settlement, economic expansion, and infrastructure development. In 1807, for example, Congress appropriated up to $50,000 to survey the Georges Bank and other geologic structures in the Gulf Stream.\textsuperscript{527} Results of surveys were to be described in charts and made available to the general public for use in support of fishing and other marine activities.

Surveys were required before federal land sales could take place throughout the lands added to the United States after the Revolutionary War. In part to facilitate these sales, to record the boundaries of federal lands withheld from sale, and for a number of other purposes, Congress contribute surveying throughout the Northwest Territory and the rest of the new lands west of the Alleghenies. Once surveyed, Congress was in a better position to offer other incentives to particular settlements, structures, and facilities as settlement spread westward. Some of acts providing surveys are described here for illustrative purposes.
The statute for the survey of Alabama is typical of the way in which each of the territories was surveyed between 1780 and 1860. Beginning in 1818, the Alabama Territory was surveyed in accordance with the system first applied in the Ohio Land Sales Act of 1796. The entire territory was surveyed, in preparation for federal land sales, and for the eventual admission of the state into the Union. The surveying statute required that Section 16 of each township be reserved for schools, that ten entire sections be reserved for towns, to be laid out and established by the surveyors, that an entire township (32 sections) be located for the support of a seminary of learning, and that another section be reserved for the seat of government of the Alabama Territory. The act set minimum land prices at $2 per acre. Sales could only be made to the highest bidder after notice and advertisement.

Surveys were also paid for by Congress for more specific purposes related to infrastructure. In 1824, for example, Congress authorized the President to cause surveys, plans, and estimates to be made of [all] the routes of such roads and canals the President deems to be of "national importance, in a commercial or military point of view, or necessary for the transportation of the public mail". The President was authorized to spend up to $30,000 and to employ two or more skillful civil engineers, and "such officers of the corps of engineers, . . . as he may think proper."

On other occasions, Congress wanted particular routes surveyed to spur particular infrastructure development. In 1826, for example, Congress authorized the President to conduct an accurate and minute examination of the country south of the St. Mary's River, Florida, to ascertain the best route for a canal for boats to travel between the Atlantic and the Gulf of Mexico. A second example is the act directing a survey of the best route for a permanent post road between Baltimore and Philadelphia. The survey route was to cross the Susquehanna at Havre de Grace ferry, Port Deposit, and Conewingo Bridges. Another example is an act passed in 1835 appropriating funds for surveys of numerous road developments in Michigan and Illinois.

To continue the effort to understand how best to develop the Mississippi, in 1871, Congress directed the Secretary of War to install water gauges on the Mississippi and its principal tributaries so that daily observations could be made of the rise and fall of the Lower Mississippi river and its chief tributaries. The results were to be published generally, and also used by the Corps of Engineers in the development of plans for continued improvements to navigation and flood control throughout the Mississippi River Valley.

Congress also funded and directed the survey work required before the arid and semi-arid lands of the West could be improved through irrigation, power generation, and water storage. In 1888, a joint resolution of Congress
directed the Secretary of the Interior, under the supervision of the United States Geological Survey, to conduct surveys throughout the West to investigate the practicability of constructing water storage reservoirs in arid regions of the US. IN 1920, Congress directed the Secretary of Interior to survey the Imperial Valley to determine whether irrigation was feasible for the valley and, if so, to make recommendations as to how this might be done.

Congress initiated the survey and planning process which led to the eventual construction of the St. Lawrence Seaway in 1902, when it directed the President to invite Great Britain to join an international commission, composed of three Americans and three Canadians to investigate, survey, and report upon the condition and uses of waters lying along the boundary between the United States and Canada. The Commission was to make recommendations for improving navigation, aiding commerce, and for better regulation of water flows throughout the entire Great Lakes system.

Congress was thinking in a strategic, long term vein, when in 1929 it authorized and directed the Secretary of War and the Chief of Engineers to investigate potential routes through Nicaragua for a second Isthmian canal connecting the Gulf of Mexico with the Pacific Ocean.

5. Subsidies in the Form of Income Streams

A more subtle, but extremely valuable, incentive frequently employed by Congress in the period was to subsidize particular infrastructure services through income streams that were either shared with the government or given outright to operators. For example, as new modes of transportation became available in the Mississippi and Missouri River Valleys, Congress would make an early decision to support these modes through contracts to transport the mail. As early as 1813, Congress authorized the postal service to hire steamboat owners to transport the mails through four year contracts at rates charged on post roads. In 1819, Congress established a steamboat postal service between New Orleans and Louisville, which subsidized passenger and freight traffic along the same route. In 1842, Congress authorized the Postmaster to contract to carry mail on the Potomac River by ice boat.

Private contracts to carry the mails were used to indirectly subsidize ocean steamer service, beginning in 1853. By this date, Congress was appropriating specific lump sum amounts to pay for contracts to carry the mails. Routes included New York and Liverpool ($850,000 per year); New York to New Orleans via Charleston, Savannah, Havana, and Panama ($290,000 per year); Panama City to California and Oregon ($348,250 per year); and tri-monthly steamship service between New Orleans and Vera Cruz, via Tampico ($70,000). These contracts were competitively awarded, and offered the steamship industry a substantial reliable income stream.
This pattern continued up to 1933, as more frequent mail service was required to more foreign ports. In 1864, Congress required that all US steamers and sailing vessels were required to take any mails offered to them by the Postal Service before sailing, and must convey these materials for the compensation provided by law. The same act authorized the Postmaster to enter into contracts of up to four years for the transportation of all mails by the existing routes through the Isthmus of Panama or Nicaragua, or both of them, up to a maximum annual amount of $160,000. Another act in the same year provided a guaranteed income stream for ten years of $320,000 to carry the mail between the US and Brazil. The length of this contract permitted proposers to finance the construction, in America, of first class ships required to meet the terms of the proposal. A similar act in 1865 established mail service between San Francisco and China, and provided an income stream of $500,000 per year to the awardee.

In 1891, Congress acted to protect competition for these long term mail contracts by requiring that all contracts to carry international mail have a minimum term of five years and be competitively awarded. When air delivery of international mail became feasible in 1928, Congress quickly acted legislation permitting contracts to be competitively awarded for carrying mails by airplane. Congress set a cap on the rate that could be charged by contractors for airmail delivery at $2 per mile. Continuing its pattern of allowing new transportation modes to carry the mails, and thus to subsidize their development, in 1933, Congress authorized the mails to be carried by trucks, in lieu of trains, and by electrically powered railroads, on condition that the cost of delivery was not higher than the railroad.

6. Land In Exchange for Infrastructure Improvement

On numerous occasions, Congress arranged for the sale of land in specific exchange for particular infrastructure improvements. An early example was in Charlestown, Massachusetts, where federal land at the Charlestown Navy Yard was sold to the Proprietors of the Salem Turnpike and Chelsea Bridge Corporation on the condition that the land be used to connect the Salem Turnpike with the Chelsea Bridge by toll turnpike. Congress did not set a sales price, but agree that the land's value would be determined through "independent valuation by disinterested men."

There are numerous other examples. In 1824, Congress granted a substantial piece of land on a bend in the Mississippi River to the inhabitants of the parish of Point Coupee, Mississippi, on the condition that the parish keep a good and sufficient levee in front of said land, upon the river Mississippi at all times. If the levee was not kept in good repair, the land would revert to the United States. In 1826, Congress exchanged federal land in the City of Detroit in exchange for the City's construction of a new
magazine for federal troops at a place outside the limit of the city, to be designated by the war department.\textsuperscript{551}

In 1846, Congress made a more complicated arrangement with the Iowa Territory to Navigation on the Des Moines River.\textsuperscript{552} The Act granted land to the Territory for five miles on each side of the Des Moines River, in the familiar checkerboard pattern, to aid the Territory in improving navigation on the Des Moines River from its mouth on the Mississippi to the Raccoon Fork. The statute contained a unique land sales requirement. The territory could only sell so much of the lands as would produce the sum of $30,000. Sales of land would then cease until the territory certified to the federal government that 50% of the receipts therefrom from land sales had been expended on Des Moines river navigation improvements. Once these funds had been spent, the state could then sell more land until the $30,000 was replaced and improvements continued.

A similar statute was enacted later in 1846 to assist the Wisconsin Territory improve navigation on the Fox and Wisconsin Rivers, and along a canal to be built between them.\textsuperscript{553} The act set a higher minimum sale price for granted land, and required that passage on the canal and rivers were forever to remain public highways, and free to the United States government for the transportation of the mails, of US property and persons in the service of the United States.

Three other instances where Congress exchanged land for particular infrastructure have been discussed above. The Swamp and Drainage acts of 1849 and 1850, described above,\textsuperscript{554} are two instances where Congress granted portions of its land holding in exchange for levee construction and drainage of swamps along the Mississippi. The benefits sought and obtained by Congress were the channelization of the Mississippi, and economic expansion throughout the Mississippi Valley.

Yet another critical exchange by Congress of land for infrastructure was the land grant engineered by Senator Douglas of Illinois which created the Illinois Central Railroad.\textsuperscript{555} Congress copied this approach for other states and other railroads at least twelve more times between 1850 and the start of the Civil War.

The concept applied by Senator Douglas for the Illinois Central Railroad’s development in Illinois, was also applied by Congress to encourage development of wagon roads in more remote portions of the country. In 1864, Congress granted land to the State of Michigan to assist the state in financing, laying out, building, and maintain wagon roads for military and postal purposes from Saginaw, Michigan to the Straits of Mackinaw and from Grand Rapids to Straits of Mackinaw.\textsuperscript{556} Much like the railroad grants, the incentives provided to states for wagon roads was a land grant of three (3)
alternate sections on each side of the ROW. The act requires the state to use the proceeds from land sales solely in support of the construction of the road.

7. Federal Franchises for Particular Infrastructure

Congress also granted a number of franchises to private corporations to build income producing infrastructure projects and to collect tolls over a set period.

In 1829, Congress incorporated the Washington, Alexandria, Georgetown Steam Packet Co., which was authorized to raise capital stock, purchase vessels, and operate on particular routes for a period ending on January 1, 1849.\textsuperscript{557}

\textit{Development of the Telegraph.} In 1855, Congress granted a franchise to Hiram O. Alden and James Eddy, their associates and assigns, to construct, at their own expense, a telegraph line from the Mississippi or Missouri River through a two hundred feet wide right of way on the federal lands to San Francisco, California, in as direct a line as practicable.\textsuperscript{558} In 1857, to assist in the development of foreign telegraph communication, Congress authorized the Secretary of State to enter into an innovative procurement contract to connect the United States to Britain by telegraph.\textsuperscript{559} The arrangement was a cooperative one with the British government, in which both governments would reimburse half the costs of furnishing and operating the lines, calculated so that the franchisee received not only reimbursement on these expenses but the equivalent of an annual dividend of 6\% over the 25 year term of the franchise. Congress reserved the right to terminate the franchise after 10 years, upon at last one years’ notice. In 1876\textsuperscript{560} and in 1877,\textsuperscript{561} Congress awarded further franchises to improve telegraph communications with Asia and with Europe, respectively.

\textit{Bridges.} Congress franchised literally hundreds of bridges over navigable waters of the United States. This form of procurement was most frequent after 1870. Franchising was an effective procurement mechanism because of the intense competition between and among railroads to provide more direct service and transfers between a steadily increasing number of stations scattered throughout the nation. Through its control over navigable waters throughout the country, Congress was able to secure a number of benefits for itself and for citizens through the award of franchises. First among these benefits was a condition written into all franchise statutes requiring that any railroad’s trains could use bridges constructed under federal franchise, provided they paid reasonable compensation for the privilege. Second among these benefits was the frequent franchise requirement that transit be provided for pedestrians and other vehicles, upon payment of reasonable tolls. In exchange, the franchisees received an income stream from tolls and charges, which assisted in financing construction and maintenance. Third among these benefits was the frequent requirement that
telegraph (and later, telephone) lines were allowed a free right of way across these franchised bridges. Fourth among these benefits was the knowledge gained by the Army Corps of Engineers of very specific details concerning natural and man-made river conditions along navigable waters, which came about because the Secretary of War, through the Chief of Engineers, was required to review and approve all franchised bridge construction in advance.

Some of the franchisees who were allowed to construct bridges over navigable waters in this way include: the St. Joseph Bridge Building Company562 (across the Missouri River at or near St. Joseph, Missouri); the Duluth, Pierre and Black Hills Railroad Company563 (across the Missouri River at Pierre, SD); the Sault Ste. Marie Bridge Company564 (across the Ste. Marie River at or near the rapids to the Dominion of Canada); the Cape Nome Transportation, Bridge, and Development Company565 (across the Snake River at Nome, Alaska); and John F. Kenward566 (to build and operate the Lake Washington floating bridge).

Congress frequently passed legislation in advance of any competition for a franchise, with the specific intent of inducing proposals from desiring franchisees, including the bridge over the Mississippi River at Clinton, Iowa,567 the pontoon railway bridge at Prairie Du Chien, Iowa,568 the pontoon wagon bridge over the Mississippi River at Dubuque, Iowa,569

Ferries. On occasion, Congress continued the practice of awarding franchises to provide ferry service in more remote parts of the nation. One example is the 1887, franchise awarded to Frank W. Hunt, his heirs and assigns, to erect and maintain a ferry at the military reservation of Fort Buford, Dakota Territory either by wire, cable, or steam across the Missouri River for a period of ten years.570

Dams and Canals. Congress also franchised the construction and operation of many dams (with associated locks and canals) on the navigable waters of the United States. Just as with bridges, franchising was an effective procurement mechanism. Private electric companies were involved in intense competition to provide more extensive, yet cheap, electric power service to a steadily increasing number of customers scattered throughout the nation. Because Congress controlled navigable waters, it could secure a number of benefits as a condition to the award of franchises for dams.

These benefits generally included the requirement that navigation be improved, not just maintained, around the site of the proposed new dam construction. This usually meant new, larger, more efficient lock (and canal) systems which reduced transit time where replacement infrastructure was provided. Franchises frequently required means for pedestrians and other vehicles to cross, upon payment of reasonable tolls. In exchange for building locks and routes for passengers, franchisees received an income stream from tolls and charges, which assisted companies in arranging financing for their
projects. The Army Corps of Engineers continued to acquire more specific details concerning natural and man-made river conditions along navigable waters, because the Chief of Engineers was required to review and approve all franchised dam construction in advance.

Some of the franchisees who were allowed to construct dams include: the Mississippi Water-Power and Boom Company of Brainard, MN\(^571\) (to construct a dam, canal, wagon and foot bridge, and to generate water-power); the Little Falls Water-Power Company of Minnesota\(^572\) (to construct a dam, a canal which allowed free passage of saw logs and rafts, works for water power, and a wagon and foot-bridge); the Chicago-Topeka Light, Heat, and Power Company\(^573\) (to construct a dam or dams across the Kansas River in the county of Shawnee, Kansas); the Twin City Rapid Transit Company\(^574\) (to construct a dam, canal, and future lock system across the Mississippi); the Grand Rapids Water Power and Boom Company of Grand Rapids, MN\(^575\) (to construct a dam, canal permitting free passage of saw logs, fishways approved by the US Fish Commissioner, and a future lock); the Twin City Power Company\(^576\) (to construct two dams, fishways, and a canal for water power purposes across the Savannah River); the Chucawall Development Company\(^577\) (to construct, maintain, and operate a dam across the Colorado River at the mouth of Pyramid Canyon, with approval by the Secretary of Interior, not the Corps of Engineers); James A. Moore\(^578\) (to construct and operate a canal from Puget Sound through Lake Union to Lake Washington); and the Greeley-Arizona Irrigation Company\(^579\) (to construct, maintain, and operate a diversion dam across the Colorado near Parker, AZ, to be approved by the Secretary of Interior, not the Corps of Engineers).

8. **Federally Funded Article/Improvement Testing**

Another means by which Congress could assist in infrastructure development was to provide federal funding for testing inventions and other articles. For example, in 1834, Congress authorized the President to arrange to test the reliability of the steam engine devised by Benjamin Phillips of Philadelphia, and to employ Phillips to make proper experiments as to the safety of the engine.\(^580\) As described above, Congress appropriated $30,000 to build an experimental telegraph line between Baltimore and Washington so that Morse’s telegraph could be tested.\(^581\) In 1845, Congress appropriated funds to arrange for the Secretary of War to appoint three officers to examine and test the practical utility of a machine patented by Dr. James R. Putnam of New Orleans for the removal of obstructions and bars in rivers and harbors.\(^582\)

9. **Easements and Right of Ways over Federal Land**

Congress did not always simply give land away. Sometimes, it chose to give easements or right of ways, usually dependent upon construction of particular infrastructure facilities. For example, in 1836, Congress authorized the Western Railroad Corporation of Springfield, Massachusetts to construct a
railroad on an eighty (80) foot strip through public lands, provided that when the strip of land ceased to be used for a railroad, the land would return to the United States.\textsuperscript{583}

Easements and rights of way became more complex in acts subsequent to that relating to Springfield. In 1836, Congress gave the right of way over an 80 foot wide strip on unsold public lands between New Orleans and Nashville.\textsuperscript{584} The right of way was contingent on approval of the route by the Secretary of War prior to construction, and ceased in the event the strip was no longer improved for the purpose of a railroad. This statute also included five acres of land granted to the railroad for railroad workshops each fifteen miles along the right of way, and also gave the railroad the right to use earth, stone, wood, and other materials on public lands along the route. All of these incentives were given, provided that construction begin within two (2) years and be completed within eight (8) years.

The grant to the New Orleans and Nashville Railroad Company was quickly followed by similar statutes for other railroads through other states and on other routes, including the New Orleans and Carrolton Railroad Company, of Louisiana,\textsuperscript{585} and the East Florida Railroad Company, of Florida.\textsuperscript{586} The grant to the East Florida Railroad Company required the company to repair any roads, bridges, or canals which the railroad crossed along the route, permitted the Territory of Florida (or state) to buy up to 25% of the stock of the company after twenty (20) years, and authorized the Company to build other roads in Florida on the same terms.

In 1852, Congress enacted an even broader program of easements and rights of way to introduce new transportation technologies into the nation's infrastructure system. The 1852 act granted a right of way \textit{to all rail and plank road, or macadamized turnpike companies} that are now or that may be chartered within ten years \textit{[after the act]}, over and through any of the public lands of the United States.\textsuperscript{587} To obtain this right of way, a rail or plank road or macadamized turnpikes company must be chartered by an act of the legislature of the States in which the right of way is located. The act authorized each company to survey and mark the public lands to be held by them for the track of said road not to exceed one hundred feet in width, and further authorized each company to use necessary earth, stone, and wood on public lands for the first construction of such roads. In addition watering sites along these rights of way were granted provided that construction starts with the ten year period following the act.

The general right of way provided in the 1852 act for railroads was confirmed in 1875.\textsuperscript{588} The 1875 acts also authorized the holders of such ROW's to take material, earth, stone, and timber which was necessary for the construction of the railroad from the right of way, and also to use adjacent land for station-buildings, depots, machine shops, side-tracks, turn-outs, and
water-stations. The amount of land used for these latter purposes was not to exceed 20 acres per station and 20 acres per 10 miles of railroad right of way. In order to claim the benefits of this act, railroad companies were required to file their plans for railroad construction with the register of the land office for the district where the land was located, and were required to complete the proposed construction within five years from start of construction.

The right of way concept was extended to another industry in 1896, when Congress granted rights of way over public land for oil pipelines throughout Wyoming and Colorado. Rights of way were registered with local land offices in the same way that railroad rights of way were recorded pursuant to the 1875 railroad right of way act.

10. Incentives to Quick Settlement

Congress used incentives to arrange for quick settlement of new territories or regions of the United States. One example is the response of Congress to a disastrous fire that consumed much of the City of Detroit in 1805. Congress immediately acted to encourage renewed settlement of the town, which was of strategic commercial and military importance to the United States, because of its location on the Detroit River between Lake Erie and Lake Huron. Congress authorized the Governor and judges of the territory of Michigan, or any three of them, to lay out a new town, including the entire town of old Detroit plus 10,000 acres of federal lands adjoining the City. Every citizen of Detroit who did not then owe allegiance to a foreign power and who resided in Detroit prior to the fire, was granted outright a lot of federal land not to exceed 5000 square feet.

Congress arranged for the prompt settlement of Oregon through unusually large grants of federal land: one whole section (640 acres) to married white males, and one half a section to single white males. Congress paid for a complete survey of the Oregon Territory, which required that both Section 16 and 32 in each township be reserved for schools, and that two entire townships (72 sections) be granted to the Territory for a University.

In 1854, Congress acted to move the sale of federal lands which had been offered for sale for long periods of time. Prices be acre were to be lowered depending on the length of time that offered land remained unsold. The schedule set by Congress was as follows:

<table>
<thead>
<tr>
<th>Length of Time Offered For Sale</th>
<th>Sale Price</th>
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<tbody>
<tr>
<td>10 years or more:</td>
<td>$1 per acre</td>
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<tr>
<td>Years or More</td>
<td>Cost per Acre</td>
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<tr>
<td>15 years or more</td>
<td>75 cents/acre</td>
</tr>
<tr>
<td>20 years or more</td>
<td>50 cents/acre</td>
</tr>
<tr>
<td>25 years or more</td>
<td>25 cents/acre</td>
</tr>
<tr>
<td>30 years or more</td>
<td>12.5 cents/acre</td>
</tr>
</tbody>
</table>

Congress continued its effort to encourage town site development through a series of acts authorizing the President to reserve town sites on the shores of harbors, at the junction of rivers, at important portages, and at any other natural or prospective centers of population. If the President designates any such town site, these acts required the federal government to survey these locations into “urban or suburban lots of suitable size”, to establish cash values for the surveyed lots through independent appraisal, and to offer the lots for sale “at public outcry, to the highest bidder.”

Congress also attempted to encourage quick settlement by dropping the land price for homesteaders agreeing to settle and cultivate arid and semi-arid lands in the Western states. Purchaser were required to agree to attempt to reclaim the land purchase through irrigation.

11. Federal Building Materials and Timber

Another incentive Congress offered to assist in the development of infrastructure was free building materials, to the extent such existed along rights of way. This same act permitted the cutting of timber on public timber lands and stone lands in California, Oregon, Nevada, and the Washington Territory, which were determined not to be cultivable. These lots were to be sold to individual citizens in lots not exceeding 160 acres each, but were not to include mineral lands. Another act passed the same day allowed free timber cutting on mineral lands of the United States, but only for resident citizens of Colorado, Nevada and the Territories, and only for building, agricultural, mining, and other domestic purposes.

12. Federal Standards

On occasion, Congress used its authority over navigable rivers and interstate commerce to provide common connections or standards in industries associated with infrastructure. For example, in 1866, Congress enacted the “Garfield Act”, which provided that every railroad operated by steam was entitled to connect with railroads of other States so as to form continuous routes for the transportation of mails, freight, and property on their way from one state to another, and to receive compensation therefor. The effect of the act was to permit movement of box cars and mail cars from system to system for reasonable compensation.
Congress also provided standards which regularized commercial conduct, with indirect benefits to infrastructure development, including standard gauges for iron and steel, and standard screw thread sizes.

13. Interstate Compacts

Although Congress controlled navigation on internal, "navigable", waterways, there was significant uncertainty about who owned the water flowing in those streams. Could headwater states divert upstream waters which were not navigable for their own internal use, thus reducing the volume of water available to downstream states? Interstate "bickering" about water rights was recognized at the time of the Constitution, which provided that suits on such matters between states would be tried and decided in the Supreme Court of the United States.

As attention turned to irrigation of arid and semi-arid lands of the West after the Reclamation Act was passed in 1902, the number of disputes among the states over water flow, diversion, and allocation grew in number, particularly with respect to the flow of the Colorado, the Platte, and the Missouri, and the Columbia Rivers. Congress moved in 1911 to encourage independent agreements among the states, called "Compacts", which allocated watershed flows. The incentives Congress offered were to agree in advance to the results of these negotiated compacts, and, more significantly, to fund reclamation projects implementing these compacts.

The first, and most famous compact, involved the Colorado River. Pursuant to a 1921 statute, then Secretary of Commerce Herbert Hoover served as the federal representative and negotiator in talks among Arizona, California, Colorado, Nevada, New Mexico, and Utah. Several years later, these talks produced the Colorado River Compact, which in turn resulted in the Bureau of Reclamation's largest project -- the Colorado River Storage Project (CRSP). The Project was designed to allocate the watershed's flow among the participating states and to assist each state to utilize its allocation to full advantage, through irrigation, power generation, and domestic use. The river's watershed was divided into an Upper Basin and a Lower Basin, with the point of division fixed at Lee Ferry, Arizona. The Compact provided that the "Upper Basin" could not bring stream flow at Lee Ferry below an aggregate of 75,000,000 acre-feet for any period of 10 consecutive years.

Based upon this fundamental agreement, upper basin and lower basin allocations were made among the states involved, also contained in the compact. Irrigation, domestic consumption, power generation, and storage for power generation were given priority as uses for Colorado River water over navigation up and down the river. On this basis, the great water and power projects of the Colorado basin proceeded during the 1930's, late 40's, 50's, and 60's, supplying power to Los Angeles, much of Southern California, and to Nevada and Arizona, as well as drinking water for Los
Angeles, and irrigation water for the Imperial Valley and other reclaimed farmland throughout the area.

Similar negotiations led to compacts with respect to the Columbia River among the states of Washington, Idaho, Oregon, and Montana, and for the South Platte River between the states of Nebraska and Colorado.

14. Leasing

Congress add another incentive mechanism early in this century, when it authorized the leasing of public lands. In 1920, in an effort to increase mining of coal, phosphate, sodium, oil, oil shale, and gas, Congress enacted the Mineral Lands Leasing Act of 1920, which permitted executive agencies to lease public mineral lands, particularly in large tracts. Leases were to be supervised by the Secretary of the Interior. The Mineral Lands Leasing Act of 1920 did not clearly permit oil and gas mining on land which were the subject of federal rights of way. In 1930, Congress extended the government's leasing options to include the land under all federal rights of way. Leasing was to be conducted under the supervision of the Secretary of Interior.

To assist in the rapid development of airfield in the late 1920's Congress authorized the Secretary of the Interior to lease public land for airfields, provided an annual rental fee was charged and collected by the Secretary.

B. Mini-Case Studies: 1780 to 1933

This section presents, in brief, a number of interesting projects undertaken during the period from 1780 to 1933 that have not been sufficiently described in chapter four. The purpose of presenting them here is to continue to demonstrate that, in our history, the application of individual ingenuity to create a competitive market advantage, or to solve a pressing strategic problem, drove much of American infrastructure development.

Mini-Case VII-1

1. The Great Falls Raceway and Power System, Passaic, New Jersey, Quadrant II.

In December, 1791, while he was Secretary of the Treasury, Alexander Hamilton and a friend from New York, William Duer, founded the Society for Establishing Useful Manufactures (Company). During the Revolutionary War, Hamilton became acquainted with the Great Falls on the Passaic River. After the War, Hamilton believed that to effectively compete with manufacturing plants in Britain, communities had to be founded which were devoted to manufacturing. The falls, which were 77 feet high and 280 feet
across, offered the opportunity to use abundant water power to run machinery at such a community, and the Company became a prime backer of a project to generate water power on the Passaic River at the falls. In anticipation that mills would be built for manufacturing once an abundant source of power was supplied, the Company built water works which could supply water power, and began selling lots on the basis that they would include access to water power.

Although the raceway system effectively offered water power, there was as yet insufficient capital and local interest in building the kind of mills Hamilton envisioned. Two decades would pass before the United States was ready to build and operate large mills with water power, but this occurred not in Passaic, but in Lowell. Passaic later developed as a manufacturing center, although not on Hamilton's time frame. The site is still used for hydroelectric power generation.

Mini-Case VII-2

2. Lancaster (Pennsylvania) Turnpike, Quadrant II.

The Philadelphia and Lancaster Turnpike, built by a private company chartered to do so by the state legislature, was completed in 1794. The road was the first major macadam highway in the United States, was approximately sixty-two (62) miles long, and connected Philadelphia with Lancaster, PA. The road generated large profits to the company that built and operated it, and led to a movement throughout the nation for the construction of similar roads. The Philadelphia and Lancaster Turnpike Company's tolls were established by its act of incorporation on April 19, 1792. Tolls were permitted to be collected every 10 miles along the route.

Mini-Case VII-3

3. Potomac Canal, Virginia, and Maryland, Quadrant II.

The history of the Potomac Canal is inextricably tied with the life of George Washington, who was the first President of the company chartered by both Maryland and Virginia to build it, the Potomac Company. Washington became the Company's first President on May 17, 1785, and served until February 4, 1789, when he became President of the United States.

The background of the company and the project begins in 1749, when Washington joined a group of Virginians, organized themselves as the Ohio Company, and began preparing plans to settle the northern reaches of the Potomac River. As a surveyor, Washington helped in the effort to blaze a trail up the Potomac and down the Monongahela River to land held by the company in the Ohio river valley. Washington was interested, during this time, in arranging for improved navigation up the Potomac River to permit
and encourage settlement beyond the Appalachians. The War intervened, and it was not until October, 1784, that Washington renewed his effort to survey the Potomac, form a company, and make improvements to navigation on the river. In October, 1784, Washington proposed that Virginia charter a company to build a canal up the Potomac. Because Maryland had water rights to the Potomac, a joint charter was required and obtained in 1785.

At the time of the charter, goods from the Ohio River Valley were inaccessible to the American seaboard. New Orleans was held by the Spanish, while Quebec and Montreal were held by the British. Yet, one-half of the population lived beyond the Appalachians.\textsuperscript{516}

At the first meeting of the Potomac Company, four hundred (400) shares of stock were sold, at $400 per share. Although the company was in constant financial difficulty, most of canal opened in 1797. Included in the facilities were the canal around the Great Falls, just 12 miles above Georgetown, and a two mile canal around the Little Falls, just 5 miles above Georgetown.\textsuperscript{617} Ten thousand dollars ($10,000) was taken in tolls in the first year and a large quantity of goods were shipped.

But the canal was never an economic success. By 1819, the company had spent approximately $7,000,000, and paid only one dividend to shareholders of $30,000\textsuperscript{618}. In that year, the Company was bankrupt. Operations continued until 1828, when the route was taken over by the Chesapeake and Ohio Company.

Mini-Case VII-4

4. Middlesex Canal, Quadrant II.

On June 22, 1793, the Middlesex Canal Company was chartered to build a canal connecting Boston with the Merrimac River by the Massachusetts General Court.\textsuperscript{519} Operated by the Proprietors of the Middlesex Canal, the object was to connect Boston to the inland commercial areas of New Hampshire through construction of a canal between the Merrimac River (above the Pawtucket Falls) and the Charles River in Boston. Work commenced in 1794, and by 1804, the canal was opened to Woburn, and opened to Boston in 1808. Completion of all work was announced by the Proprietors in 1817. The canal was 27 miles long and crossed over seven rivers on aqueducts. Barges could carry up to 25 tons, an extraordinary improvement over road travel. The Concord River was used to feed the canal in the middle using a pond whose water level was at the grade of both the river and the canal.\textsuperscript{620}

The canal was effective in diverting trade to Boston from Portsmouth, New Hampshire, but as early as 1810, revenues were not covering operating expenses, repairs, and necessary improvements. Requesting help from the
State, the Proprietors were given substantial grants of land in Massachusetts, which was sold to raise money to fund improvements. The canal apparently raised the value of land adjoining it by about one third, and increased the value of wood lots in New Hampshire, used for fuel in Boston, up to five fold. Annual revenues remained marginal, with reasonably good years sprinkled in between. For example, receipts were $32,600 in 1816, a high point, but only just enough to service the construction debt and produce a 3% profit. As the population of Middlesex County grew, so did the prospect that there would be sufficient traffic in goods and people to support the canal. This did not occur, because railroad competition shortly put the canal out of business. Revenues were cut by one third when Boston and Lowell Railroad was put in operation, and by another third when the Nashua and Lowell Railroad opened. After the assets of the company were seized in April, 1860, the Boston and Lowell purchased most of the company's assets for $130,000.

Mini-Case VII-5

5. The National (or Cumberland) Road, Quadrant IV.

The National Road was the first highway in the United States built entirely with federal funds. The road was originally built from Cumberland, Maryland to Wheeling, Virginia, where it intersected with roads previously begun by Ebenezer Zane (and since improved). Eventually, the National Road was extended through Ohio, Indiana to Vandalia, Illinois.

The general route followed from Cumberland to Wheeling was first known as Nemacolin's Trail. Washington had followed it with the British army and a group of Virginia militia sent to Fort Duquesne in 1854 (the site of present day Pittsburg). In 1755, with General Braddock in command, Washington returned along the same route, this time ahead with 600 road, who cleared a road twelve foot wide for the army. The route, now known as Braddock's road, was used continuously thereafter to traverse the Appalachians to the Ohio River valley.

In 1806, Congress authorized the President to hire three disinterested commissioners to lay out the National Road. Costs for the survey and marking, together with construction were to be paid directly by the government, and Congress appropriated $30,000 for the task. Congress provided a general description of what it wanted in the project, including an outline of the route to be followed and a short set of specifications. The route was to follow a "Path from Cumberland, Maryland to the Ohio River, a "little below Wheeling". As for specifications, the road was to be four rods wide (4x16.5 feet), with a maximum grade of 5%, with a raised middle, and with drainage ditches on the sides. Plain marks were to be made on trees, stakes, or monuments every one-quarter mile. The statute also required that after the commissioners work was done and the road laid out, a full report was to be presented to the President with maps, the commissioners' recommendations,
a plan for construction, and an estimate by the commissioners of the cost to build the road.

Under the act, the President was given a simple choice: either to reject or accept the commissioners' report in its entirety. If accepted, the President was authorized to get consent from the states involved to build the road. Work commenced in 1811, and the first section from Cumberland to Wheeling was completed in 1818.

Construction costs were to be funded through moneys received from Ohio land sales. However, a string of subsequent acts by Congress appropriated more and more money for construction. As time passed, the source of these funds went well beyond the proceeds to the 5% fund from land sales in the Northwest Territory.

Table VII-1

<table>
<thead>
<tr>
<th>Congressional Enactment</th>
<th>$$$ Appropriation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 St 357, 3/29/1806, Initial Statute</td>
<td>$30,000</td>
</tr>
<tr>
<td>2/14/1810, Act to Amend Statute re the National Road, 2 St 555</td>
<td>$60,000</td>
</tr>
<tr>
<td>3/3/1811, Further Act re the National Road, 2 St 661</td>
<td>$50,000</td>
</tr>
<tr>
<td>5/6/1812, Further Act re the National Road, 2 St 730</td>
<td>$30,000</td>
</tr>
<tr>
<td>2/14/1815, Further Act re the National Road, 3 St 206</td>
<td>$152,984.60</td>
</tr>
<tr>
<td>3/3/1825, Act for Continuation of the National Road, 4 St 128</td>
<td>$10,000</td>
</tr>
<tr>
<td>3/2/1827, Act for the Preservation of the National Road, 4 St 228</td>
<td>$30,000</td>
</tr>
<tr>
<td>5/19/1828, Appropriations for Harbors, Lights, Cumberland Road, and Surveys, 4 St 275</td>
<td>$175,000</td>
</tr>
<tr>
<td>3/2/1829, Act for Construction of the National Road, 4 St 351</td>
<td>$100,000</td>
</tr>
<tr>
<td>3/2/1829, Act for Continuation of the National Road, 4 St 351</td>
<td>$50,000</td>
</tr>
<tr>
<td>3/3/1829, Act for Preservation of the National Road, 4 St 351</td>
<td>$100,000</td>
</tr>
<tr>
<td>5/31/1830, Act Appropriating for Internal Improvements, 4 St 427</td>
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<td>3/2/1831, Act for Continuation of the National Road, 4 St 351</td>
<td>$244,915.85</td>
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<tr>
<td>3/2/1833, Act Appropriating for Internal Improvements, 4 St 648</td>
<td>$459,440</td>
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<tr>
<td>6/24/1834, Act for Continuation/Transfer of Nat. Road, 4 St 680</td>
<td>$750,000</td>
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<td>Date</td>
<td>Description</td>
</tr>
<tr>
<td>-------------</td>
<td>-------------------------------------------------------</td>
</tr>
<tr>
<td>7/2/1836</td>
<td>Act Continuation &amp; Transfer of National Road, 5 St 71</td>
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<td>3/3/1837</td>
<td>Act Continuation &amp; Transfer of National Road, 5 St 195</td>
</tr>
<tr>
<td>5/25/1838</td>
<td>Act Continuation &amp; Transfer of National Road, 5 St 228</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
</tr>
</tbody>
</table>

Political controversy surrounded the project, which was centered on the question whether the Constitution authorized the national government to build internal improvement projects, or whether this power was left to the states, consistent with the Tenth Amendment. Sectional interests were involved, as well. For example, why should federal tax dollars be spent on developing the National Road, which primarily benefited Baltimore and Washington, when similar aid was denied to the State of New York in connection with the construction of the Erie Canal? Why should tax dollars from New Englander’s support the construction of the National Road?

Surrounded by this controversy, in 1820, Congress passed an act authorizing the commissioners to make a survey **ONLY to be used by the States** to extend the National Road from Wheeling through Ohio, Indiana, and Illinois to the Mississippi River.\(^623\) Congress was interested in increasing the value of federal land holdings in these same states, and a surveyed route for the National Road through to the Mississippi was viewed as a good mechanism to increase land values.\(^624\) The act followed the familiar formula of authorizing the President to appoint three commissioners to lay road out all the way to the left bank of the Mississippi, at a point “between St. Louis and the mouth of the Illinois river”. Limited specifications were again provided, including a surveyed width of 80 feet, marked by trees, stakes or other conspicuous monuments at the distance of every quarter of a mile. Plans were to be delivered to the President, including an estimate of expense of making each section of the road.\(^625\)

Work on the extension did not proceed well or quickly, despite healthy appropriations from Congress. In 1825, Congress acted to require the President to appoint a single, independent, superintendent who was personally supervise and oversee the expenditure of all appropriated moneys and to ensure that the road opens promptly.\(^626\) The superintendent was to contract the work out to separate companies in ten mile segments along the route. This piece-meal scheme was extended in 1829, but the work was still incomplete.\(^627\) By 1829, Congress had changed the description of its financial support for the National Road to “preservation”.\(^628\) This term was found more politically acceptable to a Congress where there was increasing hostility to further funding. Beginning in 1829, Congress was both “preserving” and extending the road with its appropriations, including repairs to the original section of the road from Cumberland, Maryland to Wheeling, Virginia.
By 1830, support for extending the road to the Mississippi was over. The 1830 act appropriated more funds to complete the road, but now, the project was not to extend to the Mississippi River, but stop when the road reached Vandalia, Illinois. Funds appropriated were split between construction west of Zanesville and repairs east of Wheeling. This pattern of construction westward and repairs eastward continued in subsequent years.

The "Final" Appropriation. The 1834 act marked a turning point in funding for the road. Congress specifically stated that this act would contain the final appropriation for construction westward (a whopping $450,000) or for repairs eastward (a large sum of $300,000). The statute required the Army Corps of Engineers to disburse the last appropriation, after which the entire road shall be surrendered to the states through which it passes. The statute also required that "the United States shall not thereafter be subject to any expense for repairing said road". Despite its resolve in 1834, Congress simply could not hold the line on spending in support of the National Road. In 1836, $600,000 more was appropriated as Congress' "final, final" financial support for westward construction. Three years later, another "final" appropriation of $397,183.63 was made. In 1838, yet a fourth "final" appropriation of $450,000 was made for construction of the road westward from Wheeling.

Congress got out of the "road construction and maintenance" business between 1848 and 1856, when it successively transferred the entire interest of the United States, including the right to use earth, timber, stone, and other materials along the right of way, to the states of Indiana, Ohio, and Illinois.

Mini-Case VII-6

6. Bridge Over the Potomac, Quadrant II.

In 1808, Congress authorized an excellent early example of a Build Operate Transfer (BOT) project in the United States. The project involved the erection of a bridge over the Potomac River between the city of Washington and Alexander's Island. The statute chartered a number of citizens in Washington to act as a board of commissioners for "The Washington Bridge Company" and to receive subscriptions for raising capital stock not to exceed $200,000, in shares of $100 each. The franchise given to the Company by Congress was to build, maintain, repair, and operate the bridge as a toll facility for sixty (60) years, at which time the bridge would become the property of the United States and free from toll. Tolls were set in the statute by the Congress, not by the bridge company. Sections 9 and 10 of the act contain an outline specification for the project, including the specific route of the bridge from Maryland Avenue in the District to Alexander's island. Minimum requirements were also included, including that the main thoroughfare be 36 feet wide to accommodate travelers by horse and carriage, and for cattle. The bridge was to have four foot railings on each side, with an additional six foot
wide path for pedestrians, also separated with another 4 ft railing. The statute required that the bridge was to be made of good and suitable materials. The statute also specified a draw in the bridge at least 35 feet wide in the main span, a second draw at least 15 feet wide on the Maryland span, together with a quay to be used for boats to tie up to the bridge.

In exchange for the franchise, and the right to collect tolls, the government retained the right to move federal troops, equipment, and property over the bridge free from toll throughout the franchise period.637

Correlative Note VII-3

This project is the first in a number of examples by Congress using the BOT model to encourage the development of infrastructure. Note, however, that these early BOT projects differ significantly from Hong Kong’s BOT projects, described in Chapter 2, and from the conclusions reached in this thesis. There was no procurement process to be conducted by the government to permit the government to select “best value” from among a number of competing proposals. In the case of the bridge over the Potomac, Congress conducted no competition among interested proposals to build the bridge. Did the statute represent the most favorable combination of toll rates, franchise period, design/construction? Congress did not test the competitive waters of the Potomac to find out.

Mini-Case VII-7

7. The Washington and Alexandria Turnpike, Quadrant II.

On the heels of the act establishing the Washington Bridge Company, a second Build Operate Transfer (“BOT”) franchise was enacted by Congress in 1808 for the development of the Washington and Alexandria Turnpike, which connected Alexandria with Alexander’s island at Bridgepoint.638 The Washington Bridge project and this project connected the City of Washington to Alexandria by road. The act was similar to that for the Washington Bridge,639 except that Congress explored different means of setting, changing, and eliminating tolls.640 The franchisee was chartered as “The Washington and Alexandria Turnpike Company” and was authorized to take subscriptions for raising capital stock not to exceed $50,000, in shares of $50 each. Shares were issued upon payment of a $10 cash deposit. Shares in the Company were transferable. The act also authorized the Company to acquire land along the route of the roadway. If a sale price could not be agreed between the Company and the owner, the price to be paid by the Company was to be set by a grand jury.

The mechanism by which tolls were established was quite different for this project. Initial toll rates were set in the act by Congress. After the road
opened, the Circuit Court of the United States for the District of Columbia was empowered to regulate the level of the tolls, to determine when the tolls should cease, based upon the filing of annual financial statements by the Company each year. The act required that the Company was authorized to collect tolls until the capital expense of building, operating, and maintaining the road plus 12% is returned to the Company. After that point, the road was to revert to public ownership, free from toll.

Correlative Note VII-4

Congress took an entirely different tack on setting tolls for the Washington and Alexandria Turnpike Company, making a mistake that has become classic in procurement planning. Faced with a difficult problem of how to set tolls in a non-competitive, sole-source procurement, Congress could have chosen to obtain comfort on toll terms through innovative ways to add competition for the BOT franchise.\textsuperscript{641} Such a competition might have produced a choice of alternatives for the government, from which "best value to the government over the franchise period" could have been evaluated. Only one ingredient of this evaluation would have been the "toll rates and terms" proposed. Advantages of a competition include (a) choice (to the government), (b) market prices and terms, and (c) an arms-length relationship between the government and the franchisee governed by terms established and agreed at the start of the franchise.

Congress elected to follow a different course, the effect of which was to (a) cap potential earnings for the Company at 12\%,\textsuperscript{642} thereby introducing substantial ambiguity on the financial side of the transaction, (b) preclude an independent financial and technical check of the project in the marketplace, and (c) create a potentially adversarial relationship between the government and the franchisee over toll rates, duration, and changes.

Mini-Case VII-8

8. Mason’s Causeway Turnpike, Quadrant II.

Only one year later, Congress authorized a third BOT project,\textsuperscript{643} this time for the purpose of building and operating a road between the west end of Mason’s Causeway to Alexandria, which was then part of the District of Columbia. The statute is nearly identical to that authorizing the Washington and Alexandria Turnpike Company, except that Congress tinkered with how the price of land required to be purchased for the road would be set.\textsuperscript{644} This statute authorized citizens to act as a board of commissioners for the "Georgetown and Alexandria Turnpike Road" and to receive subscriptions for raising capital stock not to exceed $20,000, in shares of $100 each.
Mini-Case VII-9

9. General Authorization of the Columbia Turnpike Company, Quadrant II.

In 1810, Congress authorized a number of BOT turnpike projects at once, when it chartered a group of citizens to act as a board of commissioners for the "President, Directors and Company of the Columbia Turnpike Roads." The Company was authorized to receive subscriptions for capital stock not to exceed $60,000, in shares of $100 each. In this act, Congress expanded the use of the BOT model to authorization for multiple projects. The statute is otherwise remarkably similar to earlier BOT statutes, although Congress continued to tinker with the means for valuing land taken by the Company to build roads. In this statute, Congress authorized the Company to acquire land, the value of which would be set by three independent, non-interested people appointed by Court, if a mutually agreeable price could not be set. This procedure is quite similar to binding arbitration.

Mini-Case VII-10

10. Alexandria Turnpikes Franchised. Quadrant II.

Congress continued to expand the use of BOT processes in 1813, when it authorized another company to build a series of turnpikes in Alexandria City, the "Alexandria and Leesburg Turnpike Company". A repeat of the statute authorizing the Columbia Turnpike Roads company, the Alexandria and Leesburg Turnpike Company was aimed by Congress at construction and operation of a number of smaller roads within the city limits of Alexandria. The Company was authorized to receive subscriptions for capital stock not to exceed $8,000, in shares of $50 each. The first project authorized was for a road between West Street and Pendleton Street in Alexandria.

Tolls were set in the statute and adjusted in the same way described above, that is by a Court, after reviewing annual financial statements of the Company. Profits were capped at 12% per annum. The franchise ended and the road became free upon a finding by the Court that capital and operating expense plus 12% had been returned. A subsequent statute provided that when such turnpike roads in Virginia became free, the levy court of Alexandria County, Virginia would be required to collect funds to keep the road in good repair, at the expense of the county. Shares were transferable.
Mini-Case VII-11

11. Georgetown and Leesburg Turnpike, Quadrant II.

Yet another example of the BOT model is the franchise awarded to the "Georgetown and Leesburg Turnpike Company", chartered by Congress to improve a road between Falls Street and Water Street in Georgetown to the boundary line of the District of Columbia by the most direct route possible. This Company, too, was authorized to build and operate multiple turnpikes. The Company was authorized to receive subscriptions for capital stock not to exceed $10,000, in shares of $50 each for the Fall Street project. This act is a repeat of that authorizing the Alexandria and Leesburg Turnpike Company.

Correlative Note VII-5

The number of BOT projects authorized by Congress for turnpikes, bridges, and canals in and around the City of Washington in the decade beginning with 1808 represents a consistent pattern in American infrastructure development. Once Congress creates a particular mold for producing infrastructure projects, it is very difficult for Congress to proceed in other ways. Three examples of this pattern readily come to mind during the period from 1780 to 1860. One example of this pattern is the Turnpikes surrounding Washington. Another is the railroad land grant model Congress first enacted in connection with rail transportation between Chicago and Mobile, Alabama. The coalition of Representatives and Senators assembled by Stephen Douglas of Illinois to support the initial bill, reenacted this same procurement mechanisms for eleven other projects in the next ten years. A third example is the direct, segmented procurement model followed by the Congress for the construction, extension, and repair of the National Road. After the first appropriation, Congress had a difficult time saying "no".

Mini-Case VII-12


In 1824, Congress began long effort, supplemented by nineteen additional statutes between 1824 and 1844, to improve navigation on the Ohio and Mississippi Rivers through federal appropriations to be spent on contracts to clear these rivers. The statute identifies a number of sand bars along the route which are to be removed from the river, and authorizes the President to cause to be removed all trees, stumps, and other growth in the Ohio River between Pittsburgh and the location where the Ohio meets the Mississippi. In this effort, Congress was directing the result and dealing with the peculiarly federal right to control the navigable waters and rivers of the United States.
Correlative Note VII-6

Could Congress have "franchised" the clearing of the Ohio and Mississippi Rivers by chartering a company or companies to clear and maintain specific segments of these waterways? No, because of the provisions of the Northwest Ordinance of 1787. The Ordinance included an agreement among the original states which relinquished all states' competing claims to the lands of the Northwest Territory (Ohio, Indiana, Michigan, and Illinois). The agreement required that the navigable rivers and waters throughout the Territory would be "forever free", without toll or duty. A toll-free franchise is a non-sequitur, better to be accomplished through direct contracts in Quadrant I or Quadrant IV.

Mini-Case VII-13

13. The Chesapeake & Ohio Canal. Quadrant II.

In 1825, in an effort to provide financial support for the struggling Chesapeake and Ohio Canal, Congress followed an indirect route to provide financial assistance, one that involved substantial risk for the government. The Act required the Secretary of the Treasury to buy 1500 shares of stock in the Chesapeake and Ohio Canal Company. The stock subscription was of questionable value to the project, as described below.

The Chesapeake and Ohio Canal was an attempt to expand and replace the Potomac Canal, which had failed financially in 1819. The goal was to connect the coal fields on the eastern side of the Allegheny Mountains with Georgetown. Virginia had already incorporated the Chesapeake and Ohio Company on February 22, 1823. Unlike the case of the Potomac Canal, a similar bill in Maryland’s legislature to charter the Chesapeake and Ohio Company failed to pass, primarily because Baltimore’s interest lay in the development of the Susquehanna River, rather than the Potomac.

On April 30, 1824, President Monroe signed a bill appropriating $30,000 for surveys and cost estimates in connection with canal and road development in the United States. More than one half of this amount was spent on surveys of the route for the proposed canal. Federal engineers estimated the cost of the canal would be in excess of $8,000,000, five times that estimated by any previous survey. The Company engaged its own engineers, who "confirmed" the Company's claim that the project could be constructed for approximately $3,500,000. The Company commenced work on the project in 1828, with the United States as a shareholder. Construction proved very difficult, and final costs exceeded even the $8,000,000 projected by the federal engineers. Construction was not completed until 1850.
By 1850, the state of Maryland had been forced to come to the financial aid of the project, with stock subscriptions of $125,000 in 1834, a loan of $2,000,000 in 1835, another stock subscription of $3,000,000 in 1836, and yet another in 1839 of $2,000,000. By the time the canal was finished in 1850, Maryland was the largest investor. At that time, the Baltimore and Ohio Railroad had been transporting coal to Baltimore from the Allegheny Mountains for eight (8) years. The canal was only able to capture approximately one-third of the Allegheny coal market, but this was not enough to produce any return on the shareholders' investment. Interest on bonds sold by the Company was no longer paid after July 1864.\textsuperscript{658}

Mini-Case VII-14

14. The Louisville/Portland Canal Company. Quadrant II.

In 1826, Congress required the Secretary of the Treasury to buy not more than 1000 shares of stock in the Louisville and Portland Canal Company for a price not to exceed $100 per share.\textsuperscript{659} This project was of critical importance to opening the Ohio and Mississippi Rivers to uninterrupted traffic from New Orleans to Pittsburgh.

The canal was to circumvent the Falls of the Ohio at Louisville, Kentucky. Since the first settlement of the Ohio river valley, the obstruction of the Ohio River at Louisville impeded commerce up and down the Mississippi. In 1817, the first steamboat had reached from New Orleans to Cincinnati, but only because extremely high water permitted. In the same year, approximately 5,000 flatboats crossed the falls, 3,000 of which required pilots. The cost of these pilots, estimated at $15,000 per year,\textsuperscript{660} provided the cash flow which, it was hoped, could provide a means to construct a canal around the falls. River pilots were adamantly opposed to the canal, while long shippers and steamship companies favored its development. The project generated extensive controversy over which side of the Ohio river to construct the canal, beginning in 1817. An interstate commission with one representative from Kentucky, Ohio, Virginia, and Pennsylvania [without a member from Indiana] unanimously recommended that the canal be built on the Kentucky side. Indiana responded by promptly appropriating $10,000 to help fund the Jeffersonville Canal Company, whose purpose was to build the canal on the Indiana side. Kentucky appropriated $100,000 for the construction of the Portland Canal, on its side of the river. The impasse continued, until Congress favored the Portland Canal through a federal stock subscription on May 13, 1826. The canal was opened in 1828.
Mini-Case VII-15

15. The Dismal Swamp Canal. Quadrant II.

Five days after enacting legislation to subscribe to stock in the Portland Canal, Congress passed legislation requiring the Secretary of the Treasury to buy 600 shares of stock in the Dismal Swamp Canal Company at $250 per share. The statute was generally similar to that for the Portland Canal, except that the Army Corps of Engineers was required to investigate and report on the feasibility of the canal. The purchase of shares was not to take place unless the examination of the project by the Corps of Engineers resulted in an opinion that (a) the Company’s plan for the canal was consistent with Congress’ plan for a chain of canals along the Atlantic Coast, and (b) that the sum authorized, $150,000, would be sufficient to finish the canal. The statute also required that the appropriations be used to finance the completion of the canal, and for no other purpose whatsoever, including payment of any debts then owing by the Company.

Correlative Note VII-7

Congress’s subscription of stock in the Chesapeake and Ohio Canal Company, the Louisville/Portland Canal Company, and the Dismal Swamp Canal Company were precedents Congress found difficult to handle with the advent of railroads. On what standards could Congress select a few projects among many to support through stock subscriptions? The answer was not apparent in 1830, and remains elusive today.

The competition between the C&O Canal and the B&O railroad for federal stock subscriptions is a classic example. Both the C&O canal and B&O railroad had competing groundbreaking ceremonies on the Fourth of July, 1828. In 1830, a bill was filed in Congress to give aid to the Baltimore and Ohio Railroad through a federal stock subscription. If passed and signed into law, Congress would be in the position of investing in the stock of competing ventures for coal transportation from the eastern slope of the Alleghenies. The conflict between the Chesapeake and Ohio Canal and the B&O Railroad was now apparent, as the canal also sought further stock subscriptions or other federal aid. A Senate committee favored the stock subscription to the B&O. In the House, however, Representative Mercer was both the President of the C&O Canal and the Chair of the House Committee on Roads and Canals. There, the bill suffered a quick defeat. Mercer drew the conclusion that it was impossible to convince the Senate to discard its “delusion” that railroads were preferable to canals. The rivalry between the C&O and the B&O continued into 1832, when a court had to determine which company had the prior claim to control a narrow valley along the Potomac above the Point of Rocks, where there was hardly enough room to build both a canal and a railroad.
Mercer probably made a mistake in concluding that canals, not railroads, more likely represented the future of transportation in America. Both the Senate and the House, however, probably made a bigger mistake in putting the federal government in the position of choosing to invest in a handful of private ventures, giving the appearance that the federal government would provide funds to rescue private companies from their own mistakes in judgment.

Mini-Case VII-16

16. Detroit, Michigan Waterworks, Quadrant II.

Between the time of the first European settlement of Detroit in 1701 until 1805, Detroit had no water supply problems. Virtually all of the town's homes were located along the Detroit River. Needed water was simply drawn from the river. A disastrous fire destroyed virtually the entire settlement in 1805. In response to fears over another fire, water wells were constructed throughout the rebuilt town. As the town grew, and homes were constructed away from the river, these wells also served as a drinking water supply. Faced with steady increases in the demand for water, on February 26, 1820 turned to a Build-Operate-Transfer mechanism. Proposals were invited "... for the exclusive privilege of erecting water works within the city of Detroit, for the purpose of furnishing the inhabitants thereof with water for a certain number of years ... [each] proposal to specify the sum and number of years." A franchise was awarded, and by March 23, 1827, a functioning privately owned water works system was in operation. The works consisted of a pumphouse with a storage cupola 40 feet high. The system was steadily expanded to include, by 1830, a steam engine which served double duty for the water system and to operate machinery at the Detroit Iron Works.

In 1836, the private system was converted to a publicly owned and operate system when the City purchased the entire works from the franchisee for the sum of $20,500.

Mini-Case VII-17

17. Pennsylvania Railroad, Quadrant II.

On April 13, 1846, the legislature of the state of Pennsylvania chartered the Pennsylvania Railroad Company, and gave the Company the authority to construct a railroad from Harrisburg to Pittsburgh, with branches to Erie, Blairsville, Uniontown, and to any parts of the counties through which the main road might pass. The purpose of the railroad was to accomplish what New York had done through the Erie Canal and what Pennsylvania had failed to economically achieve through the Pennsylvania Portage Road -- an
efficient, inexpensive connection between the Ohio River valley and the state’s chief eastern port.

The statute authorized the Company to received up to $10,000,000 in stock capital for the purpose of building the road. Stock was purchased mostly by Pennsylvania residents in an effort that included house-to-house canvassing. Over $1,000,000 in stock was subscribed between April, 1846 and July, 1847. In exchange for the charter, the Company agreed to pay $0.033 for every ton of freight carried one mile on the railroad system. The state also reserved to itself the right to purchase the road at the end of 20 years at cost, with 8 percent interest thereon, after the profits of the company were deducted.\(^{66}\) Subscriptions to the Company’s stock were high, contracts for construction let, and the eastern portion of the road completed by 1850. In 1854 the Mountain Division was completed, connecting Philadelphia directly with Pittsburgh.

Mini-Case VII-18

18. Lowell Lock and Waterways, Quadrant II.

This waterways project established the City of Lowell and resulted in one of the first industrial manufacturing centers in the United States.\(^{569}\) Built at the Pawtucket Falls on the Merrimack River, the project was similar to the Great Falls Project on the Passaic River in New Jersey, except that its private promoters were textile manufacturers who could match the opportunity to provide water power with the commercial need to construct particular manufacturing plants which could use this power.

An early canal around the Falls was completed in 1796 by the Proprietors of the Locks and Dams, but fell into disrepair and disuse by the early 1800's. Francis Cabot Lowell, a Boston merchant who visited British textile factories in England and Scotland in 1811, returned from Great Britain to start a firm called Boston Manufacturing Company. After first building a small mill using water power in Waltham in 1813, and developing an effective power loom which used water power to drive it, Lowell determined that the Charles River simply could not provide enough power for the Company's mills at Waltham. In 1821 the Boston Manufacturing Company acquired control of the Proprietors of the Locks and Dams Company in Lowell. In 1822, Lowell merged the two entities in a new company called the Merrimack Company.\(^{570}\) The Merrimack Company proceeded to build, at its own expense, a series of locks, dams, water wheels, pulleys and conveyors, that powered all the numerous mills built by the company. The site was close to the newly opened Middlesex canal,\(^{671}\) providing ready transportation to Boston markets. By 1836, the income stream from water rental agreements between twenty six textile mills at the site and the Company was sufficient to finance four additional canals and a storage reservoir. These mills, along
with other shops and works, produced 50 million yards of cloth each year and employed 8,000 people.672

Mini-Case VII-19

19. The Erie Railroad, Quadrant II.

Sectionalism in infrastructure development during the period is well demonstrated by the construction and operation of the Erie Railroad Company, which was built to extend the territorial claims of New York state to the commerce of the West, particularly, the Great Lakes. The route authorized was between Piermont, New York (on the west side of the Hudson River) to Dunkirk, New York (on Lake Erie). The Charter creating the company was granted by the New York legislature on 4/24/1832. The railroad’s gauge was made wider than standard, to prevent diversion of rail traffic, passengers, or cargo to Boston, Philadelphia, or Baltimore. Another of the charter’s peculiar provisions prohibited any connection with Pennsylvania and New Jersey railroads. The lack of connections with Pennsylvania and New Jersey backfired on New York at a later time, when through traffic required connections, which the Erie could not supply. Although the charter was granted in 1832, little progress was made on the road until 1840. Between 1836 and 1840, including the time of the Panic of 1837, some counties along the proposed route were willing to construct the road privately, while other counties were waiting for state aid for the road. In 1838, the state granted funds for the construction of the terminals at Dunkirk and Piermont, and authorized loans to be made to the company of $100,000 for each $100,000 in private funds contributed to the capital of the company. This incentive proved insufficient to raise enough private capital to complete the road, so in 1840, the legislature amended the 1838 statute to authorize $100,000 in loans for each $50,000 in private contributions to the capital of the Company. In all, approximately $3,000,000 was loaned to the company by the State of New York.

As of 1842, $15,000,000 had been spent on construction and $6,000,000 more was estimated to complete the effort. Parts of the line were opened, and the southern section from New York City to Middletown was very profitable. Large quantities of milk, poultry, fruit, and vegetables began to be shipped to the city, fueling farming expansion in NY state and feeding a burgeoning population in the city. After further fits and starts, track laying began in earnest in 1848, and the road was opened to Binghamton in early 1849 and completed to Lake Erie on May 15, 1851.
Mini-Case VII-20

20. The (First) Canal at St. Mary’s. Quadrant II.

In 1852, Congress gave the State of Michigan a right of way and a grant of land to arrange for the construction of a canal through the military reservation at the Falls of St. Mary’s. The St. Mary’s river connects Lake Superior to Lake Huron, but was yet impassable for large ships. The right of way granted was 400 feet wide, and provided that any canal erected over the right of way was to be at least one hundred (100) feet wide, twelve (12) feet deep, with locks at least two-hundred and fifty (250) feet long and sixty (60) feet wide. Before construction could begin, the Secretary of War had to approve the actual canal route through federal lands, including the size of the canal and lock system. Congress also provided that the canal was to be funded through the sale of public lands held by the United States for private sale. The statute gave Michigan the right to sell 750,000 acres of these lands to finance construction of the canal. Federal troops, cargo, and personnel were to have free passage through the canal forever. Tolls on the canal were to be set to reimburse for the expenses to build and operate the canal, together with legally permitted interest as a profit. Once this reimbursement was made, tolls were to be reduced to a point at which the canal was a break-even proposition.

As an incentive for the state to start and complete the project quickly, the statute also provided that if the canal was not started within three years and completed within ten (10) years, the state of Michigan was required to pay the United States all the proceeds collected by the state from the sale of public lands. The canal was constructed by a private company, who obtained a franchise from the state to build and operate the facility. Work was completed in 1855, at a cost of approximately $1,000,000, twice that estimated. The company still prospered because the grant included land rich in copper. Tolls were sufficient to pay for the cost of repair and maintenance, especially as boat traffic increased dramatically.

Mini-Case VII-21

21. The Clinton, Iowa, Waterworks. Quadrant II.

Located on the Mississippi River due West of Chicago, Illinois, Clinton, Iowa lies approximately forty miles upriver from Davenport, Iowa. In 1874, in order to obtain a larger, more reliable source of water, the town granted a franchise to the Clinton Water Works Company, a private firm, design, construct, operate, and maintain a pumping station and water supply for the town in the public park located on the Mississippi River waterfront. The original works took water from the river and filtered it through boxes filled with sand for delivery to the inhabitants. In 1886, two artesian wells were installed by the company to supplement the sources of water, and in 1889,
when the town extended the franchise through a r. & N. agreement, the river was abandoned as a source of water, and wells were substituted instead. Throughout the period from 1874 to 1939, Clinton received its water through franchise agreement with the Company.676

Mini-Case VII-22


The purpose of this project was to reverse the flow of the Chicago River, so that instead of flowing into Lake Michigan, where it had caused significant pollution problems, clean water from the Lake would flow into the Chicago River, through the sanitary canal via the Des Plaines, Illinois, and Mississippi Rivers to New Orleans. Reversal of flow accomplish the dual tasks of protecting Lake Michigan as a source for Chicago's drinking water and diluting pollutants in the Chicago River.

The background of this project has been touched upon previously. The first water connection between the Great Lakes and the Mississippi was the Illinois and Michigan Canal, completed in 1848, and supported by land grants from the federal government to the State of Illinois.677 Increases in ship sizes resulted in substantial money and effort being expended to deepen the canal in 1871.

As Chicago's population and manufacturing plants grew explosively, the large volume of sewage that was fed into the Chicago River polluted the lower basin of Lake Michigan. The effect on drinking water quality became a stark reality in August, 1885, when 6.19 inches of rain fell in a two-day period in Chicago. Overflowing catch basins emptied into the River and the Lake, spreading sewage and bacteria into the intake crib for the city's lake water supply. Twelve percent (12%) of the City's 250,000 inhabitants, approximately 30,000 people, died of cholera and other diseases.

A commission was formed to solve the city's water and sewer problems. Their recommendation was that the city's sewage must be separated from the City's water supply -- Lake Michigan -- 678 by redirecting the Chicago River away from the Lake to the Des Plaines River. The short portage that carried Indians and French fur trappers from Lake Michigan to the Mississippi would now be used to protect Chicago's drinking water.

The commission calculated that to effectively flush the Chicago River of sewage, a canal would have to be large enough to permit a flow of 24,000 cubic feet of water per minute for every 100,000 residents of Chicago. More than 8,500 men worked 24 hours per day for eight years. More earth and rock were excavated than that moved to build the Panama Canal: 30,000,000 cubic yards of earth and 12,000,000 cubic yards of rock. The Des Plaines river was
rerouted, and new bridges and surface roads constructed over and around the
course of the new canal.679

C. Index to the Project Brief for the Western Harbor Crossing

This Appendix contains the Index to the Project Brief which was
provided by the Government of Hong Kong for the purpose of soliciting
proposals to finance, design, construct, operate and maintain the tunnel, road
approaches, and toll facilities at the Western Harbor Crossing. The index
indicates a more specific description of government requirements than would
typically be contained in American procurements for design services in
Quadrant IV, which is certainly not unexpected. The Index represents a more
significant effort by the government, with help from consultants having
finance, engineering, architectural, environmental, and forecasting
backgrounds, to give the private sector a reasonably specific description of
what it is the government wants, when and where the government wants it,
while providing flexibility for proposing to make alternative proposals which
add to quality.

The Project Brief was not available for copying, although the Index was
made available.
1. General
   a) Introduction
   b) Purpose of the Brief
   c) The Franchise
   d) Project Scope
   e) Program
   f) Importation of Labor
   g) Disclaimer
   h) Confidentiality
   i) People’s Republic of China Consultation

2. General Conditions for Submission of Tenders
   a) Introduction
   b) Submission of Tenders
   c) Tender Deposit
   d) Bona Fide Tender
   e) Conforming Proposals
   f) Alternative Proposals
   g) Requests for Information
3. **Assessment of Proposals**
   a) **Introduction**
   b) **Evaluation of Proposals**
   c) **Shortlisting and Negotiation**
   d) **Assessment Criteria**
   e) **Assessment Process**

4. **Financial and Related Aspects**
   a) **Introduction**
   b) **Franchise Period and Date of Completion**
   c) **Toll Regime**
   d) **Toll Adjustment Method**
   e) **Toll Strategies - Relative Tolls**
   f) **Financial Strength**
   g) **Financial Guarantees and Undertakings**
   h) **Royalty and Equity**
   i) **Corporate Structure**
   j) **Financing**
   k) **No Tax Exemption**
   l) **Requirements for Forecast Financial Information**
   m) **Detailed Assumptions to be Submitted with the Financing Plan**

5. **Legal Matters**
   a) **Introduction**
   b) **Legal Framework**
   c) **Enabling Ordinance**
6. **Land Matters**
   a) Introduction
   b) General
   c) Land Title
   d) Land Premium and Rental
   e) Property Development
   f) Rates
   g) Alternative Land Requirements
   h) Reprovisioning at Sai Ying Pun
   i) Casting Basin at Tseung Kwan O
   j) Handover of Land
   k) Land Availability for Site Investigation
   l) Arrangements for Project Land Upon Completion of Works

7. **Transport Planning Information**
   a) Introduction
   b) White Paper on Transport Policy
   c) Territorial Development Strategy
   d) Metroplan
e) North West New Territories Development Strategy Review
f) South West New Territories Development Strategy Review
g) West Kowloon Reclamation
h) Kowloon Point Reclamation
i) Central and Wanchai Reclamation
j) Green Island Reclamation
k) Airport Development
l) Airport Railway
m) Port Development
n) North Lantau Development
o) Lantau Port Peninsula Development
p) Timing of Strategic Transport Links
q) Program for Connecting Infrastructure
r) Estimated Traffic Volume of Western Harbour Crossing

8. Design and Construction Requirements
a) Introduction
b) Western Harbour Crossing Study
c) The Design Manual
d) Environmental Protection Requirements
e) ACABAS
f) Government Organization
g) Restrictions on Land Availability and Use
h) Design Standards (Temporary Works)
i) Program of Construction - Interface Issues
j) Avoidance of Nuisance
k) Temporary Traffic Arrangements
l) Existing Utilities
m) Marine and Navigational Requirements
n) Project Insurance
o) Alternative Casting Basin Site
p) Operational Aspects
q) The Tunnel Area
r) Maintenance Requirements
s) Outline Quality Plan
t) Requirement for Checking Engineers
u) Tender Program
v) Works Program
w) Three Month Rolling Program
x) Monthly Progress Report

9. Annexures
a) Annex 1: Strategic Location of the Western Harbour Crossing
b) Annex 2: Design Manual
c) Annex 3: Tunnel Area Plan
d) Annex 4: Project Land
e) Annex 5: White Paper on Transport Policy in Hong Kong, January 1990
f) Annex 6: Metroplan Executive Summary
g) Annex 7: Metroplan Overview
D. Cracks in the Federal Paradigm for Infrastructure Funding

Like the abutments of many of the nation's bridges, the federal funding paradigm has developed significant cracks. While there may be substantial disagreement over cause and effect, it has becoming increasingly apparent that Congress will no longer supply cash to fund broad federal programs for infrastructure.

1. The Federal Deficit and Levels of Federal Spending

Recent commentators have focused on the steady stream of federal deficits as a particular kind of political failure. David P. Calleo, of the Paul H. Nitze School of Advanced International Studies at Johns Hopkins University, describes this failure in this way:

America's tax problem is less the public's obstinate refusal to pay more taxes than its disenchantment with the capacity of the public sector to deliver public goods. . . .
The federal budget embodies priorities that cannot garner enough public support to pay for them. The political system has nevertheless failed to alter its priorities or to improve its efficiency. A chronic and swelling fiscal deficit is the result.\textsuperscript{682}

Calleo's description is especially interesting to those involved in the design and operation of procurement systems. Calleo's analysis, viewed from the procurement perspective, is a simple one. Congress has failed to convince the American public that its procurement processes can effectively deliver goods and services valued by the public.

Perennial deficits have affected the level of federal spending for infrastructure programs. Federal spending on infrastructure rose steadily between 1956 and 1980, rising from $11.6 billion to $43.9 billion. Since 1980, federal spending on infrastructure declined slightly, and has hovered around $40 billion.\textsuperscript{683} In real terms, spending on infrastructure has declined significantly since 1980. In 1965, infrastructure spending represented 6.25\% of the federal budget. By 1992, federal spending on infrastructure had declined to 2.98\% of the federal budget.\textsuperscript{684} On a percentage basis, the funding trend is clear: \textit{downward}.

Despite the downward trend in federal infrastructure spending, the need for increased spending is reasonably clear. A recent report by the Secretary of Transportation estimated that the federal commitment to all segments of infrastructure is clearly insufficient to maintain even one major segment of the nation's infrastructure system: highways and bridges. The Secretary's report estimates that it will require an average annual capital investment of $51.6 billion just to maintain highways and bridges in their current condition.\textsuperscript{685} To improve conditions in this segment of infrastructure will require an average annual capital investment of $67.3 billion through the year 2011.\textsuperscript{686}

2. Congress' Diminishing Financial Role

For the foreseeable future, big-ticket, federal super-programs for funding infrastructure development is over. Indeed, not only has Congress not funded massive infrastructure in recent years, it has resorted to a series of unfunded mandates which affect infrastructure spending by the private sector and by the states, particularly in the environmental area. The following figures show that allocations of federal dollars are headed \textit{away from infrastructure} in a hurry. Since 1980, federal commitments to defense, human resources, interest on the debt, physical resources, and other functions have moved dramatically, as these figures show. Assuming that defense expenditures do not fall significantly below current levels (20\% of outlays), only 15\% of the federal budget is currently available to Congress for what would commonly be called "discretionary expenditures".
Federal Expenditure On Superfunctions (Current $B)
Figure VII-2

Federal Expenditure On Superfunctions
As A Percentage of Total Outlays

Source: Budget of the US Government, Fiscal Year 1992, Table 3.1, part Seven: 31-36
The substantive content of each of these super-categories make this shift even more clear, as the table below indicates.

<table>
<thead>
<tr>
<th>Category</th>
<th>Items Included</th>
<th>1990 Percentage Total Outlays</th>
</tr>
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<tbody>
<tr>
<td>Other Functions</td>
<td>General Government</td>
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<tr>
<td></td>
<td>Administration of Justice</td>
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<td></td>
<td>International Affairs</td>
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<td></td>
<td>Agriculture</td>
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<td></td>
<td>Science, Space, Technology</td>
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<td></td>
<td></td>
<td>4.9%</td>
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<tr>
<td>Net Interest</td>
<td>Interest Only</td>
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<td></td>
<td></td>
<td>14.7%</td>
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<tr>
<td>Physical Resources</td>
<td>Energy</td>
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<td></td>
<td>Natural Resources and Environment</td>
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<tr>
<td></td>
<td>Commerce and Housing Credit</td>
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<td></td>
<td>Community and Regional Development</td>
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<td></td>
<td>Transportation</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>10.0%</td>
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<tr>
<td>Human Resources</td>
<td>Education</td>
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<td></td>
<td>Health</td>
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<td></td>
<td>Medicare</td>
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<td></td>
<td>Income Security</td>
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<td></td>
<td>Social Security</td>
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<tr>
<td></td>
<td>Veterans Benefits</td>
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<td></td>
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<td>49.5%</td>
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<tr>
<td>Defense</td>
<td>Procurement</td>
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<td></td>
<td>Military Personnel</td>
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<td></td>
<td>Operations and Maintenance</td>
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<td></td>
<td>Research, Development, Testing, and Evaluation</td>
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<tr>
<td></td>
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<td>23.9%</td>
</tr>
</tbody>
</table>

If entitlements and interest payments on the debt grow in future years, Congress will be free to direct even less than 15% of the federal budget, of which infrastructure is but a small part. For the foreseeable future, funding for big-ticket, federal infrastructure programs is over. Indeed, not only has Congress not funded massive infrastructure in recent years, it has resorted to a series of unfunded mandates which affect infrastructure spending by the private sector and by the states, particularly in the environmental area.

Unless a dramatic change occurs over the next few years, Congress will have removed itself as a major player in the rehabilitation of the nation's infrastructure.687

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3. Government Funding Levels Are Insufficient to Meet Infrastructure Needs

Numerous commentators agree that federal spending on infrastructure is insufficient to maintain current infrastructure, never mind improve it. These projections are discussed below.\textsuperscript{688}

In part, this shortfall is due to the tremendous cumulative public infrastructure capital stock built with tax dollars, which must be maintained and operated through continued government expenditures. As the table below shows, 36% of this capital stock is held by governments.\textsuperscript{689} Twenty-five (25%) of net current capital stock is held by state and local governments, with a value approaching $1.75 trillion dollars. Having built much of the existing "public" infrastructure with tax dollars, all levels of government are hard pressed to simply maintain this capital stock, let alone expand it. The wisdom of continuing to increase public capital stock holdings is typically not questioned as a procurement strategy.

Table VII-3

<table>
<thead>
<tr>
<th>Private and Public Nonresidential Net Capital Stock, 1988</th>
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<tbody>
<tr>
<td><strong>Capital Stock</strong></td>
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<tr>
<td>-------------------</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Total Private</td>
</tr>
<tr>
<td>Nonfarm Business</td>
</tr>
<tr>
<td>Farm</td>
</tr>
<tr>
<td>Total Public</td>
</tr>
<tr>
<td>Military</td>
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<tr>
<td>Nonmilitary</td>
</tr>
<tr>
<td>Federal</td>
</tr>
<tr>
<td>State and Local</td>
</tr>
</tbody>
</table>

"Capital stock" includes equipment and structures but excludes land inventories and rental residential real estate. Source: Munnell, 1990.\textsuperscript{590} A different direction may come out of the new Congress, but it is hard not to remain skeptical.
VIII. BIBLIOGRAPHY


51. EPA, Region I. "Record of Decision, Industri-Plex Site." : EPA Regional Administrator, 1986.


85. Ierley, Merritt. Traveling the National Road; Across the Centuries on America's First highway. Woodstock, New York: The Overlook Press, 1990.


IX. Endnotes

1The term "infrastructure" is used in a broad sense to mean, collectively, (a) the transportation of people, goods, and information; (b) the provision of public services and utilities such as water, power, waste removal, minimization, and control; and (c) environmental restoration.

2The statistics in this paragraph come from World Resources, A Guide to the Global Environment, 1992-3, at 246, Oxford University Press, Oxford and New York, 1992, at 266, 314, 330, and 336. Power plants in the United States generate approximately 20% of the world's commercial energy production. Approximately 15% of the world's large dams (i.e., over 15 meters in height) have been constructed in the United States. Operating at only 35% of capacity, they still generate 13% of the world's hydro-electric power. Port facilities in the United States load and unload 9% of the world's volume of crude oil, 12% of the world's volume of petroleum products, and 11% of the world's volume of dry cargo. Thirty-six percent (37%) of the world's 14,000 public airports are located in the United States, serving to transport cargo and people. These airports, together with the four million miles of roads and streets, 135,000 miles of railroad, and thousands of miles of pipeline, result in 345 billion passenger miles by air, 2.5 trillion passenger miles by car, bus, and taxi and approximately three trillion revenue ton-miles of freight.

3See, also, The Universal Almanac, 1994, General Editor, John W. Wright, Andrews and McMeel, a Universal Press Syndicate Company, Kansas City, Missouri.

4Roads, bridges, traffic control systems, toll collection systems, railroads, railroad terminals, rail traffic control systems, courthouses, jails, prisons, schools, universities, city halls, police stations, canals, navigable rivers, ports, airports, air passenger and cargo terminals, air traffic control systems, power generation plants, power distribution grids and control systems, natural gas production facilities and distribution pipelines, steam generating plants and distribution pipelines, telephone lines, telephone switching stations, satellite communications systems, television communications systems, radio stations, cable systems, fresh water collection and distribution systems from dams and reservoirs to distribution pipelines and pumping stations, waste water and storm water collection and treatment systems from pipelines and pumping stations to secondary and tertiary treatment plants.

5See, Chapter III, below, which discusses the current infrastructure development process in the United States.

6In the past, Massachusetts has been fortunate with federally funded infrastructure projects. In the future, the state cannot safely rely upon federal programs to create competitive advantage for New England's key industries. Infrastructure strategies and programs must be developed and applied locally.

7Appendix D presents these stark statistics in more detail. It is difficult to imagine anything other than further declines in federal budgets for infrastructure development.

8See, Chapter II, below, for detailed treatment of infrastructure development in Hong Kong.

9See, Chapter IV, "Forgotten American Paradigm for Infrastructure Development", below, for a description of procurement methods used throughout this period, and Chapter V, "Infrastructure Development in Context", for a description of the historical context in which much of American infrastructure was provided.


11There may be inherent advantage in government/business cooperation. Government is not necessarily well-attuned to commercial matters. Samuel Morse demonstrated the telegraph to President Van Buren in 1838, requesting financial support. Five years later, the Congress authorized $30,000 to pay for the construction of the first commercial telegraph line from Baltimore to Washington. After a successful demonstration in 1844 of the new line, Morse's offer to sell his invention to the government for $100,000 was turned down, based on the
government's assessment that the device would not pay for itself. The commercial world did not agree. Within 6 years there were 50 telegraph companies in the United States. Western Union, founded in 1851, consolidated much of the industry and proceeded to build a national network. Eight million telegraph poles connected Washington to California before the start of the Civil War. The first message carried by the new line was a message from the state of California to President Lincoln promising that California would fight for the Union. Underneath New York, supra, at 101-3.

30 Thirty years after Morse's offer to sell the telegraph to the United States, Western Union flubbed a similar offer from Alexander Graham Bell to sell the telephone for $100,000. Western Union failed to see how it could be commercialized. The Bell Telephone Company of New York was organized shortly thereafter, and in various corporate forms over the ensuing years operated phone service in New York and rented telephones to phone companies throughout the nation. Growth and consolidation followed in a pattern similar to the emergence of Western Union. Underneath New York, supra, at 122-23.

31 For example, a charter given by the City of Baltimore to Rembrandt Peale to introduce gas lighting to the City produced concerted efforts against the gas industry by whalers and candle makers, who saw their markets for whale oil lamps and candles threatened. Underneath New York, supra, at 62.

32 See, Chapter VI, Conclusions and Recommendations, below, for a more detailed discussion.

33 Quadrant IV processes are most advantageous for projects of limited and well known scope, which reduce the likelihood that system-based competition in Quadrants II and I will be successful in generating valuable alternatives for government to evaluate. See, Chapter III and Chapter VI.

34 Price, time, and quality advantages of systems procurement are described in more detail in Chapter II and Chapter VI, below.

35 Henry L. Michel, Chairman of Parsons Brinckerhoff, Inc. of New York City, and Albert J. Bast, Senior Vice-President of Parsons Brinckerhoff (Asia) Ltd. were instrumental in the success of my trip, for which I am most grateful.

36 Personal Communication with Christopher P. Bailey, Wardley Holdings, Hong Kong, October, 1994.


37 An interesting question follows: Are “watershed” events, such as the coming change in sovereignty for Hong Kong, required for a state such as Massachusetts, a region such as New England, or a nation such as the USA, to conduct the kind of strategic planning exercise achieved by Hong Kong.
40 Much of the factual basis for this section comes from PADS. “Hong Kong’s Port and Airport Development Strategy: A Foundation for Growth.” : Hong-Kong, 1991, at pages 6 et seq.
41 Address by the Governor The Right Honorable Christopher Patten, Hong Kong: A Thousand Days and Beyond, at the opening of the 1994/95 Legislative Council, October 5, 1994, at pages 25 and 26, published by the Government Printer, Hong Kong.
43 One of Mr. Wu’s proposals for port and airport development, Scheme C, is presented in the PADS report, at page 40. PADS. “Hong Kong’s Port and Airport Development Strategy: A Foundation for Growth.” : Hong-Kong, 1991.
45 Figure 3 from the “Territorial Development Strategy Review.” : Planning Department, Hong Kong Government, 1994, at page 15.
46 Address by the Governor The Right Honorable Christopher Patten, Hong Kong: A Thousand Days and Beyond, at the opening of the 1994/95 Legislative Council, October 5, 1994, at pages 25 and 26, published by the Government Printer, Hong Kong. Rather than “running” from 1997, Hong Kong’s strategic plan seems to have allowed many to move toward 1997 with surprising calm. In October of 1994, the governor cited a number of statistics compiled by the government which compare 1984 to 1994 and illustrate the tenacity with which Hong Kong has been able to approach 1997:
    a 79% growth in Total GDP in real terms;
    growth in GDP per person from 28th in the world in 1984 to 17th in the world;
    a 350% increase in the value of foreign trade in real terms;
growth of Hong Kong's trading economy from the 13th largest in the world to the 8th largest in the world;
a 54% increase in labor productivity;
a planned transition from a manufacturing based economy to that of an international business center, with the service sector providing 75% of GDP and 70% of total employment;
a rise in real earnings per person of 66%;
a decline in unemployment from 4% to 2%;
a rise in owner occupied flats from 31% to 48%; and
growth in trade with China of over 500% in real terms.

49 These views were continually expressed in interviews conducted in Hong Kong, in the trade press, in government documents describing major infrastructure works in the colony, and in informal conversations during my visit to Hong Kong.
50 Indeed, the history of private finance of infrastructure is significantly longer in the United States, although it has been largely discarded since W.W.II.
51 Bailey, Christopher P. Personal Interview, Hong Kong, October, 1994. Mr. Bailey's personal views are repeatedly confirmed in the literature.
52 Consultants are frequently used by the government to supplement existing public employees in defining these requirements, including design and construction feasibility, financial feasibility, fare structures, scheduling of construction, selection of franchise period, conceptual design, schematic design, and possibly preliminary design. The government remains in control of the process by which the basic elements of the project are chosen and described in documents which become the basis upon which competition takes place on the project.
53 Measurement problems arise because most projects are built using one of the two methods, making comparison with the other method largely hypothetical.
54 Based upon a personal interview with John Climas. Hong Kong, October, 1994.
59 Environment Hong Kong 1994, page 137.
60 Actual financial performance on these projects is private information, since only the public side of the transaction, that is, the quantity of waste disposed and the dollars paid for tipping fees, is public information. Operators are betting that these income streams are more than sufficient to cover all expenses and liabilities such as bank financing, and provide sufficient return to consortia participants.
61 Environment Hong Kong 1994, page 137.
63 Environment Hong Kong 1994, pages 62 through 65.
68 Much of the information in this section is from the Tate's Cairn Tunnel Company's brochure describing the project, confirmed through personal interviews with Robert Lloyd and Albert J. Bast. "Tate's Cairn Tunnel Project," Gammon/Nishimatsu Joint Venture, 1988.
A number of issues arise when particular features of one proposal are communicated to other proposers for subsequent inclusion and pricing in revised proposals. "Technical leveling" is the term used in the United States to describe this problem.

The magnitude of these changes has been substantial, but cannot be disclosed until the project is fully negotiated and approved.


The Index to the Project Brief appears as Appendix C, and provides a better indication of the scope of work conducted by the Government before the franchise proposals are solicited.


Christopher P. Bailey, Personal Interview, October, 1994.

"Hong Kong Airport Core Program" Brochure, Hong Kong Government New Airport Projects Co-ordination Office, Wanchai, Hong Kong, 1994.


3/3/1933, Buy American Act, 47 St 1520.

8/24/1935, Miller Act, ch 642, 49 St 793.


The form of incentives used by Congress included land grants, rights of way, charters, the right to collect tolls, and stock subscriptions. These are described in greater detail in Chapter IV, and in Appendix A.

2/20/1893, 27 St 468. See, Chapter V, Section U for a more detailed discussion. Architects might also be employed to assist federal employees prepare plans and specifications. Not less than five architects were required to be invited to compete. Congress did not dictate the basis upon which a selection was to be made.
See, Chapter IV, Case Study IV-8.

See, Chapter IV, Case Study IV-9.


A 1921 amendment to the Federal Aid Act required surveys, plans, specifications, and estimates to the Secretary before federal review of requests for funding, guaranteeing a segmented process in Quadrant IV.

6/10/1920, Federal Water Power Act, 41 St 1063. See, Chapter V, Section U, for more details.

5/25/1926, Public Buildings Act, 44 St 630. See, Chapter V, Section U, for more details.

5/7/1926, Foreign Service Buildings Act, 1926, 44 St 403.

Armed services were defined to include the Army, the Navy, the Air Force, the Coast Guard, and the National Advisory Committee for Aeronautics (forerunner to NASA).

The Armed Services Procurement Act of 1947, 62 St 21, 2/19/1948. The Act also announced that the policy of the United States was to set aside a "fair portion" of the total purchases and contracts for supplies and services for "small business concerns." See, §2(b).


Ibid., at §3(a). The same requirements appear at §303(a) of the FPASA.

Ibid., at §3(b). The same requirements appear at §303(b) of the FPASA. The legislative history underlying the ASPA indicates that the Senate Armed Services Committee was aware of highly competitive conditions in the construction industry, which would tend to keep prices low for armed services construction. See, U.S. Code Congressional Service, 80th Congress, 2nd Session, 1948, at page 1063.

Ibid., at §4(a) and (b). Professional engineering and architectural fees were capped at 6% of the estimated cost of construction. The same requirements appear at §304(a) and (b) of the FPASA.

Ibid., at §§ 102 and 103.

The legislative history underlying FPASA expressly confirms Congress' intent to use identical structure and language to describe procurement procedures in both ASPA and FPASA. U.S. Code Congressional Service, 81st Congress, 1st Session, 1949, at page 1495.

Public Law 519, 83rd Congress, 1954.


Congress was forced to return to lease-purchase principles in 1972, because direct procurement failed to produce needed federal facilities in a timely manner. These later developments are described below.

The Public Building Act of 1959, 73 St 478, 9/9/1959.

Most of the 1959 Act remains effective in 1995.

Ibid., at §13 (1). Other exclusions are listed in the act, though less significant for purposes here.

The prospectus was to contain a brief description of the proposed building, the location of the project, and an estimate of maximum cost.

See, the legislative history to the Public Buildings Amendments of 1972. 1972 U.S. Code Congressional and Administrative News, at page 2370 et seq.

Testimony of the Administrator, described at 1972 U.S. Code Congressional and Administrative News, at page 2372.


The Committee Report states:

"The . . . purchase-contract authority in [the Bill] is a stop-gap expedient, an attempt to reconcile the urgent need for new Federal facilities with present economic conditions."
Congress has repeatedly asserted its insistence upon the direct Federal construction of public buildings required by the Public Buildings Act of 1959.

Direct Federal construction is the most efficient and economical means of meeting Government building needs. Nevertheless, the futility of seeking a billion dollars for direct Federal construction of the present backlog of 63 building in competition with the present spending priorities, together with the urgency of the need for these facilities, makes clear that the best course is to permit GSA to construct the presently authorized buildings over a relatively short term, then return to direct Federal construction through the medium of the public buildings fund authorized in the bill (emphasis added). 1972 U.S. Code Congressional and Administrative News, at page 2373.

113 Named for former Congressman Jack Brooks of Texas.
115 Ibid., at §542.
116 The 6% limitation is retained.
117 If a “fair” price still cannot be negotiated with the third ranked firm, a new competition is announced, and the process begins all over again.
119 See, 48 CFR §36.601-4 lengthy attempt to define what engineering and architectural services are, what incidental services are covered by the Act and under what circumstances. Not surprisingly, others groups have sought to be included in the definition of these terms, including surveyors, mappers, planners, program managers, consultants, value engineers, and a number of others. The struggle continues over who is entitled to avoid price competition under the protective umbrella of the Brooks Act.
120 An example is the grant-in-aid program for rural post road development. 7/11/1916, Act for Federal Aid to State Hwy. Depts. for Rural Post Roads, 39 St 355
121 An example is the Public Building Act of 1959, 73 St 478, 9/9/1959, just discussed above.
122 See, Chapter II, supra.
123 It is possible that Congress would have wished to expressly describe the temporary nature of the franchisee’s ownership interest in tunnel and toll facilities, but there can be no serious question that the same federal power that controlled and authorized hundreds of bridge and tunnel franchises across the navigable waters of the US prior to 1933 still exists. If Congress did not want the franchisees to collect tolls, evaluation factors could have been changed to consider the technical proposal, the financing mechanisms, and (in lieu of proposed fares) a lump sum annual federal payment to replace anticipated toll revenue.
124 Section 36.103 accomplishes this result with two [unusually] short paragraphs:

36.103 Methods of Contracting. (a) Contracting officers shall acquire construction using sealed bid procedures . . . except that sealed bidding need not be used for construction contracts to be performed outside the United States, its possessions, or Puerto Rico. (b) Contracting officers shall acquire architect-engineer services by negotiation, and select sources in accordance with applicable law [namely, the Brook Acts, described above].
125 See FAR, Section 36.207. A short primer on references to the FAR may be helpful. The entire FAR is found in title 48 of the Code of Federal Regulations, at Chapter One. Individual agency supplements to the regulation are also contained in title 48 of the CFR, at chapters 2 through 28. Part 36 of the FAR contains all government wide procurement regulations directed specifically at public construction. To find whether DOD has any supplements to the government-wide regulations relating to construction, one would look at 48 CFR Chapter 2 (DOD’s supplement to the FAR) at Part 236. The DOE supplement to the FAR is contained in Chapter 9 of 48 CFR. To find DOE’s supplements to government wide construction regulations,
one would look at 48 CFR Part 936. Because there are twenty eight supplements to the FAR, to
determine the regulations applicable to any particular contract, one has to check the
government wide regulation, at 48 CFR Chapter 1, Part 36, and Part 36 in the appropriate
agency supplement. Generally, the agency supplements do not represent significant differences
from the FAR.
126 48 CFR §36.501 through 36.521. See 48 CFR Part 52.36 and 53.36 for the actual text of clauses
and contract forms required for use on federal construction projects in the United States.
127 48 CFR §36.6. This Subpart also define the contractual relationship between the government
and its designers. 48 CFR §36.608, which makes the A/E responsible to the government for the
professional quality, technical accuracy, and coordination of all services required under their
contracts, and 36.609, which lists other clauses to be included in design contracts, including a
requirement that all designers be registered engineers or licenses architects, until the project is
outside the United States, or located in a jurisdiction where there are no licensing requirements.
128 These methods are well known in the private sector. They have also be used overseas in
the public sector. See, for example the design build projects described at Chapter II.B.1, supra.
129 These methods were in widespread use in the United States before 1933 (See, Chapters IV
and V) and are in widespread current use overseas (See Chapter II.B.2 and B.3, supra.)
130 5/7/1926, Foreign Service Buildings Act, 1926, 44 St 403.
132 Numerous books and articles have attempted to describe this history. Mark Rose’s work
provides a reasonably complete account, which forms the basis for much of the discussion in this
section. Rose, Mark H. Interstate: Express Highway Politics, 1939-1989. Revised ed:
133 Lowi’s work is a fascinating indictment of what he calls “Interest Group Liberalism”, that is,
the abdication by Congress of its legislative power, and the substitution of a process by which
Congress enacts the “consensus” of groups who claim to be affected by proposed legislation.
New York: W. W. Norton & Company, 1978. Lowi’s logic is directly applicable to numerous
federal procurement programs, the most prominent of which is CERCLA, discussed below.
134 The push for better roads began with the formation in 1880 of the League of American
Wheelmen (bicyclists), and was followed by the creation in 1893 of the federal Office of Road
Inquiry, the passage of the first federally aided highway program in 1916, and the
identification by Congress in 1944 of a National System of Interstate Highways, not to exceed
40,000 miles, which was to be the backbone of interstate travel.
135 Civil Engineering History. The American Society of Civil Engineers, New York, New York,
136 Rose, Mark H. Interstate: Express Highway Politics, 1939-1989. Revised ed: University of
137 Ibid., at page 42.
138 Ibid., at pages 44 et seq.
139 Ibid.
140 Intense lobbying by national leaders in truck transportation, city planning, road engineering,
contract construction, and politics coalesced around the 90:10 federal/state funding split for the
Interstate System. Interstate, Chapters 2 through 6, by Mark H. Rose, Revised Edition,
University of Tennessee Press, Knoxville, 1990. Superhighway -- Superhox, Chapters 1 to 3,
142 According to Rose, Eisenhower and his advisors hoped "to relieve traffic congestion and to
hitch the economy, in part, to a gigantic public works project, one financed and structured to
safeguard the budget." Rose, supra., at page 96.
143 Lewis, David L. “The Interstate Highway System: Issues and Options.” : The Congress of the
United States, Congressional Budget Office, 1982.
Rose, supra, at 41, suggests, with substantial force, that interest groups lobbying for the IHS's toll-free roads before Congress were concerned that independent turnpike authorities in the states were not subject to easy political control, and were self-perpetuating.

In the mid-forties, Commissioner Thomas H. MacDonald, chief of the Bureau of Public Roads in the Department of Agriculture, ordered state officials to submit proposals for their share of Interstate mileage by July 1, 1945. Routes "should be so selected as to form an integrated network." Consultations would then result in development and designation of the routes. State road agencies complied promptly and by August 2, 1947, MacDonald and state road officials had prepared a tentative outline for 37,700 Interstate miles. Rose, supra, at page 30.

Superhighway - Super Hoax, Helen Leavitt, page 52.


Rose, supra, at page 111 et seq.

In a subsequent statute, Congress changed this result and required that moneys saved from deleting a portion of the Interstate Highway System would have to be returned to the Treasury. Substitute funding for mass transit project would have to come, if at all, through a separate appropriation.


A 1982 National Research Council report estimated that $350 Billion would be required between 1980 and 1995 to maintain existing highway mileage at minimum levels of service. Against this expense, current capital spending budgets to cover these costs totaled only $115B. Rose, supra, at 112.


10/18/1972, Federal Water Pollution Control Act of 1972, 86 St 816.


The author represented several cities and towns in connection with the program, and is personally familiar with the manner in which EPA issued grants and implemented the program.


The Brooks Act principles applicable in direct federal contracting were passed down to municipal grantees throughout the nation.

40 CFR Part 33.


Ibid., at page 56 to 58.

Ibid., at page 57.

Ibid., at page 60.

Ibid., at page 60.

supra, at page 56, note 18.


Rather than directly making federal policy which establishes winners and losers, Congress has, since 1933, increasingly followed the pattern of requiring executive branch agencies to establish federal "law" at the regulatory level. This is accomplished by directing agencies to "process" competing claims of interest groups presented to agency rulemakers. See, generally, Lowi, Theodore J, The End of Liberalism: The Second Republic of the United States. Second ed. New York: W. W. Norton & Company, 1978.

94 St 2767, Public Law 96-510 [H.R.7020].


"Environment" includes all "navigable waters, any other surface water, ground water, drinking water supply, land surface or subsurface strata, or ambient air within the United States or under the jurisdiction of the United States". CERCLA, 94 St 2767, §101.

"Facility" is defined as "any building, structure, equipment, pipe or pipeline, well, pit, pond, lagoon, impoundment, ditch, landfill, storage container, motor vehicle, rolling stock, or aircraft, or any site or area where a hazardous substance has been deposited, stored, disposed of, or placed, or otherwise come to be located." CERCLA, 94 St 2767, §101.

The term "release" is broadly defined to include "any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment. Other "releases" were defined away by the Congress, including: any release which results in exposure to persons solely within a workplace; emissions from the engine exhaust of a motor vehicle, rolling, aircraft, vessel, or pipeline pumping station engine; release of source, by-product, or special nuclear material from a nuclear incident; and the normal application of fertilizer.

CERCLA is so broad in its assertion of federal power that other levels of government are precluded from acting in conflict with the Act under the Supremacy Clause of the United States Constitution, and indeed, are also liable under the Act to the federal government to pay for or to clean Superfund sites.

Persons liable under the act fall into four categories: present Owners and Operators, persons who owned or operated a facility at the time hazardous materials were released, persons who arranged for disposal of hazardous substances at a facility, and persons who accepted hazardous substances for transport to a facility.

There is no dollar limit with respect to facilities on land. There are dollar ceilings for vessels.

See, for example, United States v. Dickerson, 640 F. Supp. 448, 451 (D. Md. 1986).

CERCLA, 94 St 2767, §105.

CERCLA, 94 St 2767, §107.

CERCLA, 94 St 2767, §106.

The two prior chemical companies will bear no share of the clean-up costs at Industri-Plex, nor will their shareholders.

Corporations, individuals, the Town of Woburn, the State, an independent authority, and a public utility are among those who caused releases of hazardous substances in the area chosen by EPA as the Industri-plex Superfund site. The MBTA, the City of Woburn, and Boston Edison are public or quasi-public entities that will not go out of business or declare bankruptcy. They are liable for releases of hazardous substances elsewhere within the area selected by EPA as the Industri-plex site. Nineteen other individuals were owners or operators of some portion of the site at some time in the past when there was a release at the site. Death has provided many people who owned or operated the site over the last one-hundred and fifty years one of the few permissible excuses to CERCLA liability. When EPA draws the boundary line around a Superfund site, such as it did at Industri-Plex, all of these various releases, as disparate and
unconnected as they may or may not be in time, significance, and extent, are aggregated into a single, forever-indivisible liability.

188 CERCLA, 94 St 2767, §105.
189 Superfund Amendments and Reauthorization Act of 1986, ("SARA"), 100 St. 1613, October 17, 1986, at §121.

For example, Congress directed the President to accomplish all the following at the same time:

1. Select remedial actions that "to the extent practicable, [are in accord with] the NCP and which provide for cost-effective response";
2. [Prefer as a principal element] "permanent and significant reduction in the volume, toxicity, or mobility of hazardous substances . . . over other remedial actions;
3. [Consider] off-site transport and disposal of hazardous substances without treatment [to] be the least favored alternative remedial action where practicable treatment technologies are available;
4. [Achieve] that "degree of cleanup" . . . "which assures protection of human health and the environment"; and
5. [Select] remedial actions [that are] "relevant and appropriate" under the circumstances of a particular release.

Congress offered no clue how these competing requirements were to be reconciled at individual Superfund sites? For example, at what point does increasing levels of cleanup assure protection of human health and the environment stop being "cost effective"? "Cost effective" for whom? How "practicable" must a treatment technology be in order to prevent "off-site transport and disposal" of hazardous substances without treatment? What is a "permanent" disposition of hazardous substances? What reduction in the volume, toxicity, or mobility of hazardous substances is "significant"? These and similar questions were to be answered in the National Contingency Plan.

190 The Preamble to the NCP 1985 Revision admits it: "The characteristics of CERCLA sites are too varied and unpredictable for EPA to specify, by regulation, which Federal requirements are 'applicable'. Such a determination necessarily will be made on a case by case basis."

191 The NCP is drafted in broad, general terms, with little guidance respecting what methods are appropriate for remediating releases of hazardous substances, or what constitutes the appropriate extent of a response or remedial action. The NCP contains no substantive standards and little detail for assessing the adequacy of a response action. . . . In a similar vein, the NCP lists, in inventory form, the various methods for remediating releases of hazardous substances that may be considered before selecting a response action." RCR A and Superfund, A Practice Guide with Forms, by Christopher R. Schraff, Robert E. Steinberg, Garland Law Publishing, 136 Madison Avenue, New York, NY, 10016, 1988, at pages 1-18 to 19.

192 SARA, 100 St. 1613, October 17, 1986, at §107. There were a few exceptions. SARA, 100 St. 1613, October 17, 1986, at §310(d)

193 These proposals assume that more fundamental changes in Superfund are not possible from a political perspective. The first proposal is the elimination of joint liability under CERCLA, accompanied by an amendment to CERCLA §107 which would provide for an early Court allocation of Response Costs among PRPs. The second proposal is the procurement of an independent site remediation contractor, on a Design-Build-Operate basis to implement a Record of Decision issued much earlier in the Superfund process.


195 Stauffer had, in effect been "requested" by EPA to develop these recommendations on behalf of all PRPs (to act as a "Lead PRP"). Although a Lead PRP has a greater influence in how the site is ultimately handled, incurred costs are typically paid solely by the Lead in the hope that some of these funds will be recovered from other PRPs.

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Conflicting studies and reports by EPA, citizens groups, and PRPs were prepared and circulated. Toward the end of this period, largely because of tension in the relationship between EPA and Staufer, EPA turned to Monsanto as Lead PRP. Monsanto likely accepted this position in the Consent Decree, not out of charity, but because Response Costs were allocated in the Consent Decree and Monsanto was given control over site remediation activities of the Industri-plex Site Remediation Trust (ISRT).

Are We Cleaning Up? 10 Superfund Case Studies. Special Report, Office of Technology Assessment, OTA-ITE-362 (Washington, DC: U.S. Government Printing Office, June 1988), at 30. These administration, litigation and related expenses are described as "transaction costs" throughout this case study, and include all costs except those incurred for actual cleanup of Superfund sites.


High transaction costs benefit no one. Public interest groups devote their resources to technical studies, engineering studies, epidemiological studies, objections and questions regarding Preliminary Assessments ("PAs"), Remedial Investigation/Feasibility Study ("RI/FS"), and other studies prepared by PRPs for EPA. For PRPs, particularly cities and towns, liability is assigned without considerations of fault and without regard to the intent of those made liable. No PRP is given an opportunity, in advance, to adjust their conduct to avoid liability under CERCLA. That any activity was permitted, encouraged, or even required at some time in the past makes no difference to the liability imposed upon PRPs.

For example, parties named by EPA in §106 orders for abatement may not decline to comply with such orders, without being subject to a $5,000 per day liability and treble damages for failure to obey under §107(c).

Numerous studies of Superfund, all critical, are listed in the Bibliography. Newspaper treatment of Superfund is entirely consistent, and almost without exception, uniformly critical. See, for example the San Francisco Chronicle coverage entitled "Superfund Costs May Top S&L Bailout", May 29, 1991.

As related in a lengthy, confidential interview with one of the firm's most senior corporate officers.

Inconsistencies across Superfund sites creates substantial problems, since local decision-makers are selectively applying their discretion different to individual PRP's and interest groups. In the area of criminal law, where police have the opportunity, but not the manpower, to enforce numerous laws, the exercise of police discretion has been found by Kenneth Culp Davis and others to be systematically directed against particular groups. Police Discretion, Kenneth Culp Davis, West Publishing Co., St. Paul, MN., 1975. Prof. Davis forcefully argues that laws which grant such unbridled discretion are unconstitutionally "void for vagueness", since they encourage arbitrary and discriminatory enforcement. The Supreme Court adopted this express logic in Papachristou v. City of Jacksonvile, 405 U.S. 156 (1972), striking down Jacksonville's vagrancy laws. The Court held that the arrest of two black men and two white women in a single car was the result of selective, standard-less enforcement of the vagrancy laws.

And pay for these studies.


Such litigation, in turn, breeds a host of related legal questions which are becoming of decreasing interest to business men and women. For example: If a settling PRP later enters bankruptcy, is its settlement obligation dischargeable? Are cleanup costs property damage? When is the "occurrence" at a Superfund site for purposes of standard CGL insurance policies?
Are joint tortfeasors liable to reimburse paying PRP's on a pro rata or a per capita basis under local law? Which state law applies? These and other questions have been repeatedly answered in suit after suit, on site after site.

211 Particularly, those who operated town dumps and landfills. Presumably, EPA allows cities and towns to remain as Weed Sitters for political reasons.

212 Frequently funded with EPA grant money for which PRPs are liable as Response Costs.

213 Funding for citizens groups at Industri-Plex is through an EPA assistance grant to be reimbursed to EPA by the PRP's as a response cost.

214 Transaction costs for ISRT, EPA, DEP, and citizens groups continue to climb, while delays and changes cause increase in the cost of the construction work itself.

215 Congress knew what it was doing when it defined "response costs" in this fashion, as Congress' lengthy statutory experience with specifically identifying each and every allowable cost payable under defense contracts demonstrates. Ironically, Congress has never, and presumably would never, apply such a definition of "costs" to federal contracts.

216 EPA's Superfund Innovative Technology Evaluation Program ("SITE") is a well publicized EPA effort directed by EPA's Risk Reduction Engineering Laboratory in Cincinnati responsible, in its own words, for "planning, implementing and managing research, development, and demonstration programs that provide an authoritative, defensible engineering basis for EPA policies, programs, and regulations concerning ... Superfund-related activities.

217 Contrast this phenomenon with the manner in which Congress has increasingly funded the research and development of military equipment over the last decade. Fearful of increased time and costs that typically are incurred in complicated R&D projects, Congress required development of the Air Force's A-10 to be designed and prototyped by two major aerospace companies at their own cost.

218 At least three practical considerations require these suits to be brought. First, such suits require all PRPs to participate in the judicial process by which Response Costs are allocated. This participation binds all PRPs and substantially reduces the risk to Lead PRPs that Response Costs will later be successfully challenged as "excessive" by Weed Sitters and Orphans. Judgment binds all PRPs to accept the Court's allocation of Response Costs. Second, the Court has broad power to attach and secure assets of PRPs who are in poor financial condition. Assets can be frozen or taken by the Court for use in paying that PRP's allocated share of Response Costs. Third, contribution suits are likely to force the Court to get involved with the method and cost of cleanup. The Court's allocation of Response Costs may well vary depending upon the nature of each PRP's releases on the site, the ease with which such releases can be remedied, and the likely costs of such remedies. Contribution suits often have the very practical effect of involving the Court in approving a particular remediation scheme, and delaying a final allocation of responsibility until treatment methods are known and contributions to contamination from PRPs are determined.

219 For small, well-defined, simple buildings, Quadrant IV processes work reasonably well and avoid unnecessary duplication of the expense to multiple teams to produce proposals to finance, design, construct, and operate small projects. These considerations change, however, for larger infrastructure projects, which warrant consideration of a number of design approaches, construction methods, equipment, and materials.


222 The City of Boston is a well-known national example.

One example is the water power works associated with the Merrimack Company's factories in Lowell, Massachusetts.

This project is discussed in more detail below.

The results are presented in charts, not as a definitive statistical analysis, but to show that current perceptions that infrastructure development has always occurred in Quadrant IV is nonsense.

Most statutes revoked the franchise if construction was not commenced within a set period of time (usually one year) and completed within a second time period.


MacGill, Caroline E., History of Transportation in the United States, at page 590.


Ibid., at 366.

Railroad gauge is just one example of local efforts to obtain and retain competitive advantage in the short run. Pennsylvania revoked the charter of the B&O to cross Pennsylvania territory. The Middlesex Canal was primarily an effort by Boston merchants to divert growing Merrimack Valley trade to Boston rather than Portsmouth, NH.

New York state is a good example. Public funding of the Erie Canal created the presumption that the state, eventually, would fund the Erie Railroad (a presumption not held by canal supporters). In anticipation of state funding for such a road, real progress on construction of the Erie Railroad was delayed from 1831 to 1838 as the nature of the state's contribution to the project was debated in the press and the legislature. Ibid., at 368-370.

See, Appendix A, infra.

2 St 457, 2/5/1808, Act Authorizing the Erection of Bridge Over the Potomac

2 St 485, 4/21/1808.

2 St 539, 3/3/1809.

2 St 570, 4/20/1810.

3 St 5, 7/13/1813.

3 St 12, 7/13/1813.

3 St 391, 3/3/1817.

3 St 482, 2/15/1819.

3 St 496, 3/2/1819, Act for Steamboat Postal Service from New Orleans to Louisville.

3/27/1798, 1 St 546, Act to Ratify Act of Massachusetts Regarding a Pier at the Mouth of the Kennebec River.

5 St 63, 7/1/1836, Act Authorizing Shenandoah Bridge Company at Harper's Ferry.

2 St 330, 3/2/1805, Act Authorizing Bridge Across the Brooklyn Navy Yard.

4 St 124; 4 St 293

4 St 162

4 St 169

3 St 412, 3/27/1818.

4 St 227, 3/2/1827.
254 See, for example, 4 St 132; 4 St 303; 4 St 602; and 5 St 67.
256 4 St 100, 3/3/1825, Act to Authorize Surveying, Making Road Missouri to New Mexico.
258 4 St 135, 3/3/1825, Act to Authorize Surveying, Opening Road from Detroit to Chicago.
259 For example, in the case of the National Road, the statute instructed the commissioner to lay out a "path from Cumberland, Maryland to the Ohio River, a little below Wheeling, Virginia." The commissioners were also to lay out a route for the National Road which was four rods wide (4x16.5 feet) wide, with plain marks on trees or stakes or monuments, every 1/4 mile.
258 4 St 521, 5/31/1832, Act Vesting the Washington Canal Company Assets in City.
259 2 St 691, 3/2/1812, Act To Authorize Purchase/Use of Lewis Patent.
261 5 St 619, 3/3/1843, Act to Test the Practicability of the Telegraph
262 5 St 798, 3/3/1845, Act to Test the Practicability Plough and Dredging Machine.
263 See, Appendix B, infra.
265 6 St 27, 5/17/1796, Act to Authorize Ebenezer Zane to Locate Certain Lands in the North West Territory.
266 At the time, this kind of "patent" is the equivalent of a federal deed to the land which was then incontestable.
267 MacGill, Caroline E., History of Transportation in the United States, at pages 13, 60, and 68.
268 MacGill, Caroline E., History of Transportation in the United States, at pages 161 to 194.
269 Ibid.
270 Ibid., at 170, These plans apparently dated from 1724. In 1773, Christopher Colles gave a series of lectures in New York favoring the development of canal routes through upstate New York to the Great Lakes. After the War, a series of proposals were made, a commission created by the state legislature, and, at Governor DeWitt Clinton's urging, two private corporations chartered by the state, one to build a canal from the Hudson to Lake Ontario and the Seneca Lake along the Mohawk River, and the second to the head of Lake Champlain. Ibid., at 172 and 173.
271 Ibid., at 167.
273 Montreal had its drawbacks, including wild fluctuations in import policy by the British colonial government, which on occasion produced outright prohibition of American products and/or various ad valorem taxes. Although sections of the Western Inland Lock Navigation Company's canals were opened through Rome, and tolls collected the company was not a financial success, as toll rates were not significantly different than transportation rates by wagon, and fierce competition drove down tolls and profits. By 1808, the Western Inland Lock Navigation Company was in difficult financial straits.
274 Through stock subscriptions made by the state in the shares of the company. The Company was chartered in 1792 to complete this canal.

MacGill, Caroline E., History of Transportation in the United States, at page 187.


Ibid., at page 34.

For example, 40,000 people passed through Utica in 1825 alone. Ibid., at 193.

Ibid., at 192.


Ibid.

Goodrich, Carter. Government Promotion of American Canals and Railroads, 1800-1890. New York, New York: Columbia University Press, 1960, at page 54. By 1836, the surplus held by the state in what was called the canal fund was large enough to retire the entire debt incurred in building both the Erie and Champlain canals.


Ibid., at pages 35 to 36.


Ibid., at page 7.

Ibid.

3/30/1822, Act Authorizing Illinois to Open a Canal Connecting Lake Michigan, 3 St 559.

3/2/1827, Act To Assist Illinois Open a Canal Between Lake Michigan & Illinois R, 4 St 234.

In 1833, Congress authorized the State to use the lands granted in 1822 and 1827 for either canal or railroad construction. 3/2/1833, Act Allowing Illinois to Open a Canal or RR Between Lake & Illinois R, 4 St 662.


Ibid., 13.

MacGill, Caroline E., History of Transportation in the United States, at pages 513 to 547.

9/20/1850, Act Granting Land In Support of A RR from Chicago to Mobile, 9 St 466.


Prior to commencing work, the figure of 7% was negotiated to fill in the blank in Rantoul’s offer.

Ibid., at page 30.

Ibid., at page 56.

Schodek, Daniel L. Landmarks in American Civil Engineering. 1 vols.: MIT Press, 1988, at pages 345 to 347.

See, for example, 8/14/1876, Act to Improve Rivers and Harbors (South Pass Army Survey/Eads), 19 St 132; 6/19/1878, Act Providing Payment to Eads for South Pass Project, 20 St 168, $500,000; 5/13/1879, Further Appropriations for South Pass Jetty System, 21 St 4; 3/12/1884, Further Appropriations for South Pass Jetty System, 23 St 4; 5/26/1886, Further Appropriations for South Pass Jetty System, 24 St 70.

Personal tour of the seaport, August, 1995.
As described below, the undisclosed ownership of William "Boss" Tweed and a number of his associates, when discovered upon the "fall" of Tweed in 1872, caused the legislature to require the cities of Brooklyn and New York, in May, 1875, to buy out all private shareholders in the New York Bridge Company, creating a publicly owned company to complete the bridge. At the time of the take-over, however, the Brooklyn tower had been completed and the New York tower was nearly completed. The risk that the bridge could not be constructed was over at that point. Hence, my classification of the project as Quadrant II.

New York Laws, April 16, 1867, Chapter 399.

3/3/1869, Act to Establish a Bridge From Brooklyn to New York City, 15 St 336. Congress, in typical fashion, required the Company, prior to starting construction, to submit to the Secretary of War a plan of the bridge, with a detailed map of the river for one mile above and below the proposed site, so that the Secretary could verify that the bridge, once erected, would not "obstruct, impair, or adversely effect the navigation of the river."

The $5,000,000 capitalization was chosen based upon a "revised estimate" presented to the legislature about which Roebling was not consulted, and did not agree. McCullough, David. The Great Bridge. 1 vols. New York: Simon and Schuster, 1972, at pages 119 et seq.

Ibid., at 131. Although there was substantial dispute at the time, it appears that 1680 of the 5000 shares of voting stock plus $55,000 in cash was paid by someone to Boss Tweed in return for arranging for New York City to contribute its cash subscription to non-voting stock. McCullough concludes that the "someone" who made this payment to Boss Tweed was the general contractor for the project. This same contractor held another 1600 shares in the Bridge Company. Combined, Tweed and the general contractor held almost two-thirds of the voting stock.

Ibid., at pages 90 to 95.

Without consulting Washington Roebling.

Hewitt was a protégé of then New York Governor Tilden, who was running for President in the 1876 election.


Note that if this project had remained a private franchise, the conflict of interest analysis would be different. In the franchise situation, the engineer who designed the bridge, John Roebling, was a member of the franchisee's team, and as a members, designed a suspension bridge premised on the supply of his own cable. The team would not only want Roebling's wire, but would have been formed in reliance that only Roebling's wire would be provided. Indeed, it is hard to imagine that any private team formed to build the Brooklyn bridge as a suspension would not have used Roebling for design and Roebling wire, which at the time, the combination of which was essentially proprietary to Roebling and his company.

McCullough, David. The Great Bridge. 1 vols. New York: Simon and Schuster, 1972, at page 377. Washington Roebling anticipated that Mr. Haigh would submit a bid, and that he was somehow connected with Mr. Hewitt, who had arranged for the resolution barring Roebling & Sons from competing, but arranged for an indirection to permit himself to continue to be involved. Hewitt was in business as "Cooper & Hewitt", a wire supply firm.

In his private papers, Roebling noted that Hewitt held a mortgage on Haigh's wireworks and had made an arrangement not to foreclose so long as Haigh turned over 10% of what Haigh made from the bridge contract. McCullough, David. The Great Bridge, at page 396.

McCullough, David. The Great Bridge, at pages 443 to 447. Roebling's comment was short and pithy: "An engineer who has not been educated as a spy or detective is no match for a rascal." He estimated that Haigh had made over $300,000 by cheating his suppliers and the owner.

Ibid., at 451.

Ibid., at 470.

See, Chapter above.

1/18/1871, Act Appropriating $100,000 for St. Mary's Canal, 16 St 402.
322 30,000 cubic feet of water per second passes through the power canal, as finally constructed.
324 The same Abram S. Hewitt who financed Lloyd A. Haigh's Brooklyn cable business in the 1870's. See, the case study, above, concerning the Brooklyn Bridge.
326 For example, New York franchises for transportation facilities were governed by the Husted Act of 1875. Hood, supra, at page 50-51. Under the Act, the mayor of New York City could appoint a five man Rapid Transit Commission which would have to power to lay out routes; specify the type of power to be used, and assign the franchise to a private operator who would build, equip, and operate the facility. In effect, the Husted Act prohibited municipal governments from owning its own rail systems.
327 Hewitt was thinking strategically. He claimed that construction of the rapid transit system would “confirm [New York’s] imperial destiny as the greatest city in the world,” and that the system would be “as important as the Erie Canal had been when it was completed in 1825.” Hood, supra, at page 26.
328 Boston faces similar questions and decisions, although the conclusions are undoubtedly different than those drawn by the City of New York in the 1890’s. What are the characteristics of Boston and the surrounding region that create (or could create) competitive advantage for business here? Once identified, can infrastructure development assist in preserving or extending these advantages? If so, how can the government arrange, either itself or in cooperation with industry, deliver infrastructure that is aligned with economic strategy?
329 Hood, supra, at page 66.
330 Ibid., at pages 66 and 67.
331 Ibid., at 69.
332 Ibid., at 70.
333 Ibid., at 70 et seq.
334 Parsons was a colorful, well-known 1879 graduate of Columbia, with a second degree in Civil Engineering from Columbia’s School of Mines. He had founded his own consulting engineering firm in 1885, an unusual step for engineers at that time. Parsons later was a founding member of what is now Parsons Brinckerhoff, Inc. one of the world’s largest engineering firms, headquartered in New York City.
335 Parsons's report brought these innovations back to the United States for application and improvement here. "Report on Rapid Transit in Foreign Cities", cited by Hood, supra, in note 9, at page 276.
336 Ibid., at page 83.
337 Ibid., at page 91.
338 Ibid., at page 114.
339 Ibid., at page 117.
340 Ibid., at page 124.
341 Ibid., at page 131 to 132.
342 Much of the information contained in this case study was obtained through the generous help of Emma Lee Hill, of the Keokuk Public Library, 210 North 5th Street, Keokuk, Iowa 52632. Ms. Hill's assistance led to several invaluable resources, used in this case study. Barr, G. Walter. Electric Power from the Mississippi: A description of the water-power development at Keokuk, Iowa. Keokuk, IA: Mississippi River Power Company, Stone & Webster Management Association, 1913; a number of newspaper articles both during construction and after construction collected by Bickel, R.L. "The Great Dust Heap Called History: Notebook Bridges and Rivers.", from the Bickel Historical Collection at the library; Dille, Earl K. "75th Anniversary Keokuk Dam & Power Plant.", published by the Union Electric Company, Keokuk,

See Chapter II, generally.

8/16/1856, Act to Improve the Des Moines Rapids in the Mississippi R., 11 St 51.

1/18/1871, Act Appropriating $341,000 for Des Moines Rapids, 16 St 399.

6/23/1874, Act to Improve Rivers and Harbors, 18 St 237.


Much of the information describing the Appleton project was obtained through the generous help of Ann Larson, Curator of the historic house museum at Friends of Hearthstone, Inc., in Appleton, Wisconsin. Ms. Larson’s assistance led to several important sources, summarized above.

Schodek, Daniel L. Landmarks in American Civil Engineering, 1 vols.: MIT Press, 1988, at pages 318 to 323. This project was organized by H.J. Rogers, president of both the Appleton Paper and Pulp Company and the Appleton Gas Light Company. Rogers obtained an exclusive right to light Appleton with the Edison electric lamp, arrange financial backing, and founded the Appleton Edison Electric Light Company. The Edison Company K-type dynamo was installed in an existing paper mill, turned by the mill’s existing water turbine. The dynamo powered a number of factories and homes in the city, and in 1886, powered the nation’s first electric streetcar.


For example, in 1895 the Westinghouse Electric Company installed power generators capable of the efficient production of hydroelectric power at Niagara Falls. Gorton Carruth, supra, at page 371.

In July, 1895, the Folson, California Hydroelectric Power Plant achieved the first long distance transmission of electric power from Folsom to Sacramento, twenty-two miles away. Construction of the dam and power plant was commenced by the Natoma Water and Mining Company in 1886. The purpose was to establish a holding pond for logs and to generate power for a sawmill located at Folsom. The company was building a dam and canal was to move logs from the pond to the sawmill, when it encountered financial trouble. To continue, it reached an unusual agreement with the state of California to cede land for the site of a new state prison, to supply the prison with power, in exchange for a specified amount of prison labor to complete the works. The President of Natoma formed the Folsom Water Power Company, which took over the rights of Natoma, negotiated a new deal with the State which provided power to the prison, and which then entered into a subcontract with General Electric for transmission equipment to send power to Sacramento. The lines terminated at the substation of the Sacramento Power and Light Company. Schodek, supra, at page 320.

2/24/1894, Act Granting Des Moines Rapids Power Co. Right to Build Dam, 28 St 38.

2/8/1901, Franchise for Wing Dam at Keokuk on Mississippi, 31 St 764. The act required that the project not interfere with navigation over the Des Moines Rapids, that plans be submitted to the Secretary of War for prior review and approval, and that construction commence within three years (amended to four by subsequent act, See 33 St. 56) and be complete within six (amended to seven by subsequent act, See 33 St. 56).

2/2/1905, 33 St 712.

See, MacGill, Caroline E. and a Staff of Collaborators. History of Transportation in the United States before 1860. Edited by Balthasar Henry Meyer. Washington: Carnegie Institution of Washington, 1917. This text contains simply extraordinary descriptions, summaries, and records of transportation costs, tolls, shipment weights, passenger miles, and other statistics that bring transportation prior to 1860 in the United States to life. Hereafter, this work is referred to as MacGill, Caroline E., History of Transportation in the United States.

1 St 51, 7/13/1787, Northwest Territory Ordinance of 1787.
The first major effort at settlement west of the Appalachian barrier came in March 10, 1775, when Daniel Boone commenced blazing the trail from Fort Chiswell in the Shenandoah Valley, Virginia, through the Cumberland Gap and into Kentucky. Boone had been hired to blaze this trail by a land company which had purchased the land between the Ohio, Cumberland and Kentucky River from the Cherokees. MacGill, Caroline E., History of Transportation in the United States, at pages 7, 8, 10. The road was intended to allow purchasers of the company’s land to reach it more conveniently. Although not improved for wagon traffic until 1795, the Wilderness road made it much easier for settlers to reach the Ohio River valley. By 1790, the population of Kentucky was nearly 75,000, more than 90% of whom had traveled the Wilderness road.

1 St 232, 2/20/1792, Act to Establish Post-Office & Post Roads within the U. S. The initial statute was followed by a number of extensions to the post road system, throughout the years between 1880 and 1860. See, for example: 1 St 354, 5/8/1794; 1 St 419, 2/25/1795; 4/23/1800.

1 St 733, 3/2/1799, Act Establishing the Post Office of the United States. This statute added a number of features to the procurement system that are still in use today. Congress expanded the advertisements required before bids to carry the mail could be received, and required that all proposals received for such contracts would be published in newspapers of wide circulation. The act also precluded postal employees from receiving fees or perquisites, indicating an early concern with organizational conflicts of interest. Uniform postage rates were set by the act, based upon distance mailed and the weight of the letters sent. The act also provided the fines of $100 per offense for postmasters charging more than these rates, and provided for the debarment of such postmaster from any office or appointment by the United States government.

5 St 60, 7/2/1836, Act to Change the Organization of the Post Office; 5 St 271, 7/7/1838, Act to Further Alter and Establish Post Roads and RR Post Routes.


2 St 57, 4/28/1800, Act for Various Navigational Aids.

2 St 125, 3/3/1801, An Act for Erecting Lighthouses and Placing Buos. This act refers to projects in Virginia, Connecticut, and Rhode Island.

See, for example, 4 St 228, 3/2/1827, Act for Improving Harbors and Rivers; 4 St 288, 5/23/1828, Act for Improving Harbors and Rivers. Appropriations by Congress for federal improvement of rivers and harbors were continued throughout the period, and, by 1920, represented a substantial financial commitment counted on by the states and cities affected.

1 St 464, 5/18/1796.

Five percent (5%) was to be paid at time of bid, "moiety" (half) of the purchase price within thirty (30) days, and the balance within one year. A ten percent (10%) discount was available to those who paid the entire purchase price at the time of bid.

If the subsequent payments were not timely made, the bidder’s claims on the land were forfeited.

2 St 173, 4/30/1802, Act for the Creation of the State of Ohio; see also the act creating the Indiana Territory, 2 St 58, 5/7/1800, Act to Establish the Indiana Territory.

Congress protected the federal government land holdings through appropriations which led to the surveying of virtually all the territory west of the original thirteen states. Surveyed land protected the government’s interest in sales, and increased the value of the land by making it possible to record valid, federally patented title in the name of the purchaser. See, for example, the Act To Procure Surveys, Plans and Estimates For Roads and Canals, 4 St 22, 4/30/1824, the General Survey Act of 1824, 4 St 34, 5/24/1824, and the Act for the Survey of Oregon, 9 St 496, 9/27/1850.

In 1803, The Louisiana Purchase greatly expanded US territory west of the Mississippi and throughout the Missouri River Basin. 2 St 245, 10/31/1803. A treaty with Great Britain in 1818 established the 49th parallel west of 95 degrees longitude as the border with Canada. Florida was ceded to the United States in 1819 from Spain. Texas was annexed in 1845. The Mexican American War of 1846-1848 led to the annexation, by the Treaty of Guadalupe Hidalgo,
what is now California, Nevada, Utah, and parts of Wyoming, Colorado, New Mexico, and Arizona. A second treaty with Great Britain settled the Oregon Question, which added the territory now comprising the states of Oregon, Washington, Idaho, and parts of Montana and Wyoming to the United States. The Gadsden Purchase from Mexico in 1853 added additional territory to what are now the states of Arizona and New Mexico.

372 In 1811, Congress passed an Act Enabling Orleans Territory to Form Louisiana, 2 St 641, 2/20/1811. The following year, Louisiana was incorporated in the United States, 2 St 701, 4/8/1812. The 5% fund in Louisiana was to be devoted to roads and levees along the Mississippi.

373 3 St 289, 4/19/1816, Act to Enable the Indiana Territory to Become a State. A second act in 1818, (3 St 424, 4/11/1818) required 3 of the 5% collected from federal land sales to be used by the new state for laying out and making public roads and canals.

374 St , 3/3/1817. Act Separating Alabama Territory from Mississippi Territory, Act 12/10/1817, Act Admitting Mississippi to the Union.

375 Illinois was separated from the Indiana Territory in 1809, 2 St 514, 2/3/1809, Act Separating Illinois from the Indiana Territory. 3 St 428, 4/16/1818, Act to Enable the Illinois Territory to Become a State. This act required Illinois to set aside Section 16 in each township for schools, granted one entire federal township to the state for use solely as a seminary of learning, and granted all salt springs in the territory to the state for lease or public use.

376 3 St 489, 3/2/1819, Act to Enable the Alabama Territory to Become a State

377 3 St 544, 3/3/1820, Act Admitting Maine into the Union. Maine was formed out of the Commonwealth of Massachusetts, with the consent of Massachusetts.

378 3 St 545, 3/6/1820, the Missouri Compromise. The act granted Section 16 of each township to the inhabitants of Missouri for schools, grants all salt springs in the territory to the state for lease or public use, required use of the 5% funds for internal improvements, including 2/5 of this money for public roads and canals, granted an entire federal township for the encouragement of learning, and granted one entire section of federal land to be used as the seat of government.

379 After the Missouri, slave and free states were generally admitted in pairs. See, for example, 5 St 50, 5/15/1836, Act to Admit Arkansas Into the Union, and the Michigan act, below.

380 See, 2 St 309, 1/11/1805, Act Separating Michigan from the Indiana Territory, and 5 St 49, 5/15/1836, Act to Admit Michigan Into the Union.

381 5 St 797, 3/1/1845, Act Annexing Texas to the United States. The act appropriated $100,000 to arrange for the annexation of Texas upon negotiated terms. Up to four other states were to be formed, consistent with the terms of the Missouri Compromise.

382 Florida was admitted as a state in 1845, on the same day that Iowa was admitted, 5 St 742, 3/3/1845, Act to Admit Iowa and Florida Into the Union; see also, 9 St 117, 12/28/1846, Act for the Admission of the State of Iowa into the Union.

383 Iowa's path to statehood began as part of the Wisconsin Territory, when Wisconsin was separated from Michigan Territory in 1836, 5 St 10, 4/20/1836, Act Establishing the Territory of Wisconsin (from Michigan). Iowa was separated from the Wisconsin territory in 1838, 5 St 235, 6/12/1838, Act Separating the Territory of Iowa from Wisconsin. Iowa was admitted as a state in 1845, on the same day that Florida was admitted to the union, 5 St 742, 3/3/1845, Act to Admit Iowa and Florida Into the Union; see also, 9 St 117, 12/28/1846, Act for the Admission of the State of Iowa into the Union.

384 9 St 56, 8/6/1846, Act to Enable the Wisconsin Territory to Become a State; 9 St 178, 3/3/1847, Act for the Admission of the State of Wisconsin into the Union; 9 St 233, 5/29/1848, Act for the Admission of the State of Wisconsin into the Union. The third of these acts required the new state to assume the obligations of the Wisconsin territory to improve navigation on the Wisconsin and Fox rivers.

385 9 St 452, 9/9/1850, Act for the Admission of the State of California into the Union.

386 11 St 166, 2/26/1857, Act to Authorize Minnesota Territory to Organize as a State. In the Minnesota act, two whole federal townships. Minnesota joined the union on May 11, 1858.
The national government's investment in the Cumberland Road was controversial throughout the period from 1806, when surveys were first authorized, through two presidential vetoes, to 1838. See Appendix B, Mini-Case Study B-5 for a more detailed discussion.


393 Ibid.

394 Gallatin's dream of a system of nationally funded improvements, including a inter-coastal waterway from Boston to Savannah and five (5) crossings of the Appalachians would never occur. Four of these crossings relied on pairs of rivers on each side of the mountain, while the fifth was to utilize the pre-existing cut made by the Hudson and the Mohawk rivers. States and companies built these projects, not the federal government. Four of the five mountain crossings had to await the railroad before they became truly effective. See, Gallatin's 1808 "Report on Roads and Canals", contained in Government Promotion of American Canals and Railroads, 1800-1890. New York, New York: Columbia University Press, 1960.

395 Ibid., at 270.

396 Ibid., see Chapter 3, entitled "The Appalachian Competition", at page 51.


398 Ibid., at pages 157 to 158.

399 Ibid., at page 158.


402 2 St 805, 2/27/1813, Act Authorizing Postal Service to Contract For Steamboats. Terms of the steamboat contracts were not to exceed four years. Rates charged by steamboats for carrying the mails were not permitted to exceed the rates charged on post roads. Contracts let by the Postal Service to carry mails by steamboat were also to require year round service.

403 11 St 101, 8/16/1856, Act Appropriating Funds for US Mail Transport by Ocean Steamer.

404 5 St 314, 1/25/1839, Act to Further Establish Postal Rates on RR Post Routes.

405 5/28/1864, Act Establishing Mail Service Between US and Brazil, 13 St 93.

406 2/17/1865, Act Establishing Mail Service Between US and China, 13 St 430.

407 3/28/1867, Franchise for Atlantic Telegraph Cable Installation, 15 St 10.


409 At this time, a substantial piece of what is now Alexandria, Virginia was still part of the District of Columbia.

410 See Appendix B, Mini-case Studies IV-6 through IV-11 for several illustrative examples.

411 Pennsylvania and Virginia are notable examples. The Lancaster, Pa. turnpike, opened in 1793, is an early American example of a Build-Own-Operate ("BOO") project, in today's usage. Also in Pennsylvania, the state chartered and invested in a company to build the Pittsburgh Pike in 1806. When completed in 1817, the Pike was a major route to the Ohio Valley. Pennsylvania's practice of investing in turnpike corporations continued for a number of years.
By 1825, Pennsylvania was a shareholder in fifty-six turnpike companies, having invested $1,800,000 in them. Private investment in these same companies totaled over $4,000,000, making the state's share of contributed capital about 30%. Goodrich, Carter. Government Promotion of American Canals and Railroads, 1800-1890. New York, New York: Columbia University Press, 1960, at page 62. Pennsylvania roads were the envy of the nation, but Pennsylvania taxpayers had subsidized the effort of private corporations to make them so. The state had also invested approximately $180,000 in bridge corporations, representing about 10% of the total capital contribution in these companies. Ibid., at 63.

412 3 St 12, 7/13/1813, Act Incorporating A Company to Build A Turnpike in Washington City. Congress had issued similar franchises in 1809 and 1810 for the construction of a bridge over the Potomac, Mason's Causeway to Alexandria, and for a number of turnpikes in the District of Columbia. See, the project descriptions below.

413 In the 1990's a state or federal grant to a private corporation to pick its own ROW and to pay fair value for the land taken is viewed as a serious constitutional issue. Is such a statute a "taking" by the statute for a private purpose or for a public purpose? Officials in Virginia agonized over this issue in connection with the Dulles Toll Road Extension. The "short view" is that a toll road operated privately is for a private purpose. The "long view" is that the private financing of a toll road used by the public and that reverts to state ownership and use at the end of a franchise period is a public purpose.

414 This process is not significantly different than that currently used in Hong Kong, although modern engineering, financial and construction expertise has substantially reduced the technical risk associated with large infrastructure projects.


416 Boston to Charlestown Ferry Route -- 11/9/1630. Massachusetts had a long history of competition for the award of franchises, unlike many other states. In 1630, competition was sought for a franchise established by the Massachusetts Court of Assistants in Boston to cross the Charles River by ferry. MacGill, Caroline E., History of Transportation in the United States, at page 66; Carruth, Gorton, ed. The Encyclopedia of American Facts and Dates, 9th ed. New York, New York: HarperCollins Publishers, 1993, at page 13. The Boston to Charlestown Ferry was the first ferry route in the United States and the forerunner of numerous other "franchises" for bridges, ferries, turnpikes, and railroads. These facilities were built by private individuals with their own money in exchange for the franchise awarded by the state, local or federal government to charge and collect tolls over a specified franchise period. This procurement approach is a close analog to those currently in use in Hong Kong (see Chapter II, above). The franchise was first awarded to Edward Converse in June, 1631. Tolls were established by the Court of Assistants at one penny per person and one penny per 100 pounds of cargo. In 1637, the Court amended the charter in order to charge Mr. Converse 40 pounds per year for the privilege of operating the ferry. The Boston to Charlestown Ferry was followed by hundreds of franchises and concessions offered by colonial governments to citizens to make improvements to infrastructure throughout the colonies. At the close of the Revolutionary War, Americans were accustomed and expected cooperative arrangements between government and private citizens which produced ferries, bridges, and turnpikes.

417 This concept, grounded in Jacksonian democracy, is a contradiction in terms if infrastructure built through franchise is viewed as a procurement process. The Court adopts the view that a franchisee owes an unspecified general obligation to the public, which destroys any opportunity for a procurement system to conduct a competition on the basis of quality, time, and price among potential franchisees. The Court confuses procurement processes, by which the government arranges for private sector performance of projects the government is unwilling or unable to perform, with performance of a government function.

The issues raised in the Charles River Bridge case are with us today, particularly in toll road franchising. The Dulles Toll Road is a classic example. The financing package for the road is based upon toll paying traffic forecasts, which in turn assume existing road and traffic patterns in the area surrounding Dulles. Virginia DOT’s plans for other roadway projects in the same area during the franchise period are of critical interest to the franchisee and its financing banks. No binding assurances were given by the state that additional, free, competing roads would not be built during the franchise period.

The Panic of 1837.


Ibid., at page 96.

Ibid., at page 70 to 71.

Ibid., at page 205.

9 St 352, 3/2/1849, Act Granting Drainage Lands to the State of Louisiana.

9 St 519, 9/28/1850, Act to Permit States, Including Arkansas, to Reclaim Swamp Lands.

In the words of Caroline MacGill, the story of the Illinois Central is the story of Illinois. Until the railroad was built through the center of the state, the near total absence of passable roads or canals made the rich farmland of Illinois virtually immune from settlement and productive cultivation. MacGill, Caroline E., History of Transportation in the United States, pages 513 - 547.

9 St 466, 9/20/1850, Act Granting Land In Support of A RR from Chicago to Mobile.


Congress picked up the pace of railroad construction through the Railroad Right of Way Act, dated 3/3/1875, 18 St 482, which granted a federal right of way (ROW) to any railroad in the US, chartered either by a state, territory, or the Congress, provided that their Articles of incorporation were filed with the Secretary of the Interior. The federal ROW was to be 100 feet wide on each side of the road. Included in the ROW is the right to take material, earth, stone, and timber necessary for the construction of the railroad, also to use ground adjacent to such ROW for station-buildings, depots, machine shops, side-tracks, turn-outs, and water-stations not to exceed 20 acres per station and 20 acres per 10 miles of road. To claim the benefits of this act, a railroad company must file with the register of the land office for the district where land is located a profile of its road. Road must be completed within 5 years, or ROW lapses and is forfeited.

7/23/1868, Grant of Land to Minnesota to Build Lock and Dam on Mississippi, 15 St 169. Mineral lands were exempt from the grant, as were other pre-emption and homestead lands. The statute also limited the grant to one section in any one township. Sales proceeds from granted land was to be only used to finance the project. Construction was to be directed by the US Army Corps of Engineers, and completed within two years.
7/2/1862, Morrill Acts (Agricultural and Mechanical Colleges), 12 St 503, sponsored by Representative Justin Smith Morrill, Republican of Vermont.

3/3/1865, Act Granting Land to Michigan To Aid Harbor, Ship Canal Portage Lake, 13 St 519

4/25/1862, Act Granting Land to Wisconsin in Aid of RR Construction, 12 St 618.

5/5/1864, Act Granting Land to Minnesota to Aid in RR Construction, 13 St 64; alternate sections five sections wide on each side of ROW, mineral lands not granted. Other conditions included lands must be used by the state exclusively in support of construction of the road, and disposed of only as progress is made. US land sale price will be $2.50 per acre. RR has a ROW over public lands 100 feet wide. RR is to be completed within 8 years or lands granted revert to the federal government. Toll free passage to US troops, officers, and goods over the road.

5/5/1864, Act Granting Land to Wisconsin to Aid in RR Construction, 13 St 66.

5/12/1864, Act Granting Land to Iowa to Aid in RR Construction, 13 St 72.

7/4/1866, Additional Grants of Land to Minnesota For General RR Construction, 14 St 87.

7/23/1866, Grants of Land to Kansas For St Joseph and Denver RR and Telegraph, 14 St 210.

7/23/1866, Grants of Land to Kansas For Kansas and Neosho Valley RR and Telegraph Company, 14 St 210.

7/25/1866, Grants of Land to California and Oregon Railroad Company, 14 St 239. The general terms of the grant were these: Grant of alternate sections ten sections wide on each side of ROW to assist in the construction of a RR and telegraph. Mails to be transported along the route, at fair prices to be determined by the Postmaster. Free transportation of federal troops, officers, and property. Sales price of remaining federal lots to be at double the current price. Materials such as stone, earth, timber may be taken from land adjoining the ROW.


7/1/1862, Union Pacific Railroad Charter (Pacific Railroad Acts), 12 St 487.

A second northern route to the Pacific was chartered on a similar basis, with grants of alternating sections of land in 1864. 7/2/1864, Act Authorizing Railroad and Telegraph Construction - Northern Route, 13 St 365.

The statute provided that sixteen (16) $1,000, 6% bonds were to be issued to the railroad for each one mile of railroad and telegraph that was properly installed and accepted. The US was to receive a first mortgage, in exchange, on the entire road, until such bonds were repaid. For the three hundred (300) most mountainous miles between the Rockies and the Sierra Nevada, the Union Pacific was to receive three times the number of bonds per mile.

The telegraph had raced onto the American infrastructure scene between 1835 and 1847. In 1835, Samuel F. B. Morse constructed his first working model. Improving the device after 1835, he obtained a patent in 1840. Carruth, at pages 195, 219, 227. Morse demonstrated the telegraph to President Van Buren in 1838, requesting financial support. Five years later, the Congress authorized $30,000 to pay for the construction of the first commercial telegraph line from Baltimore to Washington. 5 St 619, 3/3/1843, Act to Test the Practicability of the Telegraph. In 1844, hoping to sell the device to the federal government, Morse demonstrated its usefulness to Congress by sending and receiving messages between the Capitol and the City of Baltimore. Morse offered to sell his invention to the government for $100,000, but was turned down, based on the government's assessment that the device would not pay for itself. In 1847, Morse formed the Magnetic Telegraph Company in an effort to commercialize his invention himself. Soon there were fifty (50) telegraph companies in the United States. The telegraph industry was consolidated by Western Union, which was founded in 1851, which proceeded to build a national network. Eight million (8,000,000) telegraph poles connected Washington to California before the start of the Civil War. Grannick, Harry. Underneath New York. New York: Fordham University Press, 1991, at pages 101 to 103.

7/2/1864, Pacific Railroad Acts, 13 St 356.


7/3/1866, Pacific Railroad Acts, 14 St 79.
451 4/10/1869, Act to Protect US Interest in UP and CP RR Companies, 16 St 56.
452 MacGill, supra., at page 188.
453 Congress’ attitude toward the Credit Mobilier changed. A series of investigations,
litigation, and statutes kept these issues alive until all the government bonds were repaid. In
1894, for example, Congress gave all land grant railroads three months to establish and
maintain passenger stations and freight depots at or within 1/4 of a mile of the boundary limits
of all town sites already established in Territories on existing railroad lines. The act
established fines of $500 per day for failing to comply. 8/8/1894, Act Requiring RR on Federal
ROW to Establish Town Site Stations, 28 St 263.
454 Ibid., at 242 to 244.
455 For example, in 1869, Cornelius Vanderbilt financed the construction and operation of Grand
Central [Station] Depot in New York. The roof covering the train shed, an immense vault of
glass and iron, created the largest interior space in the country. McCullough, The Great Bridge,
supra, at page 83.
456 Ibid., at 271.
457 One example that was famous at the time is the Cincinnati Bridge (now known as The John
A. Roebling Bridge), which crosses the Ohio between Covington, Ky., and Cincinnati, Ohio.
Designed by John A. Roebling, the bridge was the largest in the world when opened, with a
river span of 1057 feet and an overall length of 2252 feet. The bridge was a private franchised
project developed by Amos Shinkle, a Cincinnati coal dealer. After a series of starts and stops
between 1845 and 1855, and after Roebling’s bridge over Niagara Falls was successfully
completed and tested, Roebling was hired to design and superintend construction. A Kentucky
statute had previously chartered the Covington and Cincinnati Bridge Company, as did Ohio.
Roebling developed his innovative traveler system was transporting cables over the tops of his
towers at this site. The Civil War interrupted work, which was completed by Roebling’s son,
Washington, upon his return from the Civil War. Schodek, supra, at 115; McCullough, The
Great Bridge, at pages 68 to 70.
458 A tiny percentage of these franchises are listed here: 7/25/1866, Authority to Build Bridges
as Post Roads, 14 St 244, including bridges across the Mississippi at Quincy, Illinois, Hannibal,
MO, Prairie du Chien (Wis. to Iowa), and at Keokuk; across the Missouri at Kansas City; and
across the Mississippi at St. Louis; 3/21/1868, Authority to Build Bridges at Lacrosse, WI as
Post Road, 15 St 37; 4/1/1872, Act Authorizing Bridge Over the Mississippi at Clinton, Iowa, 17
St 44. (This statute contains a particularly good procurement plan, since outline requirements for
the bridge are established before any company is identified for the franchise. Congress
describes navigation requirements, spans, pier separation, and authorizes toll collections. All
railroad companies are given equal right to pass over the bridge in exchange for reasonable
compensation. This act was later applied to all bridges over the Mississippi, by separate act of
Congress, at 6/4/1872, 17 St 215.) Other examples include, 5/25/1872, Act Authorizing Bridge
Over Mississippi at Fort Madison, Iowa, 17 St 160; 6/4/1872, Act Authorizing Bridge Over
Missouri R. at Nebraska City, 17 St 222; 6/4/1872, Act Authorizing Bridge Over Missouri R. at
Brownville, NE, 17 St 223; 6/10/1872, Act Authorizing Bridge Over Mississippi at Red Wing,
MN, 17 St 379; 12/17/1872, Act to Authorize Bridges Over the Ohio and Requirements
Therefore, 17 St 398; 3/3/1873, Act Authorizing Bridge Over Mississippi at Saint Louis, MO, 17
St 616.
459 A small number of the acts of Congress authorizing grants of land to states in aid of state
sponsored franchises for the construction of roads and roadway bridges are described here. Each
follows the pattern set forth in the first example: 3/3/1863, Act Granting Land for Construction
of Military Road from Fort Wilkins, Copper Harbor, Michigan to Fort Howard, Green Bay,
Wisconsin, 12 St 797, which provided a land grant of 3 alternate sections on each side of a ROW
in Michigan and Wisconsin to aid the State in the Construction of a military road for the
federal government. The granted land was to be sold by the state legislatures solely in support of
the construction of the road. Outline specifications provided for the road are set forth in the

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statute, including drains and ditches, a road surface not less than 40 feet wide, maximum graded area not less than 16 feet wide, with bridges and grading to permit use of the road as a wagon road in all seasons of the year: 6/20/1864, Act Granting Land for Construction of Wagon Roads in Michigan, 13 St 140; 6/25/1864, Act Granting Land for Construction of Military and Postal Road from Wausau to Lake Superior, 13 St 183; 7/5/1866, Act Granting Land to Oregon for Construction of Military Road from Albany, Oregon to the eastern boundary of the Territory, 14 St 89; 2/25/1867, Act Granting Land to Oregon for Construction of Military Road from Dalles City, on the Columbia River to Fort Boise on the Snake River, 14 St 409.

For example, see: 7/5/1884, Act Authorizing Dam Across Mississippi River at Saint Cloud, MN, 23 St 154

12/17/1872, Act to Authorize Bridges Over the Ohio and Requirements Therefore, 17 St 398. The river was divided into two segments, that upstream of the Cincinnati (the Roebling) suspension bridge and that downstream from the bridge. Clearances, lighting requirements, post and telegraph rights and routes were standardized in each of these two segments.

3/23/1906, Act to Regulate Bridge Construction over Navigable Waters, 34 St 84 (terms include construction start within one year and completion within three years, access to bridge by competing railroads for reasonable fees, tolls for persons and other vehicles, no obstruction to navigation, and lights on structures); 6/21/1906, General Act Regulating Dams Across Navigable Waters, 34 St 386.

6/23/1910, Omnibus Dam Construction Act, 36 St 593. Restates the requirements for dams across navigable waters, first enacted at 34 St 386. The advance approval of the Sec. of War and Chief of Engineers is required for all projects, and locks and suitable approaches may be required to be constructed as a condition of permitting dam construction. Congress may revoke a franchise to construct a dam when required for public use, but compensation must be paid to the franchisee of the "reasonable value of the works" as determined by mutual agreement or in Circuit Court. In any event, authority to operate the dam terminates at the end of a period not to exceed 50 years from the date of the original approval of the project. Franchisees have one year to start construction and three years to finish.

3/28/1916, Hawaii Infrastructure Franchise Acts, 39 St 38; 39 St 57; 39 St 229; 39 St 231; 39 St 232; 39 St 246. These acts authorized the Territory to franchise gas, electric light, power, telephone, railroad, and street railway companies. The reasonableness of rates, prices, and charges were to be regulated by a Public Utility Commission. See subsequent extensions of this principle at 57, 229, 231, 232, 246, II.

The Rivers and Harbors acts between 1869 and 1930 are listed for illustrative purpose in this note. Each of these acts identifies hundreds of projects to be built by the Secretary of War under the supervision of the Chief of Engineers of the Army Corps of Engineers. The pattern established the Corps close connection to civil works construction. 4/10/1869, Act to Improve Rivers and Harbors for FYE; 6/30/1869 and 1870, 16 St 44 ($2,000,000); 7/11/1870, Act to Improve Rivers and Harbors for FYE 6/30/1871, 16 St 223, ($3,900,000 appropriated to a long list of projects that are specified for completion. Congress is identifying particular projects spread around the nation; 6/10/1972, Act to Improve Rivers and Harbors for FYE 6/30/1873, 17 St 370, ($5,800,000); 6/23/1874, Act to Improve Rivers and Harbors, 18 St 237, ($5,150,000); 8/14/1876, Act to Improve Rivers and Harbors (South Pass / Eads), 19 St 132; 6/18/1876, Act to Improve Rivers and Harbors, 20 St 152; 3/3/1879, Act to Improve Rivers and Harbors; 6/14/1880, Act to Improve Rivers and Harbors, 21 St 180; 3/3/1881, Act to Improve Rivers and Harbors, 21 St 468; 7/5/1884, River and Harbor Act of 1884, 23 St 133; 8/5/1886, River and Harbor Act of 1886, 24 St 310; 8/11/1888, River and Harbor Act of 1888, 25 St 400; 7/13/1892, River and Harbor Act of 1892, 27 St 88; 8/18/1894, River and Harbor Act of 1894, 28 St 338; 6/3/1896, River and Harbor Act of 1896, 29 St 202; 3/3/1899, River and Harbor Act of 1899, 30 St 1121; 6/13/1902, River and Harbor Act of 1902, 32 St 331; 3/3/1905, River and Harbor Act of 1905, 33 St 1117; 3/2/1907, River and Harbor Act of 1907, 34 St 1073; 3/3/1909, River and Harbor Act of 1909, 35 St 815; 6/25/1910, River and Harbor Act of 1910, 36 St 630; 2/27/1911,

666 6/28/1879, Act Creating the Mississippi River Commission, 21 St 37. $175,000 was appropriated to fund a seven-member commission, with three members from the Army Corps of Engineers, one from the US Coast and Geodetic survey, and three civilians. The general scope of the Commission was to complete all current surveys of the river from its head to its mouth, and to undertake other surveys, examinations, and investigations, topographical, hydrographical, and hydrometrical of the river, including tributaries. Assistance in money and men was to be provided by Sec. of War and the Sec. of Treasury. The Commission was required to consider and develop mature plans and estimates to correct, permanently locate, deepen the channel, and protect the banks of the Mississippi River; improve and make navigation safe; prevent destructive floods; and promote and facilitate commerce, trade, and the postal service.

667 5/4/1882, Act to Remove Obstruction at Hell Gate, New York, 22 St 58.

668 5/18/1880, Act to Abolish All Tolls at Louisville/Portland Canal, 21 St 141.

669 Schodek, supra, at page 38.

670 1/27/1905, Alaska Road and Trail Act, 33 St 616.

671 Congressional interest in reclamation began thirty years earlier, when Congress required the Corps of Engineers to report to the President the best system for permanent reclamation of the entire alluvial basin of the Mississippi River. 6/22/1874, Act for Commission to Prepare Reclamation Plan for Mississippi Basin, 18 St 199.

672 6/17/1902, Reclamation Act of 1902 (Irrigation of Arid Lands), 32 St 388.

673 Schodek, supra, at page 256. At the time it was completed the Roosevelt Dam was one of the largest in the world, and serve the purposes of irrigation, flood control, power generation, and recreation. The dam generated electrical power which powered the Phoenix streetcar system.

674 8/19/1921, Act Permitting Compact Re the Colorado River, 42 St 171, between AZ, CA, CO, NV, NM, UT, and WY; and 12/21/1928, The Boulder Canyon Project Act, 45 St 1057, which confirms the Colorado River Basin Compact, and authorizes the chart of the Boulder Canyon Project (Hoover Dam).

675 7/11/1916, Act for Federal Aid to State Hwy. Deps. for Rural Post Roads, 39 St 355. Under the act, states were required to properly maintain the roads after completion, or no more money would be approved for future projects. Caps on reimbursements were set at $10,000 per mile, and all roads supported by the federal government were to be free from toll. The Sec. of Agriculture and the State highway departments were to agree on the roads to be constructed each state and the character and method of construction. Only “rural post road” were eligible for federal aid, which was defined to mean “any public road over which US mails now are or may be transported, but excluding every street and road in a town with more than 2,500 people.”

676 In a 1921 amendment to the Federal Aid Act, states were required to provided surveys, plans, specifications, and estimates to the Secretary of each of the road projects proposed for federal matching funds before they could be reviewed for approval by the federal government. This guaranteed a segmented process in Quadrant IV. Advances of federal money were allowed during the progress of construction, and $75M was appropriated for the YE 1922.

677 In 1919, Congress doubled the reimbursement cap from $10,000 to $20,000 per mile, and redefined “rural” to mean streets where dwellings were more than 200 feet apart, wherever located. 2/28/1919, Federal Aid (Amendment to Rural Post Road Act), 40 St 1200. In 1925, appropriations grew to $75,000,000 per year, 2/12/1925, Act Amending the Federal Rural Post Rd Aid Act, 43 St 889, and further increases were made in 1930, 5/5/1930, Act Amending the Federal Rural Post Rd Aid Act, 46 St 261.
6/10/1920, Federal Water Power Act, 41 St 1063. The Commission was to determine the needs of individual communities and regions for water, water power, and electrical power, and to determine whether federal, municipal, or private facilities could best meet such needs, and to issue appropriate licenses. Preferences were to be given to state or local applications to construct facilities. The Act requires prior review of all facility applications by the Corps of Engineers and the Secretary of War before the review by the Federal Power Commission. The act puts the procurement system further into Quadrant IV, through a layered set of approvals and agency determinations as to how projects will be delivered through public (Quadrant IV) and private (Quadrant II) means.

5/15/1928, Mississippi River Flood Control Act of 1928, 45 St 534. This act adopts the plan prepared by the Corps of Engineers to control floods on the Mississippi. Congress appropriated the sum of $325,000,000 to implement the plan, with no local contribution. On its face, the statute declares this to be a major departure from previous acts and principles. As a precondition of commencing work on any of the projects in a particular state, the Chief of Engineers must be first assured that all completed flood works built under this act will be maintained at the state's expense.


2/20/1893, Separate Procurement of Architectural Services, 27 St 468. The act permitted the Secretary of the Treasury to, in his discretion, "obtain plans, drawings, and specifications for the erection of public buildings for the United States, authorized by Congress to be erected under the supervision and direction of the Secretary of the Treasury and the local supervision of the construction thereof by competition among architects under such conditions as he may prescribe and to make payment for the services of the architect who plan may be selected out of the appropriations for the respective buildings: Provided, that not less than five architects shall be invited to compete for the furnishing of such plans and specifications and the supervision of such construction; and Provided, that the Secretary remains in charge of all matters connected with the erection and completion of such buildings, including receipt of proposals and award."

5/7/1926, Foreign Service Buildings Act, 1926, 44 St 403.

5/25/1926, Public Buildings Act, 44 St 630.

Authority for Design-Build was provided in the Federal Acquisition Streamlining Act of 1994, discussed in Chapter III, supra.

This could be done in house by the government itself, or with the assistance of consultants.

Value engineering alternatives have determined the winner in a number of Hong Kong BOT, DBO, and DB projects.

A key element of any BOT strategy is the capacity of the selected team to not only perform the expected work, but to overcome the unexpected problems and setbacks that typically accompany large, complex, infrastructure projects. It is not enough to be technically competent to design, construct, maintain and operate these facilities on a BOT basis. The franchisee must have the financial strength, and the appropriate financial incentives to complete and operate the project over a long franchise period.

For example, two of the three 50-year DBO franchises recently awarded in Hong Kong went to American-led consortiums.

Estimates between several hundred billions and one trillion dollars have been reported in the press.

A similar strategy by the Hong Kong transit system has produced $4B in revenue to the system, enough to meet annual debt service on the cost of subway construction.

The Alewife station is a study in contradiction. Company mini-vans cart employees and visitors from the subway grounds to office complexes just beyond a walk away. The garage and station adjoins no other facility, except the commuter garage overhead. A hotel planned to be constructed across Route 2 has never been built. A few commercial establishments appear to be successful in the garage, but half the available space has never been rented.
For example, a requirement that only American made equipment may be incorporated in a project narrows the scope of competition.

The competitive nature of source selection is sufficient to avoid the application of Truth in Negotiation Act principles to BOT and DBO infrastructure development processes.

Use of the word "Procurement" is intentional, in order to distinguish the processes proposed here from the terms "privatization" and "public-private partnerships", which have generated interminable and fruitless debate. Procurement processes do not put the government and its contractors in "partnership" with one another, nor do they require that government abdicate responsibility to manage infrastructure through "privatization", a result that is unfamiliar, uncomfortable, and inconsistent with 200 years of American history.

See Chapters IV and V, supra.

If Massachusetts determined that a class II container port was required in Boston as part of its long term economic strategy, a similar franchise arrangement could be structured for the port of Boston. Rather than funding the container terminal facilities with public money, the Commonwealth might provide sufficient incentives to obtain competitive proposals for such facilities by arranging for publicly funded dredging of the harbor to meet enlarged port requirements, and/or for prompt construction and delivery of a double stack rail link to the port.

If Massachusetts determined that a new airport was required in Boston's Outer Harbor and provided appropriate incentives for the private sector to finance it, BOT processes could be applied to the entire project or to major elements of the facility, including cargo facilities, fuel supply and distribution, aircraft maintenance facilities, and food supply.

Infrastructure Development at the State or Regional

This process and its results is described in some detail in Chapter II, §A.2, supra.

Correlative Note II-3. Similar questions, opportunities, and choices face much of the United States, for example, Boston, Massachusetts, and New England. How can metro-Boston become a significantly more important gateway between the United States and Europe? Rather than competing with the rest of New England, how can metro-Boston adjust the growth of its economy and its infrastructure to protect its existing economy, protect its investment in infrastructure, and, at the same time, assist in the expansion of the economies of other cities, ports, airports, and economic zones in New England?


The two functions are related of course, but the principle effort is devoted to establishing the desired end, which is of greater importance than the means to get there.

One of the great ironies of the current federal paradigm is that Congress's temporary turn away from Quadrant II, in response to the Depression, was made permanent in the 1950's, precisely when Quadrant II processes would have been most effective.

Senior citizens above the age of 65 are entitled to free prescription drugs in Canada: others are not. First year students at MIT take their course Pass/Fail: sophomores and juniors cannot. Picking a franchisee to build a new crossing over the Charles River gives rights only to one company or group, and not to anyone else.

Today, the term "incentives" means cash, and usually, "tax breaks". For example, Congress gives tax breaks for those who set aside money for retirement. Massachusetts punishes residents who maintain savings accounts in another state by taxing interest income at twice the rate of in-state interest.

4 St 604, 7/14/1832, Act to Release From Duty Iron Prepared for RR and Inclined Planes; 5 St 61, 7/1/1836, Act to Release From Duty Iron Prepared for RR and Inclined Planes.

6 St 555, 2/26/1834, Act Permitting Importation of Iron Steamboat Free From Duty.

6 St 739, 7/7/1838, Act Permitting Import of More Iron Steamboats Without Duty.

6 St 739, 7/7/1838.

6 St 740, 7/7/1838.
6 St 745, 7/7/1838.
512 5 St 727, 2/26/1845 , Act to Allow Duty Free Import of Experimental Pipes for the South Carolina Railroad Company. In today’s environment, to protect home industries rather than to incorporate foreign improvements, Congress might impose an extra duty on equipment needed to test innovative means of magnetically propelling trains at high speeds.
513 9 St 207, 3/3/1847 , A Resolution to Light the Capitol and Its Grounds With Gas.
514 6/6/1900, Franchise for Phone System in Indian Territory, 31 St 658.
515 2 St 35, 4/17/1800, Chapter 25.
516 6 St 87, 2/5/1806.
517 6 St 160, 4/2/1816.
519 6 St 277, 5/7/1822.
520 6 St 293, 5/7/1822.
521 6 St 330, 3/3/1825.
522 2 St 691, 3/2/1812, Act To Authorize Purchase and Use of Lewis Patent Rights.
523 6 St 370, 1/25/1828.
524 6 St 371, 2/21/1828.
525 6 St 375, 4/28/1828, and 6 St 381, 5/23/1828.
527 2 St 413, 2/10/1807, Act to Provide for Surveying Coasts of the United States.
528 Supra.
529 3 St 466, 4/20/1818, Act Respecting the Surveying and Sale of Land in the Alabama Territory.
530 4 St 22, 4/30/1824, Act To Procure Surveys, Plans and Estimates For Roads and Canals.
531 4 St 139, 3/3/1826, Act for Survey of Route Across Florida from Atlantic to Gulf.
533 4 St 777, 3/3/1835, Act Appropriating for Roads, Examinations and Surveys.
534 2/18/1871, Act For Gauging the Mississippi and Its Tributaries, 16 St 598.
535 5/20/1888, Arid Land Resolution, 25 St 618.
536 5/18/1920, Act For Study of Irrigation of Imperial Valley, CA, 41 St 600.
537 6/13/1902, International Waterways Act (Eventually St. Lawrence Seaway), 32 St 373
538 3/2/1929, Act to Investigate Route For a Second Isthmus Crossing, 45 St 1539.
539 2 St 805, 2/27/1813, Act Authorizing Postal Service to Contract For Steamboats.
540 3 St 496, 3/2/1819, Act for Steamboat Postal Service from New Orleans to Louisville.
541 5 St 585, 8/31/1842, Resolution Authorizing Ice Boats On Potomac To Carry Mail.
542 10 St 239, 3/3/1853, Act Appropriating Funds for US Mail Transport by Ocean Steamers; 11 St 101, 8/16/1856, Act Appropriating Funds for US Mail Transport by Ocean Steamers.
543 3/25/1864, Act Providing for Carrying the Mails to Foreign Ports, 13 St 56.
544 5/28/1864, Act Establishing Mail Service Between US and Brazil, 13 St 93.
545 2/17/1865, Act Establishing Mail Service Between US and China, 13 St 430.
547 5/8/1928, Act For Air Mail Transport to Foreign Nations, 45 St 248.
548 2/15/1933, Act Authorizing Railroad and Electric Car Companies to Carry Mail, 47 St 809.
549 2 St 199, 2/19/1803, An Act Authorizing Sale of Land in Charlestown, Massachusetts.
550 6 St 318, 5/26/1824, Act Granting Land on Mississippi In Exchange for Maintaining Levee.
551 6 St 346, 5/20/1826, Act to Exchange US Land in City of Detroit for New Arsenal.
552 9 St 77, 8/8/1846, Act Granting Land to Iowa Territory. to Improve Navigation on Des Moines.
553 9 St 83, 8/8/1846, Act Granting Land to Wisconsin. Territory. to Improve Navigation on Rivers.
554 9 St 352, 3/2/1849, Act Granting Drainage Lands to the State of Louisiana; 9 St 519, 9/28/1850, Act to Permit States, Including Arkansas, to Reclaim Swamp Lands.
555 9 St 466, 9/20/1850, Act Granting Land In Support of A RR from Chicago to Mobile.
6/20/1864, Act Granting Land for Construction of Wagon Roads, 13 St 140. The statute contains a functional specification of minimum requirements for the road: Cleared width not less than 6 rods wide; road bed at least 32 feet wide; center section of road raised sufficiently to provide a dry road-bed by natural drainage; drains and ditches on each side; all stumps and roots to be thoroughly grubbed out between the ditches over the entire length of the road; and with "good and substantial" bridges and sluices wherever necessary.


10 St 610, 2/17/1855, Act Authorizing Telegraph Construction to Pacific Ocean.


8/15/1876, Act Encouraging Telegraph Communication with Asia, 19 St 201. This non-exclusive franchise, awarded to a group which included Leland Stanford and Mark Hopkins, permitted the franchisee to construct, lay, land, and maintain a line or lines of telegraph or submarine cable or cables along the Pacific coast of the US, and to connect the American and Asiatic coasts by telegraph line, wire, or submarine cables.

2/20/1877, Act Encouraging Telegraph Communication with Europe, 19 St 232. This statute was essentially a copy of that for the Pacific coast, with a different franchisee.


3/3/1887, Act to Authorize Bridge at Pierre, SD, 24 St 561.


5/4/1900, Franchise to Bridge the Snake River at Nome, Alaska, 31 St 166.

7/3/1926, Franchise to Build the Lake Washington Bridge, Seattle, 44 St 824.

4/1/1872, Act Authorizing Bridge Over Mississippi at Clinton, Iowa, 17 St 44.

6/6/1874, Act Authorizing Ponton Railroad Bridge at Prairie Du Chien, 18 St 62.

3/3/1875, Act Authorizing Ponton Wagon Bridge at Dubuque, IA, 18 St 522.

2/11/1887, Act to Authorize Frank W. Hunt's Ferry at Fort Buford, ND, 24 St 401.

4/15/1886, Act Authorizing Dam Across Mississippi River at Brainard, MN, 24 St 12.

7/3/1886, Act Authorizing Dam Across Mississippi River at Little Falls, MN, 24 St 123.

1/22/1894, Act Authorizing Dam Across the Kansas River, 28 St 27.

3/5/1898, Act Authorizing Dam Across Mississippi Above Minneapolis, 30 St 253.

2/27/1899, Franchise to Dam the Mississippi R. at Grand Rapids, MN, 30 St 904.

2/8/1901, Franchise for Two Dams on the Savannah R., 31 St 763.

2/15/1911, Act Authorizing Dam on Colorado R. at Pyramid Canyon, 36 St 909.

6/11/1906, Franchise For Canal From Puget Sound to Lake Washington, 34 St 231.

3/3/1911, Act Authorizing Diversion Dam at Parker, AZ, 36 St 1081.

4 St 728, 6/30/1834, Act Authorizing Testing of the Steam Engine.

5 St 619, 3/3/1843, Act to Test the Practicability of the Telegraph.

5 St 798, 3/3/1845, Act to Test the Practicability Plough and Dredging Machine.


5 St 65, 7/2/1836, Act Authorizing the New Orleans & Nashville Railroad To Pass Through Public Lands.


5 St 144, 7/31/1837, Act Authorizing Railroad Cos. To Pass Through Fla. Public Lands.

8/4/1852, Act Giving ROW to Rail and Plank Roads and Macadamized Tumpikes, 10 St 28.

3/3/1875, Railroad Right of Way Act, 18 St 482.

5/21/1896, Act Granting ROW for Oil Pipelines In Colorado & Wyoming, 29 St 127.

4/21/1806, Act to Provide for Resettlement of Burned City of Detroit, 6 St 62.

9/27/1850, Act For Survey of Oregon and Grants of Land to Certain Settlers, 9 St 496.

Congress repealed this act, known as the Graduation Act, during the Civil War.

10 St 574, 8/4/1854, Act to Graduate the Sales Price of Remaining US Public Lands; see, also, 10 St 683, 3/3/1855.
594 3/3/1863, Act for Sale of Town Sites on Public Lands, 12 St 754.; See, also, 7/1/1864, 13 St 343;
3/3/1865, 13 St 529; 3/2/1867, 14 St 541; 6/8/1868, 15 St 67; 7/1/1870, 16 St 183.
595 3/3/1877, Desert Land (Homestead) Act, 19 St 377.
596 6/3/1878, Timber and Stone Act, 20 St 89.
598 6/15/1866, Garfield Act (Compulsory Railway Connection), 14 St 66.
600 3/3/1919, Act To Standardize Screw Thread Sizes, 40 St 1291.
601 A prominent example of this problem is the Delaware River, the headwaters of which are in
New York State. The amount of water diverted to New York City from the watershed of the
Delaware is of critical importance to Pennsylvania and its inhabitants.
602 3/1/1911, Act Permitting Interstate Compacts Re Navigable Waters, 36 St 961. This act
agreed in advance with the results of compacts which conserved forest land and water supplies
of participating states.
603 8/19/1921, Act Permitting Compact Re the Colorado River, 42 St 171.
605 Flow at the mouth of the Colorado in the Bay of California was reduced to essentially zero.
607 3/8/1926, Act Approving the South Platte River Compact, 44 St 195.
608 2/25/1920, Mineral Lands Leasing Act of 1920, 41 St 437.
609 5/21/1930, Leasing of Oil and Gas: Deposits Under Federal ROW’s, 46 St 373.
610 5/24/1928, Act for Leasing of Public Land for Airfields, 45 St 728.
611 Schodek, Daniel L. Landmarks in American Civil Engineering. 1 vols.: MIT Press, 1988, page
305.
612 MacGill, Caroline E., History of Transportation in the United States, at page 63.
613 Ibid.
614 The toll charges were specifically legislated: “For every score of sheep 1/8/dollar; for every
score of hogs, 1/8 dollar; for every score of cattle 1/4 collar, for every horse and his rider, or led
horse, 1/16 dollar; for every sulky, chair, or chaise, with one horse and two wheels, 1/8/dollar;
for every chariot, coach, stage, wagon, phaeton, or chaise with two horses and four wheel, 1/4
dollar; etc. See, MacGill, Caroline E., History of Transportation in the United States, at page
68 for the complete toll rates.
615 Schodek, Daniel L. Landmarks in American Civil Engineering. 1 vols.: MIT Press, 1988, pages
3 to 6.
616 Ibid.
617 MacGill, Caroline E., History of Transportation in the United States, at page 266.
618 Ibid.
619 MacGill, Caroline E., History of Transportation in the United States, at page 148, and
generally, from pages 148 to 152.
620 See, generally, Schodek, Daniel L. Landmarks in American Civil Engineering. 1 vols.: MIT
621 MacGill, Caroline E., History of Transportation in the United States, at 150.
622 3/29/1806, Act to Regulate Laying Out the National (Cumberland) Road, 2 St 357. Surveying
and marking were done separately from construction of the road. The project has been classified
in Quadrant IV, based upon this limited segmentation of design from construction, and the direct
funding of the project by the government.
623 5/15/1820, An Act to Authorize Commissioners to Extend National Road, 3 St 604.
Controversy over the national government’s funding of a road which did not “benefit” all states
was increasing. The 1820 act was for a survey only, and the states themselves were expected to
fund extension of the road. Section 2 of this act so provided. “Nothing shall be deemed to
imply any obligation on the part of the United States to make, or to defray the expense of making, the road . . .”

Indeed, the Act begins this way: Whereas, by the continuation of the Cumberland road from Wheeling in the state of Virginia, through the states of Ohio, Indiana, and Illinois, the lands of the United States may become more valuable, . . .”

Schodek, Daniel L. Landmarks in American Civil Engineering. 1 vols.: MIT Press, 1988, pages 35 to 38. Congress turned around again, and in 1822, passed a bill to appropriate federal money to repair the National Road, which Monroe vetoed on Constitutional grounds.

3/3/1825, Act for Continuation of the National (Cumberland) Road, 4 St 128

3/2/1829, Act for Continuation of the National (Cumberland) Road, 4 St 351

3/3/1829, Act for Preservation of the National (Cumberland) Road, 4 St 351. The similarities to the end of federal interstate highway funding are striking, and became more so over the next ten years.

5/31/1830, Act Appropriating for Internal Improvements (Cumberland) Road, 4 St 427

3/2/1831, Act for Continuation of the National (Cumberland) Road, 4 St 351; 3/2/1833, Act Appropriating for Internal Improvements (Cumberland) Road, 4 St 648; 6/24/1834, Act Continuation & Transfer of the National (Cumberland) Road, 4 St 680.

6/24/1834, Act Continuation & Transfer of the National (Cumberland) Road, 4 St 680.

7/2/1836, Act Continuation & Transfer of the National (Cumberland) Road, 5 St 71.

3/3/1837, Act Continuation & Transfer of the National (Cumberland) Road, 5 St 195.

5/25/1838, Act Continuation & Transfer of the National (Cumberland) Road, 5 St 228.

8/11/1848, Act Surrendering Part of the National (Cumberland) Road to Indiana, 9 St 283;

1/20/1853, Act Surrendering Part of the National (Cumberland) Road to Ohio, 10 St 152;

5/9/1856, Act Surrendering Part of the National (Cumberland) Road to Illinois, 11 St 7.

2/5/1808, Act Authorizing the Erection of a Bridge Over the Potomac, 2 St 457.

As early as 1808, Congress was interested in both the commercial and national defense aspects of infrastructure development. Here, Congress intended that private citizens provide the income stream needed to finance and maintain a bridge that it was also in the interest of Congress to see built.

4/21/1808, Act for the Establishment of a Turnpike Co. in the District of Columbia, 2 St 485.

Congress set the date at which stock subscriptions could be offered for sale to the general public. Other similarities include: citizens were empowered to act as board of commissioner, subscription of stock was authorized, and outline specification were included for the road and for an incidental bridge. The franchisee was required to finance, build, maintain, operate, and repair the road during the franchise period.

Just as in modern times, “who” sets the tolls, the “levels” at which tolls are set, and the means by which tolls are raised, lowered, and eliminated is of substantial importance to the government, the private franchisee, and the public.

Such competitions are routinely conducted in Hong Kong (see Chapter II).

Might a lower percentage have been obtained by Congress through competitive proposals? Or, was the project so “risky” is terms of expected traffic volumes, that the prospect of a 12% return was so low that only inexperienced or undercapitalized investors and builders would consider the project.

3/3/1809, Act Authorizing Turnpike - Mason's Causeway to Alexandria, 2 St 539.

The Company was authorized to acquire land, in what amounts to a private right of eminent domain. In this act, however, Congress set forth an alternative dispute resolution process for the parties to follow in advance of litigation. If a price could not be mutually agreed upon, a Court would determine the fair value in a proceeding much like eminent domain litigation today.

4/20/1810, Act Incorporating A Company to Build Turnpikes in DC, 2 St 570.

There are several new wrinkles to the BOT method with which Congress was becoming increasingly comfortable during this period. First, the act specifically required that the entire
project be completed before any tolls were collected. This was designed to ensure that the project was in fact completed.

5/20/1826, Act Regarding Turnpike in Alexandria City, 4 St 177.

7/13/1813, Act Incorporating A Company to Build Turnpike in Washington City, 3 St 12.

See, Chapter IV, Case Study, IV-4.

5/24/1824, Act to Improve Navigation of the Ohio and Mississippi Rivers, 4 St 32.

5/23/1813, Act Incorporating A Company to Build Turnpike in Alexandria City, 3 St 5.

A very early version of the European Economic Community, NAFTA, and recent suggestions that the Americas (North, Central, and South) become a duty-free economic zone.

3/3/1825, Act Authorizing Stock Subscription in Chesapeake & Ohio Canal Co., 4 St 124.


4/30/1824, Act to Procure Surveys Plans and Estimates for Roads and Canals, 4 St 22. This was an abrupt switch for the federal government, and in particular for President Monroe, who had long taken the position that the Constitution did not permit the Congress to build or control internal improvements such as canals, bridges, and turnpikes. In 1822, Monroe had vetoed a bill appropriating funds to repair the National Road.


5/13/1826, Act Authorizing Stock Subscription in Louisville/Portland Canal Company, 4 St 162.


5/18/1826, Act for Stock Subscription in Dismal Swamp Canal Company, 4 St 169. $150,000 was appropriated for the stock purchase.


6/6/1824, Act for Stock Subscription in Dismal Swamp Canal Company, 4 St 169. $150,000 was appropriated for the stock purchase.


Ibid.


Several months later, on August 2, 1847, Pennsylvania's governor announced that the statute giving the Baltimore and Ohio Railroad a right of way through Pennsylvania was "null and void". Ibid., at page 396.

Prior to the War of 1812, Southern farms produced cotton for British mills, who supplied Boston merchants with bolted cloth for resale in the United States. European conflicts and restrictive American tariffs had interrupted the movement of goods in this triangle, and the price of cotton was falling dramatically. A British effort after the war to kill the American textile industry by flooding the American market with extremely cheap goods failed after Congress, at Cabot's urging, enacted a protective tariff in 1816. Landmarks, supra, pp. 132 - 142.


See, Appendix B, Mini-Case B-4, at page for further information. Built between 1797 and 1803 through stock subscriptions and a state charter, the Middlesex Canal connected the Charles River (and Boston, the capital of Massachusetts) to the Merrimac River (and Concord, the capital of New Hampshire).

Civil Engineering History, supra, pp 67-72.

8/26/1852, Act Granting ROW and Land to Michigan for Canal at St. Mary's.
Ibid.


See, Chapter IV, Case study IV-3.

Another recommendation was to place the City's intake structure for drinking water much further out into the Lake. Permission to do so was given by Congress in 1888. 5/9/1888, Act Permitting Chicago to Erect Crib in Lake Michigan, 25 St 136; Beacon lights were to be installed and maintained by the City at its expense.


Indeed, states are increasingly concerned with the imposition by Congress of unfunded federal requirements on the states.


The Clinton Administration is indicating that spending will increase to $43 billion.


Assuming that 200,000 miles of highway are in mediocre or poor condition and over 100,000 bridges are structurally deficient.


Except negatively, through the imposition of unfunded obligations on state and local governments. "Unfunded obligations" refers to federal requirements for the expenditure of funds without appropriations from the federal government to meet these obligations.

DOT projections for highways alone indicate a dramatic shortfall. Independent studies by Arthur Young project a $40B annual shortfall in federal infrastructure spending to maintain current infrastructure. Industry estimates of this shortfall are significantly higher.


Ibid.