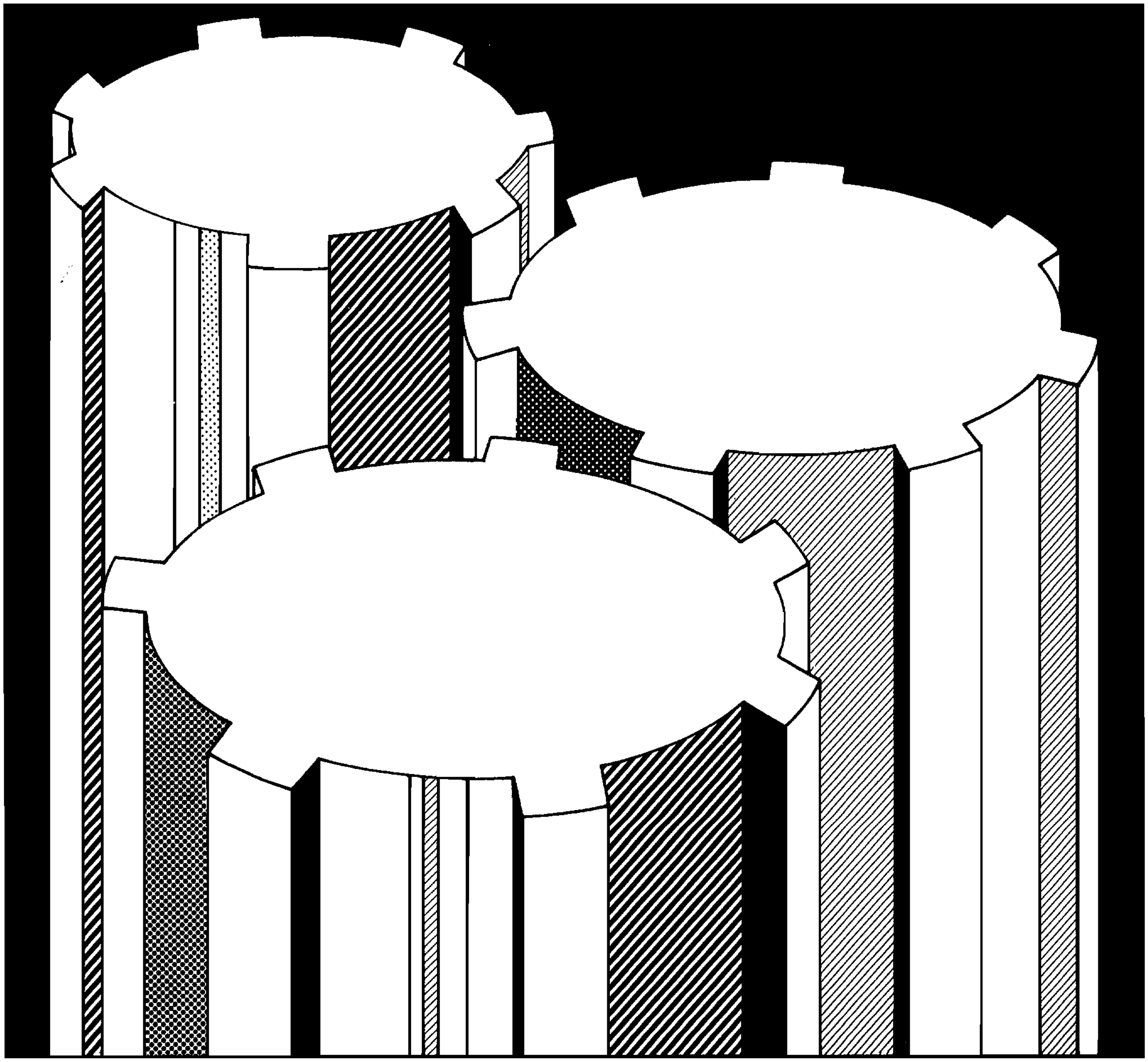
CONGRESS OF THE UNITED STATES
CONGRESSIONAL BUDGET OFFICE

DECEMBER 1985

Toll Financing of U.S. Highways



CBO STUDY

TOLL FINANCING OF U.S. HIGHWAYS

Congress of the United States
Congressional Budget Office

PREFACE

In considering legislation to reauthorize the federal highway program, the 99th Congress may also reassess the federal government's 70-year-old prohibition of tolls on highways built with federal support. To assist the Congress in its deliberations about modifying this historical legislation, the Congressional Budget Office has examined the costs and benefits of toll financing, has identified the criteria necessary for toll roads to succeed, and has analyzed the effects of two possible changes to current law. CBO prepared the study at the request of the Subcommittee on Transportation of the Senate Committee on Environment and Public Works. In keeping with CBO's mandate to provide objective analysis, the paper offers no recommendations.

Suzanne B. Schneider prepared the study in CBO's Public Investment Unit under the direction of Richard R. Mudge. This group is part of CBO's Natural Resources and Commerce Division, under the supervision of David L. Bodde and Everett M. Ehrlich. Within CBO, Kathleen L. Marek provided research assistance, and Jenifer Wishart, Kathleen Kelly, Linda Radey, and Pearl Richardson offered valuable comments. Of the many outside contributors who provided useful information and commented on earlier drafts, the author would like especially to acknowledge Craig W. Atwater, Thomas H. Boast, Thomas W. Cooper, Jonathan L. Gifford, John J. Hassett, Shelton Jackson, Damian J. Kulash, Joseph S. Revis, Richard B. Robertson, C.L. Shufflebarger, and Norman H. Wuestefeld. Valuable data were furnished by the Federal Highway Administration, especially the Highway Statistics Division in the Office of Highway Planning; by the International Bridge, Tunnel and Turnpike Association; and by Moody's Investors Service. The author also owes special thanks to Johanna Zacharias for assistance in drafting the manuscript and editing it, and to Gwen Coleman for her skill in typing and, with the cooperation of Angela Z. McCollough, preparing the manuscript for publication.

Rudolph G. Penner
Director

December 1985

CONTENTS

FIGURES

SUMMARY

In a time of financial pressure on the Highway Trust Fund, the demand for new highway capacity has led to Congressional reconsideration of the legislative limits on federal support for toll roads. Although tolls are generally a costlier way to raise funds than are tax instruments, supplementing federal and state support with tolls could allow some valuable projects to be completed more quickly than could otherwise be achieved. Furthermore, a lower federal share of highway costs than under current practice would be possible. Toll financing also offers stronger incentives for cost-effective projects. This study analyzes the costs and benefits of toll financing as a supplement to tax support of U.S. highways and compares the effects of alternative federal policies for toll road financing.

THE CURRENT STATUS OF HIGHWAY FINANCING

Allowing only a few exceptions, federal law has prohibited the levying of tolls on roads built with federal aid since 1916. As a result, the 5,000 miles of toll roads in the United States have been financed without federal support. Instead, funding has come from borrowing in the tax-exempt bond market. Particularly in recent years, very few new toll roads have been built. Inhibiting factors have been competition from tax-supported highways (especially the 42,500-mile Interstate Highway System) and record high construction costs and interest rates. Indeed, new debt issued for toll roads has almost come to a halt, dropping to only about 6 percent of what it was before the start of the Interstate system in 1956. In the present economic climate, even the most financially promising toll road projects typically require some form of public assistance.

Meanwhile, the emphasis of federal highway spending has shifted from construction of new roads to repair of the existing highway network. Furthermore, even without undertaking major new construction efforts, the Highway Trust Fund is spending money faster than it is collecting revenues from the highway users' taxes that support it. The Trust Fund used more than half of its 1985 spending of $13 billion to maintain and repair existing roads and bridges, and put $4 billion toward completing the remaining 1,200 miles of the Interstate system. This leaves only limited amounts of federal aid for construction of the new highway capacity that will be needed to accommodate the estimated 50 percent increase in vehicular traffic expected by the year 2000.

Together, these factors motivate an increased interest in modifying or repealing the federal government's present no-toll policy.

COSTS AND BENEFITS OF TOLL FINANCING

Because toll collection requires the construction and operation of toll barriers, toll roads incur extra capital costs and have higher operating expenses than do comparable nontoll routes. To collect tolls costs about twice what it does to collect state highway taxes--14 percent of receipts *versus* 7 percent for the typical state combination of highway users' taxes. In addition, debt financing through the municipal bond market can increase capital costs by as much as 5 percent to 30 percent. And for users, tolling can cause delays as well as more circuitous travel for drivers choosing to avoid paying tolls.

Certain benefits can outweigh these costs, however. Most important, given present constraints on public money available for new highway construction, toll financing can speed the completion of a new road by as much as several years. As a result, the economic benefits of new highways may be realized sooner than under tax-supported financing. Further, by providing a source of dedicated revenues over the life of a facility, tolls afford a better guarantee of upkeep. Indeed, tollways tend to be kept in somewhat better condition than comparable tax-supported roads, offering users faster travel and less wear on their vehicles. And on heavily traveled routes, tolls have the potential to help relieve traffic congestion by rationing limited highway capacity during peak periods, which can avoid or at least postpone the need for additional highway capacity.

The need to compete for funds in the municipal bond market subjects toll projects to a stiff cost-effectiveness test that only those with the best prospects for financial self-sufficiency pass. Toll-financed road projects have the clearest prospects for financial success in urban areas and high growth regions that can expect heavy traffic volumes. Such areas are not numerous, however. Today, less than 10 percent of existing urban mileage on the Interstate system carries sufficient traffic to pass the feasibility test for a new self-supporting tollway. (In CBO's analysis, these existing roads serve as rough proxies for the pool of potentially successful new toll roads.) Thus, greater use of tolling is likely only if there is a substantial drop in costs--whether through a further decline in real interest rates or the availability of public funds to help subsidize construction. By contrast, the conversion of many existing nontoll routes to tollways appears feasible without public financial support, although a change in federal law would be required to permit such conversions.

ALTERNATIVE FEDERAL APPROACHES

Changing the federal law that prohibits tolls on federally supported routes could make toll financing a more viable alternative for building new highway capacity than it is at present. The Congress may therefore wish to consider altering current federal policy in one of two ways:

-- **Modification,** to allow federal aid for *new* toll projects only, and

-- **Repeal,** to allow tolls to be levied on both *existing* and *new* federally supported highways.

Modification

Allowing toll financing for new roads could expedite the construction of new highway capacity that otherwise might well be delayed several years or longer. Federal aid could be provided on a much more limited basis than for nontoll routes--for example, a 25 percent federal matching share for new toll highways, instead of the present 75-to-25 federal-to-local matching ratio for non-Interstate construction. Even this relatively small federal share would significantly improve the feasibility of new toll road projects. Using CBO's proxy to give a measure of the stimulus such a modification would provide, for a "typical" urban toll road, a 25 percent federal matching share would double the fraction of existing urban Interstate mileage with traffic sufficient for a financially viable toll road. If this approach were combined with reduced highway authorizations, it could also provide some--albeit limited--relief for the Highway Trust Fund, by lowering the level of federal spending on certain projects that would otherwise be built with a high federal share of costs.

On the other hand, because the stiff selection test that new tollway projects must pass would be weakened, access to federal funds would reduce the potential for improved project selection that is one of the advantages of toll financing. In addition, the proliferation of financially independent toll facilities could reduce governmental control of highway spending and pricing.

Repeal

Besides permitting toll revenues to match federal funds in constructing new highways, the Congress could also allow tolls to be introduced on existing toll-free federal routes. Because conversion entails much lower capital costs and because traffic is already established, no additional federal financial help would apparently be needed to support the conversion of nontoll routes to toll facilities. Indeed, eliminating the eligibility of such roads for federal repair funds would appear practicable.

The conversion of toll-free roads to tollways would be controversial, however, with the resulting net benefits unclear. Proponents of such a change in federal policy could point to three justifications. First, it could permit states that have recently experienced rapid growth to add capacity to existing Interstate and Primary routes sooner than they otherwise could. Second, it could provide an alternative to federal financing for major repairs--less important, however, since the Surface Transportation Assistance Act of 1982 authorized a major increase in federal funds for Interstate repair. Third, tolls can provide a means to help control congestion on heavily traveled urban routes.

On the other hand, toll financing appears less suitable for improving existing roads than for constructing brand new ones. If imposing tolls were to speed highway improvements by only a few years, the capital costs of converting and the greater operating expenses associated with tolling could well swamp the economic gains stemming from more rapid completion of a needed project, except perhaps on some heavily congested routes.

PART I.

TOLL FINANCING TODAY AND OPTIONS FOR LEGISLATIVE CHANGE

CHAPTER I

TOLL FINANCING UNDER CURRENT FEDERAL LAW

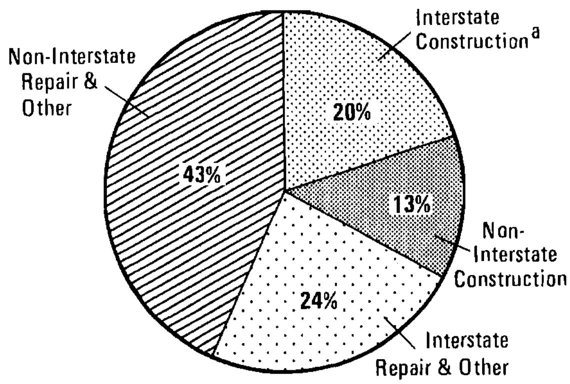
Competing spending objectives and tight constraints on the public money available for financing new highways have led to active interest in expanding the use of tolls. Though tolls are generally a costlier way of raising funds than are tax instruments, they offer two major attractions. First, toll financing can enable some valuable highway projects to be built many years sooner than would otherwise be possible. Second, it offers the potential for improved project selection because of the cost-effectiveness test that toll projects must pass in competing for capital in the municipal bond market. Moreover, even though supplementary public assistance may well be required to make most new toll road projects financially feasible today, the creation of revenue-generating roadway facilities could ease pressure for future increases in fuel taxes, and could possibly free some existing tax receipts for the repair and upgrading of nontoll routes.

Current federal policy, however, prevents the full exploitation of tolls as a financing source. The Congress may therefore decide that revision is in order. The Congressional Budget Office has analyzed the costs and benefits likely to result if federal restrictions on the use of tolls were modified or repealed. This study reviews the status of toll financing today and assesses the outlook for new toll road construction under current federal policy. Chapter II analyzes the costs and benefits of toll financing and identifies the types of roads that may be good candidates for toll financing today. Part I concludes with an evaluation of two alternatives to current federal policy governing the use of tolls. Chapters IV and V, in Part II, provide supplementary background on the status of the present toll industry, and analysis of its financial condition and success in the municipal bond market.

THE STATUS OF PUBLIC RESOURCES FOR HIGHWAYS

Maintaining existing roads and constructing new ones today compete for scarce public highway dollars. The present emphasis of federal spending for highways is on repair and rehabilitation of the existing network, in part reflecting the tendency of aging structures to incur increasingly high upkeep costs *(see Text Box, over)*. Of the $13.7 billion in federal highway obligations in 1984, $9.2 billion went for repair and improvement of facilities that are no longer new. While repair work consumes a major share

WHERE FEDERAL HIGHWAY MONEY GOES



In calendar year 1984, two-thirds of the year's $13.7 billion in obligations went toward the upkeep of existing roads.

a. Reflects Congressional delay in approving allocation of Interstate construction funds to states.

Created by the landmark Federal-Aid Highway Act of 1956, the user-financed Highway Trust Fund today supports about 95 percent of all federal spending on highways. The fund's first decade supported rapid progress in constructing the 42,500-mile Interstate Highway System. By 1966, more than half the system--21,450 miles--had opened to traffic, and work was under way on another 17,100 miles. Through 1973, authorizations for the Interstate system dominated federal highway spending, making up about two-thirds of all Trust Fund programs.

Emphasis shifted toward non-Interstate programs in the early 1970s, and the past decade has seen steady growth in federal spending for repair and rehabilitation of existing roads and bridges. Today, the emphasis is on keeping roads and bridges on the Interstate and Primary systems in good repair, and on completing the remaining (and especially costly) 1,200 miles of the Interstate system. The Federal Highway Administration's record of obligations illustrates this shift in emphasis.

of the money available, there is continuing demand for new highway construction. 1/

1. For analysis of the demand for federal aid and the effectiveness of federal programs for highways, see Congressional Budget Office, *Public Works Infrastructure: Policy Considerations for the 1980s* (April 1983), Chapter II, and *The Federal Budget for Public Works Infrastructure* (July 1985), Chapter II.

Today, most federal funds available for new highway construction are restricted to the unfinished portions of the Interstate system. In 1985, some $4 billion was spent to complete these remaining segments, many of which are costly urban routes that are of greater local than national significance. 2/ With more than half of the Trust Fund's 1985 spending devoted to repairs and improvements to existing roads and bridges and $4 billion dedicated to Interstate completion, only limited federal aid remains to construct new roadways not on the Interstate system. Thus, under current policy, states and localities bear primary responsibility for providing the new highway capacity that will be needed to accommodate the estimated 50 percent increase in traffic expected by the year 2000. 3/

Where does the money come from that finances governmental support of highways? Public highways in the United States are financed in three ways: by systemwide user fees (such as taxes on motor fuel), by project-specific fees (tolls), and by general tax revenues. 4/ Today, highway users pay for most public sector highway spending through systemwide fees; general tax revenues pay for most of the rest. Users support about 95 percent of federal highway spending by paying excise taxes that go into the Highway Trust Fund. Approximately 80 percent of state highway spending also comes directly from user fees, primarily state-levied fuel taxes and vehicle registration fees. For every gallon of gasoline sold, about 21.5 cents goes for excise taxes--nine cents to the federal government, and 12.5 cents (on average) to the states. At 15 cents per gallon, the federal tax on diesel fuel is even higher. 5/

Many states and localities face serious fiscal constraints that have already compelled them to raise highway user taxes, to seek additional revenue-raising mechanisms, and in some cases, to reorder spending priori-

2. See Congressional Budget Office, *The Interstate Highway System: Issues and Options* (June 1982).

3. The Federal Highway Administration estimates that highway travel will grow at a rate of 2.0 percent to 2.74 percent per year through the year 2000. This would mean an increase in traffic of about 40 percent to 60 percent between 1983 and 2000. See *The Status of the Nation's Highways: Conditions and Performance*, Report of the Secretary of Transportation to the United States Congress (Committee Print, House Committee on Public Works and Transportation, Washington, D.C., June 1985).

4. For detailed treatment of the major types of user fees, see Congressional Budget Office, *Charging for Federal Services* (December 1983).

5. Revenues from 1 cent of the federal tax on motor fuel are earmarked to support federal grants for urban mass transit.

ties altogether. Since 1980, for example, almost every state has raised its taxes on motor fuels at least once, with half of these increases taking effect since January 1983. Nor is the federal government in a position to cover the gap between roadway needs and nonfederal public resources. Despite the substantial boost in revenues resulting from the five-cent-per-gallon increase in the federal tax on motor fuels enacted in the Surface Transportation Assistance Act of 1982, the Highway Trust Fund has been spending more than it has been collecting. This is raising the prospect that the Trust Fund could run out of cash by the end of the decade. [6] Without further increases in the federal tax or a major refocusing of the federal highway program, federal funding for construction of new, non-Interstate highway capacity will continue to be limited. Furthermore, if another increase in the federal fuel tax were enacted, the first 2 cents per gallon of any such hike would immediately vanish in the gap between annual authorizations and expected revenues.

In this current climate of stiff competition for available highway dollars, alternative means for financing road work are being sought. An obvious but perhaps problematic possibility is expanded use of tolls.

TOLL ROADS TODAY

Toll roads, bridges, and tunnels have always played a role in the nation's highway network. The 240 toll facilities in the United States today include interurban roads (such as the Indiana Toll Road and the New Jersey Turnpike), urban expressways (such as the Kansas City Expressway and the Dallas North Tollway), and more than 160 bridges and tunnels. The great majority of these facilities are publicly owned and operated. [7] Together, tollways make up more than 5,000 miles of highway, accounting for 6.4 percent (2,691 miles) of the Interstate Highway System and 6.8 percent of vehicle-miles traveled on the Interstate system (see Table 1). In other words, the

6. The Trust Fund is protected from running out of cash by the Byrd Amendment, which reduces apportionments to states whenever authorizations exceed expected revenues over the next two-year period. For discussion of the Highway Trust Fund's financial problems, see Statement of Rudolph G. Penner, Director, Congressional Budget Office, before the Senate Committee on Environment and Public Works, Subcommittee on Transportation, July 10, 1985.

7. Of the 240 toll roads, bridges, and tunnels in the United States today, 210 (88 percent)--including 65 of the 72 toll roads--are publicly owned and operated. The other 30 facilities--22 bridges, 7 roads, and one tunnel--are owned by private firms or individuals. See Federal Highway Administration, *Toll Facilities in the United States* (April 1985). For further analysis of the management and operating characteristics of major toll facilities, see Chapter IV of this study.

TABLE 1. U.S. TOLL HIGHWAY FACILITY MILEAGE BY FINANCING CATEGORY, 1985

	Toll Facility Mileage	
Highway System	Numbers of Miles	As a Percent of Total
Federal-Aid Highway System		
Interstate	2,691	52.0
Primary	952	18.4
Secondary	27	0.5
Urban	32	0.6
Subtotal	(3,702)	(71.5)
Other Highways		
State	1,288	24.9
Local	186	3.6
Subtotal	(1,474)	(28.5)
Total	5,176	100.0

SOURCE: Congressional Budget Office from data provided in Federal Highway Administration, *Toll Facilities in the United States* (April 1985).

NOTE: Mileage includes "nontoll" sections of toll facilities that may be used free of charge by local residents.

toll portions of the Interstate system carry slightly heavier traffic relative to their overall mileage than do the nontoll portions.

FEDERAL RESTRICTIONS ON TOLL FINANCING AND EXCEPTIONS GRANTED

Current federal law prohibits the use of tolls on any new or existing road built with federal support.[8] These restrictions date back 70 years to the beginning of the modern highway program, when facilitating construction of a network of good public highways was a major federal concern. At that time, toll roads were regarded as contrary to this federal goal, in large part because of experience in the nineteenth century with privately owned

8. Title 23, *U.S. Code*, Section 301.

and operated toll facilities that exercised monopolistic powers under very limited governmental control.

Beginning in 1927, however, the Congress has granted a number of exceptions to the federal no-toll policy. 9/ Today, these exceptions permit the use of federal money to construct toll bridges and tunnels and their approaches on the federal highway network, as well as approaches to toll roads that have been incorporated into the Interstate system. Federal aid has also been allowed for upgrading, to Interstate design standards, some two-lane toll roads also included in the Interstate system.

Federal assistance to such toll facilities requires agreement among the U.S. Department of Transportation (DOT), the relevant state highway department, and the toll authority that manages the facility. The agreement prohibits the use of tolls for purposes other than constructing, maintaining, and operating the facility. Tolls must also be discontinued once construction costs have been paid. Fifteen facilities in 13 states currently have these so-called "Section 129 agreements," and two facilities (in Maine and Kentucky) have already been freed of tolls under the terms of their agreements (Chapter IV provides further details).

Other exceptions to the ban on federal assistance to toll roads exist as well. The Interstate system now includes approximately 2,700 miles of toll segments. Indeed, when a national network of interconnected high-quality roads was evaluated in the late 1930s, first consideration was given to the feasibility of constructing the network as a system of transcontinental toll roads, with three north-south and three east-west routes. But because this plan greatly underestimated the growth in automobile travel that was to ensue, planners concluded that traffic volumes--and thus toll revenues--would be far too low to cover the costs of building, operating, and maintaining an interstate tollway system. 10/ Between 1944, when the nontoll Interstate Highway System was authorized, and 1956, when the Federal-Aid Highway Act spurred its construction, many states had undertaken major toll projects of their own. By the mid-1950s, some 2,500 miles of tollways had been partly or fully built in more than a dozen states, and construction of many additional toll roads had been authorized. To prevent duplication of

9. These exceptions are now incorporated in Title 23, *U.S. Code*, Section 129.

10. See Bureau of Public Roads *Toll Roads and Free Roads* (Washington, D.C., 1939), Part I: "The Feasibility of a System of Transcontinental Toll Roads," pp. 1-86. For a critical analysis of this report, see Jonathan L. Gifford, *An Analysis of the Federal Role in the Planning, Design, and Deployment of Rural Roads, Toll Roads and Urban Freeways* (University of California, Institute of Transportation Studies, 1983), pp. 113-150.

highway facilities, the 1956 act allowed many of the existing toll facilities to be incorporated into the Interstate network. 11/

Today, these toll segments of the Interstate system may receive federal funds for repair and rehabilitation, but only under so-called "Secretarial Agreements," which require the removal of tolls once all existing bonded debt is retired. If tolls are not removed according to schedule, any federal funds used for projects on a given toll route must be returned to the federal government, though interest is charged only for the period beginning 90 days after the date on which the facility was to become toll free. 12/ Since enactment of this provision in 1978, three states--Connecticut, Kansas, and New York--have signed such agreements.

Finally, over the years, the Congress has granted exceptions to its no-toll policy on a case-by-case basis. In each instance, legislation has been necessary, requiring payback of federal funds used in exchange for release from the no-toll provision. These paybacks, without interest, have allowed tolls to be continued or even introduced. For example, Indiana, Maine, and Virginia have been granted permission to repay all federal funds used on approaches or connectors to three Interstate toll routes (the Indiana Toll Road, Maine Turnpike, and Richmond-Petersburg Turnpike), and they have thereby gained release from the toll-free commitment made when their Section 129 Secretarial agreements were signed. 13/ The Congress has also

11. See U.S. Department of Commerce, *Progress and Feasibility of Toll Roads and Their Relation to the Federal-Aid Program,* Report to the House Committee on Public Works (Washington, D.C., April 14, 1955). The inclusion of toll facilities in the Interstate network raised an issue that is still unresolved today: whether the federal government should reimburse states that built toll sections of the Interstate system for the costs of constructing these facilities. Although it has been studied at several intervals since first being raised in 1955, the issue of reimbursement has continued to be deferred until completion of the Interstate system. The most recent study of this issue appears in the Federal Highway Administration's *Bonded Indebtedness Toll Roads Study* (August 1980).

12. Enacted in Section 105 of the Surface Transportation Assistance Act of 1978. These Secretarial Agreements are often referred to as "Section 105 Agreements," to distinguish them from the Section 129 Secretarial Agreements permitting federal participation in certain toll bridge and tunnel facilities and approaches to Interstate toll routes. The Section 105 agreements allow a state's toll Interstate mileage to be included in computing the formula for its annual apportionment of federal 4R (resurfacing, restoration, rehabilitation, and reconstruction) funds regardless of whether any of these funds are actually used for toll road projects.

13. The terms of repayment are fairly generous since no interest is charged. Further, a state does not actually lose the paid-back federal monies; they are credited back to the state's unused balance of Federal-Aid funds.

56-018 0 - 85 - 2

permitted several states to repay federal funds used on specific highway segments to permit the introduction of tolls on those sections. 14/

THE DECLINE IN TOLL FACILITY CONSTRUCTION

Despite the growing number of exceptions to federal no-toll policy, toll facility construction has dwindled. Since 1950, all U.S. toll facilities have together raised about $32 billion (in 1984 dollars) in new bond financing for construction, of which 80 percent has been used for roads (see Figure 1). 15/ After passage of the Federal-Aid Highway Act of 1956, however, tollway construction dropped sharply, and except for a brief resurgence in the late 1960s, it has declined steadily since then. Without access to federal aid, very few new toll roads have been built; since 1975, bridges and tunnels have accounted for more than half the new toll debt issued.

Legislative Factors. Several developments have contributed to this dramatic decline in toll road construction. Most important, the Federal-Aid Highway Act of 1956 encouraged states to build their sections of the Interstate system by boosting the federal share of construction costs from 60 percent to 90 percent, authorizing large sums for Interstate construction, and creating the separate Highway Trust Fund to provide a reliable and continuous source of funding. 16/ Together, these features of the 1956 act made reliance on federal resources for highway construction increasingly attractive and resort to toll financing less so. Subsequent increases in federal taxes on motor fuel, enacted once in 1959 and again in 1982, compounded these effects.

Economic Factors. High interest rates have also penalized toll facility construction. Both nominal and real interest rates for tax-exempt municipal

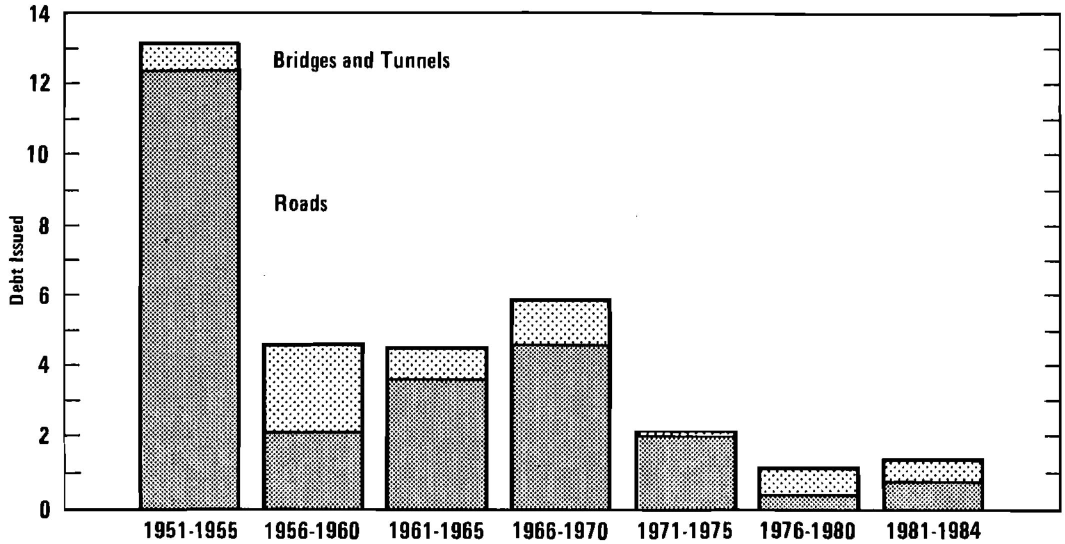
---

14. These include portions of I-95 in Maryland and Delaware (the John F. Kennedy Memorial Highway), sections of the Garden State Parkway in New Jersey, the Saint Clair River Bridge in Michigan, and sections of Route 101 in New Hampshire. The provisions concerning the Garden State Parkway required that the New Jersey Highway Authority build parallel toll-free highway facilities to accommodate local traffic in the vicinity of the sections affected. As a result of this requirement, the New Jersey Highway Authority dropped its plan to introduce tolls on these sections of the Parkway. See Annmarie Hauck Walsh, *The Public's Business: The Politics and Practices of Government Corporations* (Cambridge, MIT Press: 1978), pp. 86-87.

15. For analysis of toll facilities' financial performance and record in the tax-exempt bond market, see Chapter V.

16. See Congressional Budget Office, *Highway Assistance Programs: A Historical Perspective* (February 1978) and *The Interstate Highway System*, Chapter II.

Figure 1.
New Debt Issued for Toll Facilities, 1951-1984
(In billions of 1984 dollars)



SOURCE: Congressional Budget Office based on data provided by Moody's Investors Service.

bonds are two to three times higher today than they were 20 years ago. In recent years, these high interest rates have had a crippling effect on the feasibility of toll projects. For the Dulles Toll Road in northern Virginia, for example, rising interest rates dramatically increased projected costs, resulting in adoption of an initial maximum toll of 85 cents (6.5 cents per mile) instead of the 50 cents (4 cents per mile) originally proposed. Though the original feasibility study in 1979 assumed a 5.5 percent interest rate, the bond was finally floated in late 1982 at an interest rate of 9.1 percent. This 65 percent increase in interest rates necessitated a 70 percent increase in the actual toll. 17/

Inflation, too, has handicapped tollways. While the Consumer Price Index has more than tripled over the past 20 years, highway construction

17. JHK and Associates, *Dulles Toll Road Study* (January 1979), and *A Review and Update of the Financial Feasibility of the Dulles Toll Road*, prepared for Virginia Department of Highways and Transportation (November 1982), pp. 12-14.

costs have nearly quadrupled. [18] Together, high interest rates and construction costs have combined to make the feasibility of toll road construction much more remote now than in the past, with higher traffic volumes required for a new toll facility to be self-financing. [19]

RECENT INTEREST IN TOLL ROAD FINANCING

Despite these difficulties, the search for additional sources of highway dollars has revived interest in toll financing. Since 1980, at least 11 new toll projects and extensions of existing toll facilities have been authorized or undertaken in eight states (see Table 2). In addition, various studies have been made of toll financing options, ranging from the feasibility of building toll roads in a state with no toll facilities (Arizona) to the possibility of converting existing Interstate highways to toll routes (Wisconsin). [20]

In the last few years, several efforts have been made to ease federal restrictions on the use of tolls. In 1982, the Administration attempted unsuccessfully to include a provision in that year's highway legislation that would have allowed the use of federal funds in the construction of new toll highways anywhere in the nation, under the same conditions that govern federal aid to toll bridges and tunnels. At the state level, both Wisconsin and Pennsylvania have recently conducted toll road feasibility studies that include the option of introducing tolls on existing nontoll Interstate routes--an option that could be implemented only if present federal law were modified to permit such a conversion. The American Association of State

18. See Federal Highway Administration, *Price Trends for Federal-Aid Highway Construction (Fourth Quarter, 1984).*

19. See also Daniel W. Greenbaum (Partner, Vollmer Associates), "The Pennsylvania Toll Road Study: An Example of the New Look in Toll Road Financing," presented at the International Bridge, Tunnel and Turnpike Association Workshop, Houston, Texas, April 11, 1983.

20. Recent toll feasibility studies include Vollmer Associates and others, *Pennsylvania Toll Roads Feasibility Study: Final Report* (December 1983); Wilbur Smith and Associates, *Feasibility of Converting Wisconsin's Interstate System to the Toll Concept* (August 1983), *Dallas North Tollway and Proposed Extension--Phase I* (July 1982), *Alternative Financing Sources Study--Charleston Area Transportation Study* (November 1983), *Sawgrass/Deerfield Expressway: Comprehensive Traffic and Revenues Study* (May 1984), *Harris County Toll Road System* (August 1984); JHK and Associates, *Dulles Toll Road Study* (January 1979) and *Update* (November 1982), *Chesterfield County Toll Road Feasibility Study: Powhite Parkway Extension and Route 288* (December 1981), and *The Feasibility of Toll Roads in Arizona* (December 1984).

TABLE 2. NEW OR PROPOSED TOLL FACILITY PROJECTS, 1980-1985

Facility and Location	Length (In miles)	Estimated Cost (In millions of dollars)	Status of Project
NEW URBAN EXPRESSWAYS			
Dulles Toll Road (Fairfax Co., Va.)	12.1	57	Open to traffic (1984)
Dame Point Freeway (Jacksonville, Fla.)	13.3	136	Under construction
Sawgrass Parkway (Broward County, Fla.)	11.0	173	Under construction
Hardy and West Belt Toll Roads (Houston, Harris Co., Tex.)	48.5	900	Phase I under construction
EXTENSIONS OF URBAN EXPRESSWAYS			
Tampa South Crosstown Expressway--Eastern Extension (Tampa, Fla.)	8.8	118	Open to traffic
Dallas North Tollway Extension (Dallas, Tex.)	7.4	124	Under construction
Powhite Parkway Extension a/ (Richmond, Chesterfield County, Va.)	13.2	100	Authorized for construction
North-South Tollway b/ (Chicago, Ill.)	17.0	286	Approved by state legislature
NEW BRIDGES AND TUNNELS			
Fort McHenry Tunnel (Baltimore, Md.)	2.9	350	Under construction
Calhoun Street Bridge (Trenton, N.J.--Morrisville, Pa.)	0.4	6	Authorized for construction c/
Knik Arm Bridge (Anchorage, Alaska)	3.0	700	Approved by state legislature

SOURCE: Congressional Budget Office.

a. To be financed without support of existing parkway revenues.

b. Not strictly an extension, this route is an addition to Chicago's present system of tollways to be financed with the support of existing tollway revenues.

c. Owing to local opposition, there are no immediate plans to construct this bridge.

Highway and Transportation Officials (AASHTO) has recommended that tolls be allowed both on new federally supported roads and on existing federal-aid highways and bridges that have exceptional maintenance or improvement costs. 21/ Bills introduced in the 98th Congress (but not voted into law) would have permitted federal participation in the funding of new toll roads in Illinois and Pennsylvania. 22/ And in the 99th Congress, bills have already been introduced in both branches that would significantly modify the current federal no-toll policy. 23/

Despite this interest, most recent toll road projects have been limited to extensions of existing toll highways and new facilities with special characteristics that have made toll financing feasible. For example, Virginia's Dulles Toll Road, which opened to traffic in 1984, was built on federally owned right-of-way leased at very low cost to the state. In Houston, Texas, exceptionally strong traffic demand, good voter support, and healthy local finances have allowed Harris County to proceed with a 50-mile, $900 million toll highway project. But very few jurisdictions in the United States today are as well positioned as Houston is to undertake alone the construction of a major new toll highway. Thus, barring some federal assistance or a strong downward shift in interest rates, the prospect for wider use of toll financing for the nation's highways seems unlikely.

---

21. American Association of State Highway and Transportation Officials, *A New Focus for America's Highways: Recommendations on the Federal-Aid Highway Program* (Washington, D.C., April 1985).

22. Neither of the two bills (S. 524 and H.R. 3736) was reported out of committee.

23. These bills include S. 1488, S. 1890, H.R. 1379, and H.R. 3473.

CHAPTER II

COSTS AND BENEFITS OF TOLL FINANCING

Compared to tax-supported financing for highways, tolls present certain advantages and disadvantages. These comparative costs and benefits result from major differences in design and operation, financing methods, and pricing of road use. Relative to nontoll routes, toll facilities incur extra capital costs and higher operating expenses. For travelers, toll collection may also entail delays, though the generally better condition of toll roads provides an offsetting benefit. Other costs of toll roads include the relatively higher costs of debt financing and the diversion of traffic that results from charging tolls. Countering these additional toll-related costs is the potential for tolls to expedite financing and road construction, to improve project selection, and to help relieve traffic congestion. These financing and economic issues dominate the debate over toll roads, with significant benefits generally required to offset the higher costs of toll facilities. From an analysis of these costs and benefits, one point emerges with particular clarity: *traffic volume and the speed with which financing can be obtained are the major determinants of whether or not the benefits of toll financing can more than compensate for the additional costs associated with tolls.*

DESIGN AND OPERATING COSTS AND BENEFITS

Certain costs and benefits of toll financing are a result of the specific design and operating characteristics of toll roads, as contrasted with those of nontoll routes. These toll-related costs and benefits tend to offset each other, with one exception: toll roads have unavoidably higher operating costs than do nontoll highways.

Capital Costs. Relative to nontoll roads, toll roads incur extra capital costs--the costs of acquiring right-of-way and adding lanes at toll plazas, constructing toll booths, and installing collection equipment. Together, these requirements may add between 5 percent and 10 percent to capital costs; the actual amount depends in part on what type of collection system is selected. "Closed" systems, in which every interchange has a collection facility, are generally costlier to build and to operate than are "open" systems, in which tolls are collected at barriers placed at intervals across the main roadway. (Chapter IV details different types of collection systems.)

These additional toll-related costs may, however, be partly or wholly offset by several factors. First, because interchanges are expensive to build (particularly if they must be specially designed to accommodate toll collection) and because toll investments are subject to more stringent financial tests, many toll roads include fewer interchanges than do comparable nontoll routes.[1/] This may help offset additional toll-related capital costs. Further, because federal funds cannot be used for toll road projects, toll authorities need not incur the costs of compliance with the wage provisions of the Davis-Bacon Act or with the environmental regulations imposed on federally financed highways.[2/]

Operating Costs. Toll roads also have higher operating costs than do nontoll routes. It costs about twice as much to collect tolls as it does to administer the typical combination of state taxes on motor fuel, vehicle registration, and motor carriers. In 1982, the combined costs of collecting these state highway user taxes consumed, on average, about 7 percent of receipts. In contrast, toll collection cost an average of 14 percent of revenues for ten major toll roads in 1982.[3/] Although new techniques for "automatic vehicle identification" may help reduce toll collection costs in the future, administrative costs are likely to remain considerably higher for toll operations than for comparable tax-supported facilities. And unlike the additional capital costs incurred by toll facilities, these higher operating costs extend over the entire life of a facility.

Costs and Benefits to Users. In some instances, toll roads can mean longer travel time and higher expense for users. The necessity of stopping to pay

1. This is less true of toll roads with "open" toll collection systems, which can be designed with virtually the same number of interchanges as on a comparable nontoll route.

2. In stipulating that labor on federally supported construction must be compensated at the local "prevailing" wage rate, the Davis-Bacon Act has been estimated to increase the costs of federally aided construction in general by an average of 3.4 percent. See Congressional Budget Office, *Modifying the Davis-Bacon Act: Implications for the Labor Market and the Federal Budget* (July 1983). Other estimates of the costs added by federal regulations are higher.

3. Both tax and toll data reflect direct costs of collection only; overhead expenses are excluded. In 1982, the costs of collecting state motor fuel taxes represented, on average, about 1 percent of statewide motor fuel tax receipts. In addition to direct collection costs, many states also give gas station operators an additional one-half of 1 percent of fuel tax receipts to cover collection and bookkeeping expenses. Collection costs for state motor vehicle and motor carrier taxes are much higher, averaging 16 percent of receipts in 1982. (See Federal Highway Administration, *Highway Statistics 1982*, pp. 62, 64, and 68.) For increases to taxes already in place, the marginal costs of collection are virtually nil.

tolls can result in travel delays and increased vehicle operating costs. Also, because many toll roads have fewer interchanges than do comparable nontoll routes, users may have to travel further to get onto a toll road than they would if the road had been built as a tax-supported, limited-access highway. Besides increasing costs for local users, this reduced access can dampen the road's stimulus to local economic development.

Countering these obvious drawbacks, tollways are generally kept in better condition and can offer better service than can comparable nontoll routes. This is not an intrinsic characteristic of toll roads, but rather represents an economic choice made by managers of toll facilities. Better road maintenance usually means superior driving conditions, lower vehicle operating costs, greater time savings, and improved safety.[4] On the basis of the Federal Highway Administration's five-point scale that state authorities use to rate pavement condition, toll segments in a sample analyzed for this study scored an average of 3.8--better by 0.4 than nontoll sections of the Interstate system (see Table 3).[5] For highway users, this difference translates into roughly a 5 percent savings in costs for maintaining vehicles. (Of course, other factors--such as higher relative driving speeds--may reduce these savings.) Statistical analysis confirms that, when other factors affecting pavement condition are held constant, the pavement condition of toll sections averages 17 percent better than that of the nontoll Interstate segments (see Appendix).

Among the factors that contribute to the generally better condition of toll roads, the most important is the availability of a continuous stream of dedicated revenues. Unlike most tax-supported highways, most tollways need not compete for scarce public money for transportation. In addition, toll facilities' bond resolutions generally require establishment of a reserve fund earmarked to support "major maintenance" projects, such as guardrail replacement or pavement resurfacing. Finally, where there is competition from nontoll routes, this provides a strong incentive for toll authorities to

4. Although difficult to calculate precisely, the costs imposed on users by poorly maintained roads are substantial. A recent study found that operating costs on a road in poor condition may be 15 percent to 29 percent higher than the costs of using a road in good condition. See Federal Highway Administration, *Vehicle Operating Costs, Fuel Consumption, and Pavement Type and Condition Factors*, Final Report (June 1982), Appendix A. For further discussion of the costs of deferring highway maintenance, see Congressional Budget Office, *Public Works Infrastructure*, Chapter II.

5. The median rating for toll sections was 4.0, and the median rating for nontoll sections was 3.5.

TABLE 3. PAVEMENT CONDITION ON TOLL AND NONTOLL SECTIONS OF THE INTERSTATE SYSTEM, 1982 (In percents)

Pavement Condition Rating	Percent of Sample Sections in Rating Category by Road Type and Location		
	Rural	Urban	All
		TOLL SECTIONS	
Very Good	41.6	39.2	40.1
Good	42.4	35.4	37.8
Fair	12.8	16.9	15.5
Poor	3.2	8.4	6.6
Very Poor	0.0	0.0	0.0
		NONTOLL SECTIONS	
Very Good	16.8	21.0	19.2
Good	51.7	45.5	48.2
Fair	25.0	26.0	25.6
Poor	6.4	7.0	6.8
Very Poor	0.2	0.4	0.3

SOURCE: Congressional Budget Office analysis of Federal Highway Administration data from the Highway Performance Monitoring System (HPMS) Database for 1982--Sample Sections of the Interstate Highway System. (362 toll and 1,481 nontoll Interstate Sample Sections of varying lengths were analyzed.)

keep their facilities regularly and effectively maintained. 6/ Indeed, except where no alternate route exists, the financial success of toll facilities

6. Although some toll agencies spend more to maintain toll roads than is spent for nontoll routes, available data suggest a broad range in toll roads' annual spending for major maintenance and repairs. The estimated cost of "3R" (resurfacing, restoration, and rehabilitation) work on nontoll sections of the Interstate system from June 1983 to June 1984 averaged $33,000 per mile. By contrast, spending for major maintenance in 1983 by a sample of seven toll road authorities varied from $6,000 per mile to $132,000 per mile--on average, about $47,000 per mile. Even when adjustments are made to reflect differences in traffic volumes, the toll roads spent more on average. This may reflect the toll agencies' efforts to maintain the highways in better condition, or merely the availability of a guaranteed stream of dedicated revenues. Tollways also incur some unique maintenance costs, such as for toll booths and buildings.

depends in part on their freedom to offer superior driving conditions, together with such conveniences as gas stations and restaurants at frequent intervals--services that are prohibited on the Interstate Highway System.

FINANCING AND ECONOMIC COSTS AND BENEFITS

Financing costs are higher for toll roads than for tax-supported roads built using cash-flow financing. Except under congested conditions, the cost effectiveness of toll roads is also reduced by the diversion of some traffic to alternate nontoll routes. In addition, the creation of financially independent toll authorities can limit governmental control of spending priorities and pricing policy. On the other hand, toll financing can provide a means to build some roads sooner than might otherwise be possible. It also can determine that only those projects with good prospects of financial self-sufficiency will be built, since toll projects must be approved by investors ready to put their capital at risk. (See also Chapter V.) Tolls also can help relieve traffic congestion and reduce the need for additional highway capacity if toll rates are set to reflect congestion costs on overcrowded roads.

Financing Costs. Tolls cannot support the kind of pay-as-you-go method of financing capital investments on which the federal highway system operates. Through the federal Highway Trust Fund, each year's receipts should approximately cover the same year's construction outlays. Accordingly, under Trust Fund financing, today's highway users benefit from facilities paid for by yesterday's drivers, while current users finance facilities for future generations. Like the federal government, most states also finance their highway programs through trust funds. [7] For toll roads, however, money must be available well before a facility can be built and user fees charged. These funds are obtained by borrowing in the tax-exempt bond market, with toll revenues committed to repay principal and interest over the life of the bond. This approach effectively distributes costs over the facility's useful life, spreading the financing burden both over time and among all users.

7. A small but notable share of states' annual capital investment in highways is debt-financed--in 1983, some $1.1 billion was financed in this way, or roughly 7 percent of the total. In addition, some states have obtained "grant anticipation notes" secured by forthcoming federal grant monies. The Advance Construction Interstate program allows federal reimbursement for grant anticipation notes floated to expedite completion of Interstate routes. See also Thomas W. Bradshaw, Jr., "Bonding for Interstate Completion" and John Doyle and Daniel C. Falter, "Highway Bond Financing: An Examination, 1962-1982," both presented at the 64th Annual Meeting of the Transportation Research Board, Washington, D.C., January 1985.

Because they are debt-financed, tollway projects incur several types of costs not required for pay-as-you-go financing. 8/ These include the costs of issuing debt, including underwriters' fees and the costs of rating the bonds, which together can add between 2 percent and 5 percent to a project's costs. Moreover, before toll receipts begin, money must also be borrowed to cover interest requirements during construction. Interest costs incurred by debt-financed projects can double or triple the costs attributed to building a highway facility. These monies are, however, paid out over a long period--typically, 20 years to 35 years, as compared to the much shorter financing term for pay-as-you-go highway projects. As a result, the value of these interest payments is significantly reduced when discounted for inflation and the time value of money. The interest costs that are not offset, though they may be recouped through toll revenues, can add 5 percent to 25 percent to the costs of a toll highway project.

Traffic Diversion. For users of a highway facility, tolls are an additional cost beyond the systemwide highway taxes and other taxes that contribute to construction and maintenance of the national and state road networks. 9/ Thus, wherever alternate nontoll routes exist, tolling tends to discourage use of the toll facility compared to the volume of traffic that would use the same road if it were toll-free. Although engineers can anticipate such diversion, it is rarely so extensive as to warrant a reduction in the number of lanes or other scaling-back of roadway design. From an economic perspective, this diversion generally means that, except when congested, the road is less efficiently used than it would be if free of tolls. Over time, such diversion can mean continued delays and higher vehicle operating costs for users of the alternate routes, and eventually, improvement or expansion that might otherwise have been avoided or postponed. Of course, if the alternative to a toll road is continued delay in the construction of a new road, these problems would worsen.

Control of Spending and Pricing. The financial independence of toll road authorities can limit governmental control of spending priorities and pricing policy. The tax-exempt revenue bonds typically issued for toll projects gen-

---

8. The contrast here is between debt financing and pay-as-you-go financing; nontoll projects financed with borrowed money also incur the costs associated with bond debt.

9. Opponents of tolls argue that this constitutes "double taxation" for users. In fact, however, the user is not being taxed twice for use of any one facility. Rather, the user pays, on average, the equivalent of 40 cents per gallon (in contrast to the equivalent of 26 cents per gallon paid in federal and state user taxes) for electing to use a facility outside of the network supported by systemwide fees. Without the toll road, federal and state highway taxes would have to be increased to support the same level of highway capacity.

erally impose a strict and legally binding ordering of spending priorities and give first priority to the bondholders' protection. As a result, state and local governments may have limited influence over toll facilities. In contrast, states typically have considerable freedom to shape and modify highway programs financed out of state-levied user fees and tax collections. The legally chartered public authorities that run most toll facilities have considerable legal and financial independence from state and local governments in managing the properties under their jurisdiction. While enhancing the financial security of toll facility projects, this arrangement can encourage "overbuilding" or excessive maintenance of transportation facilities if there are substantial surplus revenues available. Moreover, a sizable surplus may exist at the same time that there is unmet demand for highway investment elsewhere in a state. [10]

Further, some toll authorities have been criticized for violating the "user pays" principle by applying surplus toll revenues to other transportation uses (including other toll routes, or, as in New York and San Francisco, mass transit systems) and even to nontransportation projects (for example, construction of the Garden State Arts Center in New Jersey). Only a few of the largest toll authorities have financed nontransportation projects with toll backing, however, and the deposit of toll revenues into a state's general fund is rare. When a toll facility's revenues are used to support other projects, this erodes the potential for tolls to strengthen the cost effectiveness of highway investments. Of course, the possibility of such cross-subsidization is not unique to toll highways; it is an inevitable part of systemwide user-supported financing of a highway network. In addition, one penny of the current 9-cent-per-gallon federal tax on motor fuels goes toward the support of mass transit.

Financing and Construction Time. The major attraction of toll facilities is their potential self-sufficiency, especially when tight budgetary constraints and sizable repair needs are forcing federal, state, and local governments to limit the funds available for new highways. By establishing a steady stream of revenues earmarked for the construction of particular highway projects,

10. For example, toll highway authorities in New Jersey only recently agreed to contribute to the state portions of their annual surpluses to help fund road and bridge repairs elsewhere in the state. See Joe Mysak, "NJ Turnpike to Give $12 Million Annually for States' Roads and Bridges," *Credit Markets*, Volume 1, Number 13 (March 26, 1984), p. 6. Conflicts may also arise between a toll authority and public officials over the types or levels of service provided to a community, as in the long-running battle over continuation of toll-free privileges for local traffic on several sections of the Garden State Parkway. Friction of this sort is likely to occur whenever sharp differences arise between bondholders' interests and what is perceived to be the "public interest." For further discussion, see Annmarie Hauck Walsh, *The Public's Business*, pp. 84-103.

the creation of financially independent toll facilities can expedite the construction of new highway capacity that might be delayed for many years while waiting for federal funds. Although other options--such as increasing state or local highway taxes or creating new, dedicated revenue sources--may also be feasible, toll financing can allow the benefits of new roads to be realized sooner while reducing the need for future increases in motor fuel taxes, and possibly freeing some existing tax receipts for the repair and upgrading of nontoll highways.

Moreover, debt-financed facilities such as toll roads can apparently be built more quickly. The availability of all necessary funds at the start of a project can speed the construction of toll facilities as compared to tax-supported routes built under a cash-flow approach. Because toll roads must make bond interest payments during construction, they have an additional incentive to complete construction quickly and begin collecting revenues.

To the extent that toll financing expedites construction of a needed facility, it allows the economic benefits of the new route to be realized sooner than if the facility were constructed with pay-as-you-go tax financing. If, for example, toll financing were to allow a needed road to be financed and built four or more years faster than under the financing alternatives, it might well pay to build the road as a tollway, so long as projected traffic volumes and other conditions make tolling feasible. On the other hand, if toll financing were to expedite construction by only a year or two, tolling would probably be a less desirable choice. Of course, this suggests only the general magnitude of the time advantage needed for the benefits of toll financing to outweigh the higher costs resulting from tolls. Analysis shows that the number of years' advantage required is highly sensitive to differences in the overall level of benefits to be provided by a road, to differences in interest rates, and to differences in the rates of traffic diversion caused by tolls. In general, the better the project, the shorter the time advantage required for toll financing to prove worthwhile.

Project Selection. Tolls can encourage more cost-effective investment in new highway capacity by linking user payments directly to particular projects. Because toll facilities must compete for funding in municipal credit markets, marginal projects tend to be scrutinized on the basis of potential financial cost effectiveness. Moreover, if a toll facility should fail to meet users' needs at any time during its life, motorists can switch to such alternate nontoll routes as are available. Thus, investors' perception of users' willingness to pay gives a good gauge of the soundness of an investment.

A systemwide approach to user financing, by contrast, lacks this direct link between users' willingness to pay and investment decisions concerning individual projects. As a result, systemwide fees provide subsidies from low-cost roads to the high-cost sections of a highway network. As noted above, cross-subsidies of this sort are inevitable in financing extensive networks; such disparities in cost provided part of the initial rationale behind a systemwide approach to highway finance. On a project-by-project basis, however, toll financing can promote more effective investment decisions by allocating a new facility's costs exclusively to its own users. These gains may be most apparent in cases in which project costs vary sharply across a state's highway network and the principal beneficiaries of a proposed high-cost route are concentrated in a single region.

Pricing to Alleviate Congestion. Once a road is built, the economic effect of tolls depends in part on the pricing policy applied. Unlike systemwide fees, tolls can allocate costs to users of a highway on the basis of both a direct measure of actual use and an approximate measure of the repair and maintenance costs they impose on the facility. [11/] Tolls also permit costs to be allocated to out-of-state users, who can escape paying their full share of costs under state-imposed systemwide fees.

Tolls may be set to include indirect costs as well--notably, the congestion or delay costs an individual user imposes on other users by choosing to travel when traffic congestion is high. [12/] The use of tolls as a means of congestion pricing has often been discussed as a strategy to limit use during peak periods and avoid the need to expand capacity on urban routes with high peak-hour traffic volumes--a very different concept from the use of tolls as a means of financing highway construction. In the case of an overcrowded highway, failing to charge fully for the congestion costs a vehicle imposes on other users can lead to overuse. In such cases, tolls provide a means to price road use more efficiently and thereby help alleviate conges-

11. Actual use is commonly measured as distance traveled; costs imposed are reflected in a graduated rate schedule based on gross vehicle weight or number of axles.

12. For further discussion of the rationale for congestion tolls, see F.H. Knight, "Some Fallacies in the Interpretation of Social Cost," *The Quarterly Journal of Economics*, Vol. 38 (1924), pp. 582-606, reprinted in American Economic Association, *Readings in Price Theory* (Chicago, Richard D. Irwin, Inc.), 1952); Gabriel Roth, *Paying for Roads: The Economics of Traffic Congestion* (Penguin), 1967; A.A. Walters, *The Economics of Road User Charges*, International Bank for Reconstruction and Development (Baltimore and London, The Johns Hopkins University Press: 1968), pp. 9-13, 22-29, 172-179, and 218-220; Richard M. Zettel and Richard R. Carll, "The Basic Theory of Efficiency Tolls: The Tolled, the Tolled-Off, and the Un-Tolled," *Highway Research Record*, Number 47 (1964), pp. 46-65; and Congressional Budget Office, *Financing U.S. Airports in the 1980s* (April 1984), pp. 75-80.

tion and avoid, or at least postpone, the need for additional highway capacity. Although the deliberate use of peak-period pricing has not been tried for U.S. roads, congestion fees are being used successfully on roads in Singapore and at several major commercial U.S. airports today. 13/

IDENTIFYING CANDIDATES FOR TOLL FINANCING

Whether tolls or tax-supported financing will be used to pay for a highway is a choice that is independent of a project's economic feasibility. A road that cannot be justified in economic terms as a tax-supported facility will not be viable as a toll road, either. The evaluation of candidates for toll financing entails an additional test, however: analysis of the costs and benefits associated with tolling, reviewed earlier in this chapter. *In general, significant toll-related benefits are required to offset the higher costs of toll facilities.* As a result, a proposed toll project's potential feasibility and cost effectiveness depend critically on its outlook for heavy projected traffic volume. *This points to urban expressways and highways in high growth regions as the strongest candidates for toll financing today.*

Requirements for New Toll Roads

Although revenue and traffic requirements vary according to individual projects' characteristics, high interest rates and escalating construction and right-of-way costs mean that high levels of traffic are needed to make a new toll road self-supporting today. Table 4 shows the traffic required to finance a toll road under various costs and toll rates. These are estimates of the average daily traffic required over the term of a 30-year bond; the analysis does not reflect future rates of traffic growth. As a result, these estimates are conservative; many projects might in fact be feasible with lower traffic volumes in the initial years than those shown here.

A "typical," medium-cost urban highway with moderately high tolls (8 cents per mile) would need to average 116,000 daily trips to be self-financing at a 10 percent interest rate--close to the current 9.5 percent average for tax-exempt revenue bonds (see Figure 2). In contrast, a high-cost urban road with the same 8-cents-per-mile toll would require about

13. The discounts for commuters offered by many U.S. toll facilities are the opposite of congestion pricing, and indeed they can encourage overuse of crowded urban facilities during peak periods.

TABLE 4. MINIMUM REVENUE AND TRAFFIC REQUIREMENTS FOR CONSTRUCTING A MILE OF SELF-SUPPORTING TOLL HIGHWAY AT INTEREST RATE OF 10 PERCENT FOR 30 YEARS

	Revenue Requirement (In millions of 1984 dollars)				
	Urban Highway			Rural Highway	
Type of Requirement	Low Cost	"Typical"	High Cost	Low Cost	High Cost
Construction Costs					
Preliminary Engineering	1	1	2	0.1	0.3
Right-of-Way	2	4	5	0.3	0.7
Construction	7	15	28	2.6	7.0
Total	10	20	35	3.0	8.0
Annual Costs					
Debt Service a/	1.3	2.7	4.6	0.4	1.1
Operations and Maintenance	0.1	0.3	0.4	0.1	0.2
Maintenance Reserve Fund	0.2	0.4	0.6	0.1	0.3
Total	1.6	3.4	5.6	0.6	1.6
	Average Daily Traffic Requirement				
Average Toll Rate (per mile)					
4 cents	110,000	233,000	384,000	41,000	110,000
6 cents	73,000	155,000	256,000	27,000	73,000
8 cents	55,000	116,000	192,000	21,000	55,000
10 cents	44,000	93,000	153,000	16,000	44,000

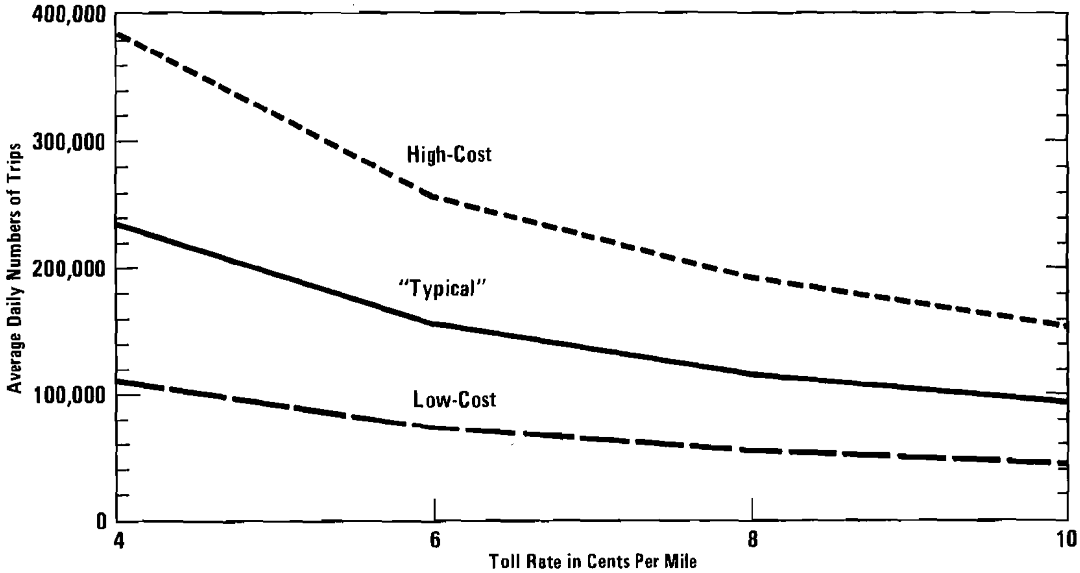
SOURCE: Congressional Budget Office, based on cost data provided by the Federal Highway Administration.

a. Includes coverage of 125 percent of typical year's debt service requirement.

192,000 trips a day. For rural routes, a low-cost facility with tolls set at 4 cents per mile would require traffic of about 41,000 vehicles a day, while a more expensive rural highway with tolls of 6 cents per mile would need

Figure 2.

Traffic Required for Self-Sufficient Toll Financing for High-, Typical-, and Low-Cost Urban Roads (Interest Rate 10 Percent on a 30-Year Bond)



SOURCE: Congressional Budget Office based on data provided by the Federal Highway Administration.

more than 70,000 trips. (Tolls for passenger cars average 2.5 cents per mile on existing toll roads, with rates averaging 5 cents per mile on urban expressways and 7 cents to 10 cents per mile on new urban tollways.)

Comparison of these estimated requirements with existing traffic volumes reveals the limited feasibility of new toll-financed highways without outside support. In 1983, only 11.8 percent (1,206 miles) of all urban mileage on the Interstate system had average daily traffic volumes of 100,000 or more vehicles, and 14.4 percent (4,735 miles) of rural Interstate mileage had average daily traffic of 20,000 or more trips.[14] Less than 1 percent of total Interstate mileage, and 3.2 percent of urban Interstate miles only, had average daily traffic in excess of 150,000 trips. Thus, the very high traffic requirements limit the prospects for new toll roads to routes in urban areas, particularly to and from populous urban centers and in

14. Data provided by the Office of Highway Planning, Federal Highway Administration (Highway Statistics Division).

high growth regions. Were interest rates to drop significantly, however, considerably more new roads might become viable candidates for toll projects. For example, with interest at 8 percent, a low-cost urban highway could be financed with tolls of 8 cents per mile and average daily traffic volume of 48,000 trips--a volume already reached by 41 percent of existing urban Interstate highway mileage.

Requirements for Conversion of Existing Nontoll Routes

Under present economic conditions, converting existing nontoll routes to tolled highways is more widely feasible financially than construction of new toll roads (see Table 5). The much lower capital costs of conversion mean that considerably less traffic would be required to transform an existing tax-supported route into a self-supporting tollway. For example, with the interest rate at 10 percent, a low-cost conversion of an urban highway could be financed with tolls of 8 cents per mile and average daily traffic volume of 14,000 trips--a volume already reached on 87 percent of urban mileage on the Interstate system. A high-cost urban conversion at the same toll rate would require average daily traffic of about 58,000 trips. Conversion of some rural routes might also be feasible. If extensive reconstruction or repair work were also to be financed by tolls, however, considerably higher traffic volumes would be required.

Candidates for Toll Financing

From the perspective of financial feasibility, the best candidates for toll financing--major intercity routes with heavy volumes of long-haul traffic--have already been built, either as toll roads or as federally funded routes on the Interstate or Primary systems. Today, therefore, the likeliest candidates include:

- Expressways along heavily traveled urban "corridors,"
- Highways in high growth areas, such as parts of the Sunbelt, and
- Extensions of existing toll facilities.

The traffic requirements reviewed above indicate, however, that *even the best candidates for financing as new toll roads generally can be expected to require some form of governmental assistance.* A fourth, more controver-

TABLE 5. MINIMUM REVENUE AND TRAFFIC REQUIREMENTS FOR CONVERTING A MILE OF NONTOLL HIGHWAY TO TOLL, AT INTEREST RATE OF 10 PERCENT FOR 30 YEARS

Type of Requirement	Revenue Requirement (In millions of 1984 dollars): Urban Highway Low Cost	Urban Highway High Cost	Rural Highway Low Cost	Rural Highway High Cost
Construction Costs	1.0	5.0	0.2	0.8
Annual Costs				
Debt service a/	0.1	0.7	b/	0.1
Operations and maintenance	0.1	0.4	0.1	0.2
Maintenance reserve fund	0.2	0.6	0.1	0.3
Total	0.4	1.7	0.2	0.6
	Average Daily Traffic Requirement			
Average Toll Rate (per mile)				
4 cents	27,000	116,000	14,000	41,000
6 cents	18,000	78,000	9,000	27,000
8 cents	14,000	58,000	7,000	21,000
10 cents	11,000	47,000	5,000	16,000

SOURCE: Congressional Budget Office.

a. Includes coverage of 125 percent of typical year's debt service requirement.

b. Less than $50,000.

sial possibility is to convert existing federal tax-supported routes to toll roads as a means to finance repair and modernization.

Urban Expressways. Most new toll roads built or proposed in recent years are urban expressways or suburb-to-city routes along heavily traveled corridors. These routes offer heavy traffic and a pool of prospective users--commuters--likely to place a high value on reduced travel time. A possible obstacle, however, is the high cost of acquiring right-of-way along such corridors. In one recent project, the Dulles Toll Road in northern Virginia, the virtual elimination of right-of-way costs was a major factor in the tollway's financial feasibility; the toll road was built largely on federally owned land leased at very low cost to the state. Even projects with extremely strong projected traffic--such as the two major toll road projects under way in the Houston area of Texas (the Hardy and West Belt Toll Roads)--have relied on some form of public assistance to improve their feasibility. Although once built, the Houston toll roads are expected to be self-sustaining, they are receiving governmental support in the form of general obligation bonds backed by a tax pledge by Harris County. 15/

Roads in High Growth Areas. The Houston toll roads are also examples of toll facilities planned or built in areas where population growth has outpaced highway construction. In such locales where existing facilities are inadequate to serve present traffic volumes, toll financing may be attractive if it enables new facilities to be built much more quickly than possible with conventional "pay-as-you-go" financing supported by tax collections. 16/

Extensions of Existing Toll Facilities. Additions to existing toll facilities are often easier to finance through tolls than wholly new facilities can be. In general, this is because the revenues of the established toll system can be pooled with revenues from the new project to back bonds for constructing the new facility. This financing mechanism can make it quicker--and possibly cheaper--to build such a project as a toll facility than as a tax-supported route. On the other hand, some projects that could not meet the test of cost effectiveness on their own may get built anyway under such "piggyback" financing. Planned additions to existing toll facilities include the North-South Tollway in Chicago, a new 17-mile highway that will be part of the Illinois Tollway system. Pennsylvania has proposed extending the Pennsylvania Turnpike, with one financing package including the imposition of tolls on some existing sections of the Interstate system.

---

15. An *ad valorem* tax is expected to be levied, but only early in the project, to assure that interest and coverage requirements will be met. See Underwood, Neuhaus & Company, Inc., *Harris County Toll Road Authority Toll Road Project: Financing Plan* (September 20, 1984), p. 3.

16. Toll financing has also been used to encourage economic development in areas that are not high growth corridors. Such "bootstrap" projects have included tollways in Kentucky and Oklahoma, and are typically supported by a mix of toll and tax revenues. In a related example, Alaska is planning to construct as a toll facility a three-mile bridge crossing the Knik Arm near Anchorage to allow the city to expand northward and to improve access to Fairbanks.

Introduction of Tolls on Nontoll Routes. In recent years, several states have shown interest in the possibility of converting to toll facilities some routes that have received federal tax support. The objective is not to recover construction costs, which have already been paid through tax collections, but rather (as in Wisconsin) to provide a continuous source of funding for maintenance and upgrading needs, or (as in Pennsylvania) to help finance new connections or extensions to existing routes. 17/ Acceptance of such proposals would require a change in the federal law that prohibits tolls on any road constructed with federal support.

CONCLUSIONS

With revenue, and hence traffic, requirements as high as they now are to make a possible toll road financially viable, there are very few good candidates for new toll roads today. Only about 3 percent (1,335 miles) of the entire Interstate system and 7.5 percent (765 miles) of urban Interstate routes could pass the feasibility test, although these roads can be considered only as rough proxies for the pool of possible roads that might be good candidates for toll financing.

Even the best toll projects being built today depend for their success on some form of public assistance--such as general obligation backing by a state or county, pledges of local property tax collections, or dedication of a portion of the receipts of state taxes on motor fuel. In other words, partial, not total, self-reliance is the typical objective of a toll-financed enterprise.

At current interest rates, the feasibility of toll financing for new highways will likely depend increasingly on the creation of "partnerships" in funding between toll authorities and various levels of government. Borrowing costs can be reduced when toll projects are supported by a combination of tolls and tax revenues, by governmental provision of right-of-way, or by other forms of public assistance.

17. For details, see Wilbur Smith and Associates, Inc., *Summary Report on Feasibility of Converting Wisconsin's Interstate to the Toll Concept*, August 1983, and Vollmer Associates, *Pennsylvania Toll Roads Feasibility Study Summary Report*, June 1983.

CHAPTER III

ALTERNATIVES TO CURRENT FEDERAL POLICY

Under current federal policy, and barring a significant decline in interest rates, states and localities will probably continue to make only limited use of tolls to help fund highway construction, with new tollways continuing to need help from nonfederal sources. As a result, some economically valuable highway projects may well have to wait while alternative sources of funds are sought, causing a net loss not only for highway users but also for the economy as a whole.

Should the Congress wish to encourage expanded use of toll financing as a way of attending to continuing demand for new road capacity, but without adding undue pressure to the federal budget or the Highway Trust Fund, it will need to revise the federal stance on tolls. The Congressional Budget Office has analyzed the federal costs and benefits of two possible changes in the present federal law prohibiting the levying of tolls on highways built with federal support:

- **Modification**, to allow federal aid for *new* toll projects only, and

- **Repeal**, to allow tolls to be levied on both *new* and *existing* federally supported highways.

If federal law were modified to permit the use of federal funds to construct new toll roads, how much federal support would be necessary to effect a significant improvement in the feasibility of toll roads? Federal aid for toll road projects could be far more limited than it is for nontoll projects--for example, a 25-to-75 federal-to-local match for new toll roads, rather than the current 75-to-25 federal-to-local match for non-Interstate construction. The rationale would be to provide a federal boost sufficient to facilitate a project's construction without undermining the stringency of the market test that toll projects undergo in the bond market.

The size of the federal match would strongly influence the feasibility of a proposed new toll project (see Table 6). For a "typical" urban road, for example, a 25 percent federal share would reduce toll revenue requirements enough to lower the average daily traffic needed for a self-supporting toll

TABLE 6. FEASIBILITY OF URBAN TOLL ROADS WITH ALTERNATIVE LEVELS OF FEDERAL AID, AS MEASURED BY TRAFFIC REQUIREMENTS

Level of Federal Assistance	Minimum Average Number of Trips Required Daily	Percent of Urban Interstate Mileage Now At or Above Minimum
No Federal Aid	116,000	7.5
25 Percent Federal Share	92,000	14.6
50 Percent Federal Share	68,000	26.1
75 Percent Federal Share	48,000	41.2

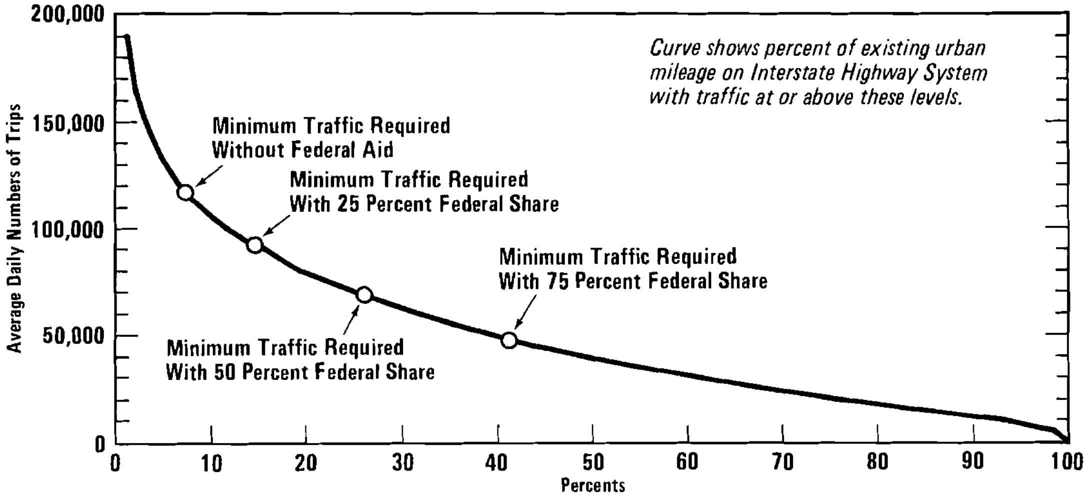
SOURCE: Congressional Budget Office. Data on existing Interstate system traffic provided by Federal Highway Administration.

NOTE: Assumes construction costs of $20 million per mile, 30-year bond financing at 10 percent interest, and toll rate of 8 cents per mile.

road (with tolls of 8 cents per mile) from 116,000 trips to 92,000. To give a measure of the stimulus such a modification would provide, this lower traffic level has been met or exceeded by almost 15 percent of existing urban Interstate system mileage (see Figure 3). By comparison, a 75 percent federal share would lower traffic requirements for a typical urban toll road to about 48,000 vehicles--a level that has been met or exceeded by more than 40 percent of existing urban mileage on the Interstate system.

For conversion projects, low capital costs and established traffic use suggest that no further federal aid would be needed. For example, at a toll rate of 8 cents per mile, a high-cost urban conversion would require average daily traffic of about 58,000 vehicles--a level already reached on one-third of the existing urban mileage on the Interstate system. A low-cost urban conversion at the same toll rate would require average daily traffic of only 14,000 vehicles. If, however, major upgrading or extensive reconstruction were to be financed through tolls, much higher traffic volumes would of course be required.

Figure 3.
Feasibility of Toll Financing for Urban Roads With and Without Federal Aid



SOURCE: Congressional Budget Office based on data provided by the Federal Highway Administration.
NOTE: Assumes total construction costs of $20 million per mile, an interest rate of 10 percent, and a toll rate of 8 cents per mile. Urban mileage on the Interstate system taken as a proxy for possible tollways.

MODIFICATION

In 1982, the Administration proposed that the Congress change existing federal law so that tolls could be used to finance the nonfederal share of construction costs for new federally supported highways, just as they can be used now for new toll bridges and tunnels. The 1982 proposal, never voted into law, would have permitted federal participation in new toll highways at the same federal matching ratios provided for nontoll routes (a 75 percent federal share for non-Interstate construction). A similar proposal is currently under consideration by the Department of Transportation for inclusion in the Administration's proposed 1986 highway act. The following analyzes the costs and benefits to the federal government of such an approach.

Benefits. By stimulating the use of toll financing, a federal share for new toll roads could speed construction of new highway capacity that otherwise might be delayed for several years or more under current financing constraints. To whatever degree economic growth followed, all levels of government would benefit. For states and localities, the freedom to use tolls to cover the nonfederal share of construction costs on new federally aided roads could help relieve pressure on their own transportation resources. The creation of financially independent facilities could also help reduce the need for future increases in highway taxes and could possibly free some existing tax receipts for the repair and upgrading of nontoll highways. The improved project selection that toll financing can achieve (see Chapter II) could lead to more cost-effective investment of federal dollars.

The financial problems affecting the Highway Trust Fund could also be somewhat alleviated, but only if a reduction in the overall level of federal highway authorizations accompanied the changes in federal toll policy. If a low federal matching share were offered for toll highway projects, this would reduce the level of federal spending for some projects that would otherwise have been built with a high federal share of costs. Toll revenues would substitute for a portion of the federal excise tax receipts that typically supply the bulk of the financing for federal projects. For instance, if highway projects amounting to $1 billion a year--roughly 7 percent of the current federal program--were built as tollways and financed with a 25 percent federal share, savings to the Highway Trust Fund could amount to as much as $2.5 billion over the next five years. 1/ The effect on the overall federal budget, however, would be smaller because of the loss of federal income tax revenues on the tax-exempt bonds issued to finance the new toll facilities. Thus, tolls would provide, in part, a hidden subsidy to the Highway Trust Fund out of general tax revenues. In any case, the magnitude of the savings clearly would not be sufficient to restore balance to the Trust Fund unless accompanied by other measures, such as program cutbacks or fuel tax increases.

Costs. Providing federal funds for toll projects would, however, dilute the stiff selection test such undertakings must pass in the bond market. With access to federal backing and the freedom to use toll revenues to cover the nonfederal share of costs, states and localities might at times pursue less cost-effective toll projects. The lower the federal share of capital costs, however, the lower the risk of financing unpromising toll projects.

Federal participation in funding new toll highways would also eliminate the savings that toll road projects currently can realize through their freedom from certain federal regulations. These include federal design standards, environmental regulations, and the wage provisions of the Davis-

1. At the current 75 percent federal matching share for non-Interstate projects, each $1 billion in nontoll roads would require a $750 million federal outlay. Assuming a 25 percent federal share instead, the $1 billion spent on toll roads would require only $250 million, for a potential savings of $500 million a year to the Trust Fund.

Bacon Act.[2] In addition, by receiving no federal support, toll roads can avoid possible delays in funding and other costs associated with the federal grant process. The introduction of federal aid would preclude such savings.

Creation of financially independent toll facilities, as Chapter II noted, can limit governmental control of highway spending and pricing. Although federal participation would subject newly eligible toll projects to federal regulations, toll agencies would probably retain extensive latitude in pricing and future investment decisions. This could result in overcharging or other inefficiencies in road pricing, over which the federal government would have no influence unless restrictions were imposed as a condition of federal aid.

Other Federal Issues. Federal assistance for a toll bridge or tunnel project is currently granted with the stipulation that tolls be used only to recover the costs of constructing, maintaining, and operating the facility in question. In effect, this provision prevents the use of tolls to finance projects other than the original toll facility. Application of this provision to newly eligible toll projects would improve efficiency by strictly enforcing the "user pays" principle, but it could limit states' flexibility to finance later additions to their toll networks.

Standing legislation also limits the duration of tolling to the period in which a facility's original bonded indebtedness is being paid off--a policy the Congress might wish to reconsider as part of the modification option. Since the usefulness of tolls as a pricing mechanism grows as a facility's traffic congestion increases, removing tolls after capital costs have been paid and traffic has increased may be counterproductive.[3] Indeed, a rate structure scheduled to begin low and rise over time, as congestion increases, might have economic merit.[4] In addition, financial pressures on states can increase when tolls are removed, particularly since upkeep costs rise as facilities age. As a result, three states--Indiana, Maine, and Virginia--have already obtained Congressional permission to "buy back" federally assisted toll facilities, and thereby become free to collect tolls indefinitely.

---

2. Toll projects must, however, comply with relevant state regulations or standards, which in some cases may be more restrictive than federal regulations.

3. For example, traffic congestion on the Connecticut Turnpike has increased substantially since tolls were removed in October 1985. See James Brooke, "Tolls Lifted, I-95's Popularity Grows," *The New York Times*, Thursday, December 12, 1985, p. B2.

4. See A.A. Walters, *The Economics of Road User Charges*, p. 219. The Administration's proposed changes to existing policy are likely to include a liberalization of the toll removal requirement. Under the new terms, a toll facility built with federal assistance would be permitted to continue tolls after debt retirement on the condition that toll revenues be used only for the facility or for other public highways.

REPEAL

In addition to permitting the use of federal funds to construct new toll roads, the Congress could also allow tolls on existing toll-free federal routes. In light of the long-time federal commitment to a nontoll highway network, however, the conversion of tax-supported roads to toll facilities could be controversial, with the net benefits unclear.

Benefits. Allowing imposition of tolls on existing federal routes would provide a source of capital for new highway construction in areas that have recently experienced rapid growth. Thus, states could increase the capacity of their Interstate and Primary routes sooner than would otherwise be possible. As with new toll roads, the bond market process would provide somewhat better discipline in ensuring the selection of economically worthwhile projects only.

Financing for major repairs could also come from tolls rather than federal aid. This option is less important today than it might have been several years ago, however, since the major increase in federal funds for Interstate repair authorized by the Surface Transportation Assistance Act of 1982 appears sufficient to maintain the Interstate system in adequate condition.[5] Tolls could, however, assist in financing major repairs and reconstruction of Primary and other non-Interstate routes.

In addition to the traditional cost-recovery function of tolls, they can help control congestion on heavily traveled urban roads. That is, higher peak-period tolls could be used to divert traffic to less congested times of day and to other routes, thus ensuring that the road be used to its maximum capacity. To date, however, such congestion pricing has been applied only rarely in this country.

Costs. For routes converting to toll roads, the additional capital and operating costs associated with tolling represent a much larger fraction of total system costs than they do for a new toll road. As a result, tolls appear to be a more costly means to collect revenues to finance improvements on an existing road than they are for construction of a brand new road. If imposing tolls can speed such improvements by only a few years, the conversion costs, the higher administrative costs associated with tolling, and the

5. Federal funds could, however, be better targeted to areas of greatest need. For details, see Congressional Budget Office, *Public Works Infrastructure*, Chapter II.

attendant loss of traffic are likely to swamp the economic gains stemming from more rapid completion of a needed project. Only on heavily congested routes would this not apply.

Because tolling of an existing route can be expected to divert some traffic to nearby nontoll roads--thereby hastening the latters' deterioration--such conversions could increase the demand for federal repair funds. On the other hand, there would likely be a net decrease in the demand for federal repair monies if newly converted routes lost their eligibility for federal "4R" funds (for resurfacing, restoration, rehabilitation, and reconstruction).

Finally, from a federal perspective, the tolling of existing roads on the Interstate and Primary systems can be seen as interfering with the goal of providing a federally supported, national network of highways, insofar as tolls would replace this concept of a nationwide "system" with one of disparate, self-sustaining facilities.

PART II.

BACKGROUND ON THE OPERATION OF TOLLWAYS

AND THEIR FINANCIAL STATUS

CHAPTER IV

THE OPERATION OF MAJOR U.S. TOLL FACILITIES

The 240 toll highway facilities in the United States today include interurban roads, urban expressways, and more than 160 toll bridges and tunnels. (The nation's 116 toll ferries are not treated in this study.) These diverse types of facilities have different design and operating characteristics and serve different kinds of traffic. This chapter develops a profile of the nation's major toll facilities, focusing on key features of their operation and design and assessing recent trends in traffic, costs, and revenues. The chapter also reviews new techniques that could make toll collection easier.

OWNERSHIP AND MANAGEMENT

Of all U.S. toll facilities, 210--including 65 of the 72 toll roads--are publicly owned and operated. The other 30 facilities--22 bridges, 7 roads, and one tunnel--are owned by private firms or individuals.[1] Publicly owned toll facilities are usually run by state highway or transportation agencies or by single- or multipurpose public authorities. Public authorities are legally chartered institutions with the status of public corporations, and they may operate a single type of facility, such as toll bridges only, or such diverse facilities as roads, harbors, and tunnels. Many public toll authorities have considerable independence from state and local governments, based on the power to issue their own debt in the form of revenue bonds. In addition, some of the larger authorities are able to draw on a broad base of revenues to support their operations.

Fifteen toll facilities in 13 states currently are bound by "Section 129 agreements" with the U.S. Department of Transportation, which permit the use of federal funds to construct certain types of toll facilities on the federal highway network (see Table 7).

1. Federal Highway Administration, *Toll Facilities in the United States* (April 1985).

TABLE 7. EXCEPTIONS TO FEDERAL NO-TOLL POLICY: SECTION 129 SECRETARIAL AGREEMENTS, AS OF 1985

Toll Facility and Location	Date of Agreement	Type of Agreement
FACILITIES WITH OUTSTANDING AGREEMENTS		
Calumet Skyway Connection (Illinois)	1961	Section 129d (approach to toll road on Interstate system)
Evergreen Point-Union Bay Bridge (Washington)	1961	Section 129a (bridge)
Astoria Bridge (Washington-Oregon)	1962	Section 129a (bridge)
Newburgh-Beacon Bridge (New York)	1964	Section 129a (bridge)
Ohio Turnpike (Ohio)	1964	Section 129d (approach to toll road on Interstate system)
Sunshine Bridge (Louisiana)	1965	Section 129a (bridge)
West Virginia Turnpike (West Virginia)	1971	Section 129e (upgrading of two-lane toll road on Interstate system)
New Muscatine Toll Bridge (Iowa)	1972	Section 129a (bridge)
Kansas Turnpike (Kansas)	1974	Section 129d (approach to toll road on Interstate system)
Sunshine Skyway Bridge (Florida)	1975, 1981	Section 129a (bridge)
Antioch Bridge (California)	1976	Section 129a (bridge)
Everglades Parkway (Florida)	1976	Section 129e (upgrading of two-lane toll road on Interstate system)

(Continued)

TABLE 7. Continued

Toll Facility and Location	Date of Agreement	Type of Agreement
FACILITIES WITH OUTSTANDING AGREEMENTS (Continued)		
Fort McHenry Tunnel (Maryland)	1978	Section 129a (tunnel)
Torras Causeway (Georgia)	1980	Section 129a (bridge)
Hood Canal Bridge (Washington)	1980	Section 129a (bridge)
FACILITIES NOW TOLL FREE		
Augusta Memorial Bridge (Maine)	1948	Section 129a (bridge)
Louisville-Elizabethtown (Kentucky)	1961	Section 129d (approach to toll road on Interstate system)
FACILITIES BOUGHT BACK [a]		
Indiana Toll Road (Indiana)	1961, 1962, 1963	Section 129d (approach to toll road on Interstate system)
Maine Turnpike (Maine)	1964, 1965	Section 129d (approach to toll road on Interstate system)
Richmond-Petersburg Turnpike (Virginia)	1964, 1971	Section 129d (approach to toll road on Interstate system)

SOURCE: Federal Highway Administration.

a. Special legislation enacted by the Congress in 1978 permitted Indiana and Maine to reimburse the federal government for federal funds expended on these projects (without interest), thereby freeing the toll agencies from their Section 129d agreements requiring the cessation of tolls upon retirement of construction debt. Similar legislation was passed in 1984 to allow continuation of tolls on the Richmond-Petersburg Turnpike in Virginia.

OPERATING CHARACTERISTICS

The design and operation of tollways differ according to a facility's type, its location, and the nature of traffic it serves. The interurban toll roads, including some of the nation's first "superhighways," serve predominantly long-haul traffic, with commercial vehicles typically accounting for 10 percent to 25 percent of average daily traffic. By contrast, urban expressways and many toll bridges and tunnels carry a higher proportion of commuter traffic, with correspondingly smaller percentages of commercial vehicles and a greater disparity between peak-hour traffic levels and off-peak use.

Most toll facilities derive the bulk of their income from toll revenues, which vary according to the volume and composition of traffic as well as toll rate levels. In the Congressional Budget Office's random sample of 18 toll roads and 14 toll bridges and tunnels, tolls produced an average of 87 percent of annual gross revenues over the 1977-1981 period. (The remainder consisted largely of concession revenues and investment income.) Commercial vehicles are major revenue producers for many toll facilities; their contribution to toll revenues typically is two to three times greater than the fraction of overall toll facility traffic they represent. On a number of major interurban routes (such as the Indiana Toll Road and the Ohio Turnpike), commercial traffic contributes more than half of the facility's total toll revenues.

Closed *Versus* Open Toll Collection

Most toll bridges and tunnels and some roads apply "closed" toll collection systems; these impose a toll on all users. Closed systems are well suited to bridges and tunnels, which commonly have only two access points. Tolls are collected at barriers across the main roadway at the access points. For roads, closed collection systems are generally feasible only on intercity routes with a very limited number of access points, and they tend to be much costlier to build and operate than "open" toll collection systems. Closed toll collection systems on toll roads generally use tickets that are dispensed, with the entry point identified, to vehicles entering at any access point; the tickets are surrendered and the toll paid when the vehicle exits. The toll thus reflects the distance traveled on the route. Most toll roads with closed toll collection systems use a combination of main toll plazas at either end, and tolled entrance and exit ramps along the route. With such closed collection systems, all users pay.

"Open" collection systems, in contrast, are not designed to collect tolls from all users. Open systems can be designed with virtually the same number of interchanges as on a comparable tax-supported, limited-access highway. Toll barriers are placed at strategically selected intervals across the main roadway, with flat rates charged to each class of user passing the barrier. Such barrier systems are usually intended to allow certain local trips to be made toll free. So-called "barrier-ramp" systems, which use a combination of several barriers placed at intervals across the main roadway and tolled exit and entrance ramps, may be designed as closed or open toll collection systems. Barrier-ramp systems are generally designed to collect tolls from at least 95 percent of the traffic using a toll facility. 2/

Of 22 major U.S. toll roads, 11 use closed ticket or barrier-ramp systems, eight have open barrier systems, and three use a combination of closed and open systems. Ten of the 17 interurban roads sampled have closed systems, while four out of five urban expressways use barrier systems.

Toll facilities differ considerably in how they implement these basic types of toll collection systems. On some bridges, for example, tolls are collected in one direction only, but at double the rate that would be charged if traffic were tolled in both directions. At other facilities, reversible center-lane collection booths that can reverse with peak-hour traffic flows have been installed. The type of toll collection system used and the complexity of the rate schedule together influence what mix of manned and automatic collection equipment a facility needs. Toll roads with closed ticket systems can use automated equipment to dispense tickets, but they require at least one manned booth at every access point to collect the variable tolls. On barrier and barrier-ramp systems, the mix of equipment depends in part on the elaborateness of the rate schedule, on the proportion of commercial traffic using the road, and the number of coins required for each toll. In general, the more complicated the transactions, the greater the number of manned toll collection booths required at each toll station.

Toll Rate Schedules

The levels and structures of toll rates vary widely. For passenger cars using toll roads, for example, the average rate ranges from a low of 1 cent per mile to a high of 9 cents per mile (see Table 8). Rates are generally higher

2. See Applied Economics, Inc., *An Economic Evaluation of Toll Financing for Highways*, Final Report, prepared for the International Bank for Reconstruction and Development, Washington, D.C. (September 1972).

TABLE 8. AVERAGE RATES ON SELECTED U.S. TOLL ROADS, 1985
(In cents per mile)

Name of Facility	Passenger Cars	Five-Axle Trucks
Interurban Toll Roads		
Blue Grass Parkway (Kentucky)	1.8	5.5
Everglades Parkway (Florida)	1.0	3.8
Indiana Toll Road	3.0	9.3
J. F. K. Memorial Highway --Delaware Segment	9.1	27.3
New Jersey Turnpike	2.3	7.7
Turner Turnpike (Oklahoma)	2.3	7.6
Urban Expressways		
Dallas North Tollway (Texas)	5.0	12.0
Dulles Toll Road (Virginia)	7.0 a/	b/
Massachusetts Turnpike --Boston Extension	6.3	16.3

SOURCE: Congressional Budget Office, adapted and updated from International Bridge, Tunnel and Turnpike Association, *Toll Rates Survey* (July 1985).

a. Estimate based on results of an April 1985 survey of users, provided by Vollmer Associates.

b. Information not available.

on newer facilities than on older toll roads built when construction and interest costs were markedly lower than they are today. In addition, toll highways in urban locations tend to have higher toll rates than do rural or interurban routes, since construction and right-of-way costs tend to be much greater in urban areas. While the present average toll rate for passenger cars for all U.S. toll roads is 2.5 cents per mile, the average for urban tollways is 5 cents per mile, with most recently constructed urban routes charging not less than 7 cents a mile. Bridge and tunnel toll rates also show considerable variation, with passenger car rates per crossing ranging from 25 cents or less for a number of small bridges to $9.00 (for the Chesapeake Bay Bridge-Tunnel crossing).

To reflect different classes of users, most toll facilities have graduated rate structures, with toll rates rising with vehicle size or weight. These graduated toll schedules can be designed to reflect the differences in the costs imposed on a facility by the various types of vehicles that use it. Vehicle classification systems vary considerably from one facility to another. In levying tolls on trucks and buses, for example, most toll facilities charge according to size, as measured by a vehicle's number of axles. Some bridges, however, and two major toll roads (the Ohio and Pennsylvania turnpikes) assess tolls on commercial vehicles according to weight. The number of vehicle classes for toll purposes ranges from three or four on the simplest rate schedules to 15 or more, with separate rate classes based on different combinations of the numbers of axles, tires, and trailers. Many toll facilities also issue coupon books, annual permits, or other mechanisms to offer discounts to commuters, carpools, commercial operators, and other regular users.

Toll rates can also reflect differences in trip distance. In general, rates on roads using the closed ticket system of toll collection can more readily capture differences in users' trip distances than can the flat rates commonly imposed at each collection point on open barrier systems.

RECENT TRENDS IN TOLL RATES, TRAFFIC, COSTS, AND REVENUES

After years of very slow growth in U.S. toll rates, many agencies have recently raised tolls for passenger cars and commercial vehicles. Since 1973, for example, tolls have risen on some 35 toll roads. On average, rates have risen about 32 percent for passenger cars and 20 percent for commercial vehicles using toll roads, and approximately 40 percent for cars and

60 percent for commercial traffic on toll bridges and tunnels. 3/ Despite these increases, though, average toll rates today are only about twice what they were in the mid-1950s, though inflation (as measured by the rise in the Consumer Price Index) has nearly quadrupled in the interim.

In general, the recent toll increases have been prompted by rising operating and maintenance costs, which have been growing faster than toll facility traffic or revenues. Over the past decade, the nation's traffic on toll facilities has increased by about 14 percent, while annual toll revenues of publicly owned U.S. toll road, bridge, and tunnel facilities have grown by about 60 percent. Since 1973, however, annual operating and maintenance costs for publicly owned toll facilities have grown by about 80 percent. 4/ This does not reflect the costs of major maintenance and rehabilitation, which appear to be increasing even faster as facilities age. In some cases, tolls also have been raised to finance additions or improvements to existing toll facilities or to support other transportation facilities such as mass transit systems. 5/

RECENT TRENDS IN TOLL COLLECTION TECHNIQUES

In recent years, considerable interest has focused on the potential for speeding the toll collection process and reducing toll facilities' operating, maintenance, and construction costs through use of new, no-stop toll collection techniques. Using various technologies--including optical labels scanned by cameras, microwave systems, low-frequency induction, and laser beams--these systems all are based on the goal of identifying and recording automatically each vehicle as it crosses a toll plaza. 6/ Such "automatic vehicle

3. Data provided by the International Bridge, Tunnel and Turnpike Association.

4. Based on revenue and cost data collected in the Federal Highway Administration, *Highway Statistics 1982* and earlier volumes. Dollars are nominal dollars, to permit comparison with change in average toll rates.

5. Between 1981 and 1983, for example, toll rates for passenger cars on the Dallas North Tollway were doubled to help finance the Dallas North Tollway Extension. During the 1981-1984 period, there was a 50 percent increase in tolls on the New York City bridges operated by the Triborough Bridge and Tunnel Authority, intended to help support the city's subway system.

6. For discussion of the various vehicle identification systems being studied and tested today, see Kiran Bhatt, *Road Pricing Technologies: A Survey*, The Urban Institute (August 1974); Robert S. Foote, "Prospects for Non-Stop Toll Collection Using Automatic Vehicle Indentification," *Traffic Quarterly*, Volume 35, No. 3 (July 1981), pp. 445-460; Jeanne McDermott, "Bridges: Back to Private Enterprise?" *Technology*, January-February 1982, pp. 19-24; and John Armstrong, "Breakthroughs in Vehicle Identification," *Railway Age*, April 1984, pp. 40-48.

identification" (AVI) systems are being developed and applied on an experimental basis in a variety of settings both in the United States and abroad. More conventional processes, such as special licenses, magnetic card systems, and on-vehicle meters, are also being explored.

Automatic Vehicle Identification Systems

Automatic vehicle identification generally requires three components:

- A vehicle-mounted *transponder* to transmit information about the vehicle,
- A road-stationed *interrogator* that "reads" the information from the transponder, and
- A *computer* to handle vehicle recognition and record trips for later billing.

To accomplish no-stop toll collection, the interrogation, verification, and billing must all occur within a few seconds--the time it takes for a vehicle to move to the toll barrier from the point at which the transponder is first queried by the electronic interrogator. To do this at a low enough cost to be competitive with conventional collection procedures, an AVI system must be extremely reliable, able to identify and bill a large number of vehicles, easy to install, and cheap relative to the benefits provided.

Experiments to date have focused largely on the identification component of AVI, rather than on the development of computerized accounting and billing procedures. An optical system using automatically scanned stickers has been in use for many years on toll bridges operated by the Delaware River Port Authority in the Philadelphia area. The stickers, replaced monthly, qualify users for reduced rates, but they cannot identify each vehicle uniquely as more sophisticated systems can. In recent years, several firms have developed interrogator-transponder systems, which have undergone limited field tests at New York's Lincoln Tunnel, San Francisco's Golden Gate Bridge, and elsewhere in the United States and abroad. Since the early 1970s, the Port Authority of New York and New Jersey has conducted field tests of AVI equipment on buses, including radio frequency, microwave, and infrared devices. On the basis of these experiments, the Port Authority has found the microwave systems that use battery-powered transponders most promising. 7/ Sometime in 1986, the Port Authority plans to institute a broad test of a full AVI system that will provide automated no-stop toll collection for buses using the Lincoln Tunnel. The system will probably work on microwave technology, and some 2,500 buses, or 95 percent of the area's buses using the tunnel, are expected to participate. A low-power radio frequency system is now being tested on the San Diego-Coronado Bay Bridge in southern California. 8/

Promising results of the recent research and experimental applications indicate that the basic technology necessary for fully automatic no-stop toll collection is available now. 9/ The highly accurate performance of some of the equipment tested so far suggests that these systems need not be plagued by the unreliability of the optical system of Automatic Car Identification (ACI) adopted by the Association of American Railroads in the early 1960s. Still, a number of significant problems threaten the potential applicability of AVI to toll facilities. First, because the costs of transponders would be borne by individual users, the participation rate cannot be expected to exceed about half of all the vehicles using a toll facility; the remaining traffic would have to be handled through conventional collection procedures. As a result, facilities with a high proportion of commuter traffic are the best candidates for AVI systems. Second, the total costs of implementing and operating AVI systems have not been worked out. Though some estimates emphasize long-term savings in capital costs, others suggest that initial costs for AVI systems may be considerably lower than those for conventional toll collection systems, but annual costs--including the costs of billing toll facility users--are likely to be significantly higher. 10/ Wider

7. Two major manufacturers of such battery-powered transponders are the Siemens Company of Germany and the Sivers Lab of Sweden. For detailed information on the Port Authority's AVI experiments, see Robert S. Foote, "Automatic Vehicle Identification," presented at the 53rd Annual Meeting of the Highway Research Board, January 1974; "Developments in Automatic Vehicle Identification During 1974 and 1975," The Port Authority of New York and New Jersey, Tunnels and Bridges Department, Research Division, November 1975; and "Automatic Vehicle Identification: Tests and Applications in the Late 1970s," presented at the International Symposium on Traffic Control Systems, Berkeley, California, August 1979.

8. Science Applications International of San Diego has developed this sytem. See "California DOT Starts AVI Demonstration Project," *Tollways* (June 1985), p. 4.

9. Robert S. Foote, "Prospects for Non-Stop Toll Collection Using Automatic Vehicle Identification," pp. 454-455.

10. See Jeanne McDermott, "Bridges: Back to Private Enterprise," p. 23, and Kiran Bhatt, *Road Pricing Technologies: A Survey*, pp. 21-23.

testing of AVI systems is necessary to determine the technical and economic feasibility of applying such systems to the needs of U.S. toll highway facilities. In the meantime, modifications of existing systems, such as reversible center booths and one-way toll collection, offer ways to improve traffic flow and reduce costs while more sophisticated toll collection systems are still in the experimental stages.

CHAPTER V

THE FINANCIAL CONDITION OF MAJOR U.S. TOLL FACILITIES AND THEIR PERFORMANCE IN THE BOND MARKET

Financial strength is key to a toll facility's capacity to survive with little or no public support. Based on analysis of widely used financial ratios, this chapter assesses recent trends in the financial performance of the nation's major toll facilities. It also gauges their success in competing for private investment capital in the tax-exempt municipal bond market since the beginnings of the modern-day toll era in the mid-1900s, and it evaluates the effects on toll financing of historical shifts in the investment climate.

TRENDS IN FINANCIAL PERFORMANCE

Analysis of basic financial ratios is a widely accepted way to gauge the financial condition and performance of either a single enterprise or an entire industry. Various different financial ratios can be constructed, each revealing a particular aspect of business performance. Four indicators commonly used by investment advisors to assess the value of a municipal enterprise to potential bondholders are examined here: operating ratio, net take-down ratio, interest coverage, and interest safety margin. The first two indicators measure the availability of revenues beyond those needed to pay regular operating expenses:

- *Operating Ratio*--Derived by dividing operating and maintenance expenses by total operating revenues, this ratio measures the share of revenues absorbed by operating and maintenance costs. A relatively low operating ratio reveals financial strength by indicating that only a small share of revenue is needed to satisfy operating requirements.

- *Net Take-Down Ratio*--Calculated as total revenues minus operating and maintenance expenses, divided by gross revenues, the net take-down is similar to the operating ratio but also includes non-operating revenues (such as interest income). The higher the ratio (closer to one), the greater the share of toll facility revenues remaining after payment of operating and maintenance expenses.

The second two indicators measure a toll facility's capacity to support existing borrowing for capital investment:

- *Interest Coverage*--Calculated as gross revenues less maintenance and operating expenses, divided by interest requirements for the year, this indicator reveals the extent to which a toll facility's net revenues exceed interest requirements for a given year.

- *Interest Safety Margin*--Defined as total revenues minus operating and maintenance expenses and annual interest requirements, divided by gross revenues, this ratio reveals the financial cushion available beyond the revenues needed to satisfy a toll facility's annual operating and maintenance costs and interest requirements on existing debt.

Recent Trends in the Financial Strength of Toll Facilities

Examination of these measures shows that the financial performance of toll facilities is strong today compared to that of other major public enterprises. In 1983, the median operating and net take-down ratios for turnpikes and other toll facilities were substantially better than those of other financially self-sufficient public enterprises such as airports, electric utilities, water supply systems, and sewage treatment authorities (see Table 9). Indeed, the median operating ratios for turnpikes and for bridges, tunnels, and expressways were almost 20 percentage points better than the ratio for airports, which had the next best showing reported by Moody's Investors Service.[1] Interest coverage for toll facilities was on a par with the medians for other public enterprises, except the extraordinarily high coverage demonstrated by electricity distribution systems.

Despite this evidence of the financial strength of toll facilities today, operating and maintenance costs appear to be consuming a steadily increasing share of revenues. For toll facilities of all types, median operating ratios have risen and net take-down ratios have declined appreciably in recent years (see Table 10). The median operating ratio for toll roads, for example, rose from 36.3 percent in 1977 to 41.4 percent in 1983, while the median net take-down dropped from 66.4 percent to 61.1 percent during the same period. For bridges and tunnels, the median operating ratio rose over

1. Data on toll facilities' financial performance were provided by Moody's Investors Service, Inc. The Congressional Budget Office is alone responsible for the analysis and interpretation of these data.

TABLE 9. FINANCIAL PERFORMANCE OF MAJOR PUBLIC ENTERPRISES: PERFORMANCE MEDIANS IN 1983

Service	Operating Ratio (In percents)	Net Take-Down Ratio (In percents)	Interest Coverage (Ratio)	Interest Safety Margin (In percents)
Turnpikes	41.4	61.1	4.28	44.9
Bridges and Tunnels a/	42.2	62.8	3.21	38.1
Airports	60.4	53.3	4.05	N/A
Electricity Generation and Transmission	76.6	26.0	3.68	N/A
Electricity Distribution	83.1	21.4	13.12	N/A
Water Supply	67.5	40.5	4.22	N/A
Wastewater Treatment	70.7	41.3	3.11	N/A

SOURCE: Adapted by Congressional Budget Office with the permission of Moody's Investors Service.

NOTE: N/A = Not Available.

a. Includes some urban expressways.

the same period from 30.5 percent to 42.2 percent, and net take-down fell from 74.8 percent to 62.8 percent. One explanation for this trend may be that toll increases, hence revenues, have failed to keep pace with rising operating costs.

On the other hand, toll facilities have improved their interest coverage over the 1977-1983 period (as shown in Table 10), and their interest safety margins have not diminished. In the same years, the median interest coverage for toll roads rose from 3.78 times annual interest requirements to 4.28; for bridges and tunnels the 1983 median was 3.21

TABLE 10. FINANCIAL PERFORMANCE OF TOLL FACILITIES ACCORDING TO FOUR MEASURES, 1977-1983

Years	Operating Ratio (In percents)	Net Take-Down Ratio (In percents)	Interest Coverage (Ratio)	Interest Safety Margin (In percents)
		ROADS		
1977	36.3	66.4	3.78	44.1
1978	36.5	68.3	4.42	43.3
1979	37.8	64.3	4.94	47.6
1980	39.6	62.4	5.81	46.9
1981	39.7	64.0	4.77	46.1
1982 [a]	38.8	62.0	4.77	46.0
1983 [a]	41.4	61.1	4.28	44.9
		BRIDGES AND TUNNELS		
1977	30.5	74.8	2.36	38.1
1978	32.1	70.7	2.77	41.0
1979	29.5	71.8	3.58	47.1
1980	37.4	67.6	3.32	41.4
1981	43.4	60.3	2.85	41.2
1982 [a]	47.5	64.5	2.96	42.4
1983 [a]	42.2	62.8	3.21	38.1

SOURCE: Congressional Budget Office, based on financial performance data furnished by Moody's Investors Service, Inc., for 18 toll roads and 13 toll bridge and tunnel facilities.

NOTE: Methods of calculating performance measures are outlined near the beginning of Chapter V. Data reflect medians of all facilities represented.

a. Medians for 1982 and 1983 were provided by Moody's Municipal Department, and are based on a somewhat different sample from that used by CBO to calculate medians for 1977-1981.

times annual interest requirements, as compared to 2.36 in 1977. Interest safety margins also showed improvement during this period, although in 1983 the medians dropped back to about their 1977 levels. Thus, even during a period when operating and maintenance costs consumed a growing share of revenues, toll facilities have maintained and even improved their ability to cover the costs of borrowing on existing debt. In part, this general improvement may reflect declining interest requirements as bonds have gradually been paid off and no new debt incurred.

TOLL FACILITIES IN THE BOND MARKET

Even more than for other public enterprises that rely on the bond market to raise investment capital, the financial history of a toll facility is shaped by its success in the tax-exempt municipal bond market. Indeed, a toll facility's very existence relies on such success, since in most cases tolls are imposed expressly to provide the guaranteed stream of revenues necessary to secure debt for the construction of the facility in the first place. Major extensions or improvements to the original facility typically require additional borrowing. How would-be investors rate toll facilities as investments is therefore crucial to such projects' financial feasibility and important to the success of later improvements.

Participation in the Bond Market

Since 1950, U.S. toll facilities have raised more than $35 billion (in 1984 dollars) in the tax-exempt municipal bond market--more than $32 billion in new bond financing and $3 billion in refunding issues. [2/] More than 45 toll facilities participated in the bond market during this period, including at least 28 roads and 18 bridge and tunnel facilities. [3/] As Table 11 shows,

---

2. Toll bond data were provided by Moody's Investors Service and exclude any bonds issued during this period that were not rated by Moody's. Also excluded are a number of issues for which information was unavailable, including those for the New Hampshire Turnpike and toll-related portions of general revenue bonds issued by the Massachusetts Port Authority. The toll facility bonds included here probably represent at least 90 percent of the toll bond activity during the 1950-1984 period.

3. This count understates the number of individual toll facilities that have participated in the bond market, since a number of authorities (such as the Oklahoma Turnpike Authority and New York's Triborough Bridge and Tunnel Authority) operate several different facilities, for which bonds typically are not issued separately.

TABLE 11. BOND ISSUES FOR TOLL FACILITY CONSTRUCTION BY FACILITY TYPE, 1951-1984

	Roads		Bridges and Tunnels		All	
Year of Issue	Amounts in Billions of 1984 Dollars	Percent of Toll Road Volume	Amounts in Billions of 1984 Dollars	Percent of Bridge/ Tunnel Volume	Amounts in Billions of 1984 Dollars	Percent of Total Volume
1951-1955	12.27	48.0	0.81	11.7	13.08	40.2
1956-1960	2.06	8.1	2.53	36.6	4.60	14.1
1961-1965	3.63	14.2	0.93	13.4	4.56	14.0
1966-1970	4.58	17.9	1.20	17.3	5.78	17.8
1971-1975	2.04	8.0	0.10	1.4	2.14	6.6
1976-1980	0.33	1.3	0.79	11.4	1.12	3.4
1981-1984	0.68	2.7	0.56	8.1	1.24	3.8
Total Issues 1951-1984	25.59 a/	100.0	6.92	100.0	32.51 a/	100.0

SOURCE: Congressional Budget Office.

NOTE: Excludes refunding issues. Details may not add to totals because of rounding.

a. Excludes $500 million in state-guaranteed debt for the New York State Thruway, for which issue dates could not be assigned.

about $25.6 billion in new bond financing has supported the construction of toll roads, while $6.9 billion has been used for bridge and tunnel construction.

Almost half of this new debt was sold in the 1951-1955 period, before passage of the Federal-Aid Highway Act of 1956. The volume of new debt for toll facilities dropped off sharply following passage of this act, which gave states a strong incentive to build their portions of the Interstate Highway System by boosting the federal share of construction costs to 90 percent. A total of $4.6 billion (in 1984 dollars) in new toll debt was issued over the 1956-1960 period, as compared to $13.1 billion between 1951 and 1955--a two-thirds decline in the overall level of new investment in toll facility construction. The mix of projects also shifted dramatically, with investment in bridge and tunnel facilities tripling while new toll road investment fell to less than one-fifth of its 1951-1955 volume. 4/

Except for a brief resurgence in the late 1960s, the volume of new debt for toll facility construction has declined in the last 20 years. In addition to the construction of an extensive network of federally supported nontoll routes, historically high interest rates and rising construction and right-of-way costs have contributed to this decline. The volume of new toll bonds dropped from more than $5.7 billion in the 1966-1970 period to just above $1 billion between 1976 and 1980. Only about $1.2 billion in new debt was sold in the 1981-1984 period. Since 1975, toll roads have accounted for less than half the new toll debt issued. The volume of refunding issues has risen, however, with some of the $2.9 billion in refinancings since 1970 dedicated to extension and improvement of existing toll systems.

Trends in the Types of Financings

As in the case of most municipal bonds, the toll facility bond issuer's pledge to pay interest and repay principal is generally made under one of two approaches:

- o *General obligation bonds* pledge the unlimited taxing power and the full faith and credit of the state or other general-purpose government, while

---

4. Toll bridges and tunnels have been less affected by the 1956 Act because federal law permits the participation of federal funds in toll bridges, toll tunnels, and their approaches on the federal highway network.

- *Revenue bonds* have as their underlying security a pledge of user fee or lessee revenues generated by the actual facility to be developed.

Potential investors usually consider general obligation bonds the most secure type of obligation that can be used to finance construction of a toll facility. General obligation bonds are issued only by states and other general-purpose governments; most states limit the amount of general obligation debt that a municipality may issue to a specified fraction of the taxable value of all property within its jurisdiction. In addition, many states require voters' approval before issuing general obligation debt. In contrast, the volume of debt issued through revenue bonds is not included in the amount of total indebtedness subject to state debt limits, and voters' approval is usually not required. Revenue bonds typically have higher interest costs than general obligation bonds, because they are not backed by the full faith, credit, or taxing power of a governmental unit, and because the receipts from user charges are subject to greater uncertainty than are tax revenues.

In recent years, with increasing financial pressure on local governments to reserve general obligation funding for non-revenue-producing facilities, there has been a dramatic increase in the use of tax-exempt revenue bond financing. In 1982, for example, revenue bonds accounted for 73 percent of all tax-exempt bond sales, as compared to 34 percent in 1970. By contrast, revenue bonds have dominated the toll facility bond market since the toll revival began in the mid-1900s. Of the 27 new toll bonds issued during the years 1951 through 1955, 24 were revenue bonds, and these represented 87 percent--$11.4 billion--of the $13.1 billion of new debt (in 1984 dollars) issued for toll facilities in that period. Overall, since 1950, revenue bonds have represented about three-quarters of all new toll financings, and about 80 percent of the total dollar volume of debt sold for toll facility construction. That revenue bond issues have so dominated toll financings reflects the underlying intent of most toll enterprises: they are planned to be self-supporting, and few states have been willing to embark on major toll projects that were not expected to earn revenues sufficient to cover the costs of their own construction.

In recent years, however, it has become increasingly difficult to finance major new toll projects solely with a pledge of project revenues. The investment climate has changed markedly since the days of the first major toll facility financings in the mid-1900s. Today, the feasibility of toll projects is tested in a market characterized by high interest rates, vigorous competition from an abundance of tax-exempt revenue bond issues, and escalating costs of project construction.[5] Texas's Dallas North Tollway, built in the mid-1960s, was the last major new toll road to be financed by conventional revenue bonds; another Texas Turnpike Authority project, the Houston Ship Channel Bridge, for which revenue bonds were sold in 1978, was the last major new toll bridge to be financed solely with its own project revenues.[6]

To reduce borrowing costs, recent toll financings have taken advantage of general obligation and special tax backing, such as a pledge of some portion of local property taxes or state motor fuel tax receipts. The Dulles Toll Road in northern Virginia was financed by a state-issued general obligation bond, based on a provision in Virginia's constitution permitting such backing for projects judged to be self-supporting. In Oklahoma, bond security for the Oklahoma Turnpike System is enhanced by a pledge of motor fuel excise taxes levied within the turnpike's service area. Two new toll roads in Houston, Texas, are being financed by a mix of revenue bonds and general obligation bonds backed by an unlimited tax pledge of Harris County. The unlimited tax backing means that the bonds can be issued with a higher rating, hence lower interest costs, than could otherwise be done.

The Competitiveness of Toll Facility Bonds

The performance of toll facilities in the municipal bond market can be weighed according to three conventional indicators of investment quality:

- *Bond ratings*--a simple system used by the major investor services to grade bonds on the basis of their investment quality,

- *Defaults*--the frequency with which toll facilities have defaulted on bond issues, and

---

5. See Daniel H. Harman, III, "The Outlook for Toll Facilities Financings," presented at the International Bridge, Tunnel and Turnpike Association 50th Annual Meeting, Montreal, Canada, September 1982; Norman H. Wuestefeld, "1983: Beyond the Nickel," *Transportation Quarterly*, Vol. 38, No. 1 (January 1984), pp. 5-14; and Daniel W. Greenbaum, "The Pennsylvania Toll Road Study: An Example of the New Look in Toll Road Financing," presented at the International Bridge, Tunnel and Turnpike Association Workshop, Houston, Texas, April 11, 1983.

6. Norman H. Wuestefeld, "1983: Beyond the Nickel," p. 11.

- *Interest costs*--the interest paid by issuers of toll facility bonds to attract investors, relative to what other public enterprises pay. 7/

Bond ratings. For the more than 45 toll facilities for which new bonds have been issued since 1950 and rated by Moody's Investors Service (including general obligation bonds used partly or wholly for toll facilities), about 95 percent of the more than 140 outstanding issues currently carry an "investment grade" rating. (See Table 12 for ratings of the toll facilities' most recent issues.) Of the five facilities that have received ratings below investment grade, four have defaulted on their bond issues; the fifth is the Houston Ship Channel Bridge, which has earned initial toll revenues well below original projections. 8/

Although most investors today have confidence in the toll industry, individual facilities' ratings show considerable variation, ranging from Aaa (best grade) to Caa (poor, generally indicating default). As shown in Table 12, toll road bonds generally have significantly better ratings today than do bonds issued for toll bridge and tunnel facilities. Toll road issues carry a higher percentage of best- and high-grade ratings (Aaa and Aa1/Aa) and a much lower percentage of ratings below the four investment-grade categories. Indeed, only one toll road has a non-investment-grade rating on outstanding issues, while four bridge and tunnel facilities currently bear ratings below investment grade. 9/

General obligation bonds issued to back toll facilities have won consistently high ratings, with none below the upper-medium grade (A1/A). For this type of security, ratings are determined primarily by the economic vigor of an entire state or local jurisdiction. Toll revenue bonds, by contrast, draw ratings according to the financial strength of the facility, as well as the economic vitality of the area it serves. The criteria major investor services use to rate these issues are central to the bonds' marketability.

---

7. Interest costs are not analyzed here because historical data on interest costs for toll facility bonds were not available at the time of writing.

8. In 1983, Moody's lowered its credit rating for the Houston Ship Channel Bridge from Conditional Baa to B. (See *Moody's Municipal Credit Report,* Texas Turnpike Authority--Houston Ship Channel Bridge, December 16, 1983.) Moody's is currently reviewing this rating.

9. The five facilities that currently have below-investment-grade ratings are the West Virginia Turnpike, the Calumet Skyway and the McKinley Toll Bridge in Illinois, the Houston Ship Channel Bridge in Texas, and the Chesapeake Bay Bridge-Tunnel in Virginia.

TABLE 12. TOLL FACILITIES' BOND RATINGS (AS REPORTED BY MOODY'S INVESTORS SERVICE), 1951-1984 (In percents)

	Toll Facilities by Category and Bond Type					
	Roads			Bridges and Tunnels		
Recent Moody's Rating	General Obligation (6 issues)	Revenue (22 issues)	All (31 issues) a/	General Obligation (1 issue)	Revenue (19 issues)	All (22 issues) a/
INVESTMENT-GRADE RATINGS						
Best Grade (Aaa)	50	4	29	0	5	5
High Grade (Aa1/Aa)	33	23	23	0	5	9
Upper Medium Grade (A1/A)	17	50	39	100	42	45
Medium Grade (Baa1/Baa)	0	9	6	0	16	14
NON-INVESTMENT-GRADE RATINGS						
Ba1/Ba	0	0	0	0	11	9
B1/B	0	0	0	0	5	5
Caa	0	5	3	0	16	14

SOURCE: Congressional Budget Office, adapted from data provided by Moody's Investors Service.

NOTE: Data reflect recent Moody's ratings of the latest issues of each bond type by all toll facilities represented (excluding refunding issues). Toll facilities that used 2 bond types in this period appear twice. When the most recent issues bear identical issue dates but different ratings, each rating is counted.

a. Includes lease rental, special obligation, and other special issues.

Credit analysts at the major investor services rate a toll facility revenue bond according to various factors, including the strength of traffic demand, the protection afforded by rate covenants and other security provisions in the bond resolution, and (for existing facilities) financial performance as measured by the indicators described above. [10] Because the history of toll financings has not been without blemish, potential investors seek strong assurances that a toll facility project will in fact be able to earn revenues sufficient to cover the costs of debt service. Credit analysts examine traffic and revenue projections for a given project, including such factors as the expected mix of passenger and commercial vehicles, the anticipated diversion of traffic to alternate nontoll routes, and the likelihood of seasonal variation or other shifts in use. In addition, a financing structure of sound design is considered essential to assure that the facility will be able to meet all debt service obligations on time.

Defaults. Another index of an industry's investment value is its history with regard to the number of defaults. On this measure, the toll facilities' record is mixed. Unlike the airport industry, which has never suffered a default, the toll industry has experienced defaults on bonds issued for four different facilities (six of a total of 170 bond issues). [11]

In general, these defaults occurred either because expected traffic volumes failed to materialize or because the opening of competing toll-free routes diverted significant volumes of traffic. From its early years, the West Virginia Turnpike, for example, has been plagued by problems because connecting highways to its north and south were not constructed as planned. As a result, the turnpike could not attract sufficient traffic to cover the high costs of road construction in a mountainous area. The West Virginia Turnpike Commission was in arrears on interest payments on its turnpike revenue bonds from 1958 through 1979. For many years, traffic also fell short of projected levels on the Chesapeake Bay Bridge-Tunnel; what traffic it did have showed strong seasonal fluctuation and tended to reflect weather

10. The *rate covenant* is the toll operator's promise to establish a schedule of toll charges for the use of the facility, and to adjust tolls as necessary so that total revenues will be sufficient to meet all obligations and produce a margin of safety--a cushion over and above what will be required to pay operating costs and debt service. The *bond resolution* establishes a number of special funds and accounts to facilitate management of bond proceeds and revenue. Today, most toll revenue bond issues require a Debt Service Reserve Fund equal to about one year's annual debt service.

11. The four toll facilities are the West Virginia Turnpike, the Chesapeake Bay Bridge-Tunnel from Norfolk to the Delmarva Peninsula, the Calumet Skyway in Chicago, and the McKinley Toll Bridge in Venice, Illinois. For analysis of the airport industry's performance in the bond market, see Congressional Budget Office, *Financing U.S. Airports in the 1980s*, Chapter IV.

conditions and movements of military personnel in the region. Significantly improved traffic, however, has recently brought the facility out of default. In the case of the McKinley Toll Bridge, the opening of two competing toll-free bridges underlies its default on "Series B" bonds, while the Chicago Skyway has suffered from shifting patterns of highway use stemming from the opening of several toll-free routes in the area. The Chicago bridge has also had problems with its financing structure: it lacks a Maintenance Reserve Fund, and heavy maintenance expenses have cut into interest coverage. 12/

While these defaults have drawn attention to the uncertainties associated with toll financing, the financial success of the great majority of toll projects undertaken since the mid-1900s has securely established the general creditworthiness of toll facility enterprises, and has helped assure their continuing competitiveness in the municipal bond market.

12. See Moody's *Municipal Credit Reports:* West Virginia Turnpike Commission, January 6, 1983; Chesapeake Bay Bridge and Tunnel Commission, Virginia, December 22, 1983; Venice, Illinois--McKinley Toll Bridge, August 25, 1980; and Chicago, Illinois--Chicago (Calumet) Skyway, May 13, 1983.

APPENDIX

THE PAVEMENT CONDITION OF TOLL AND NONTOLL SECTIONS OF THE INTERSTATE SYSTEM

One of the most widely used measures of how well a highway facility is maintained is the condition of its pavement, which is generally rated according to the Federal Highway Administration's five-point Serviceability Index (see Chapter II). To determine whether the pavement of tollways differs significantly from that of nontoll facilities, the Congressional Budget Office analyzed data on 1,084 nontoll and toll sample sections of the Interstate Highway System. The analysis used 1982 Highway Performance Monitoring System (HPMS) data furnished by the Federal Highway Administration. The results of the statistical (regression) analysis, summarized in Table A-1, indicate that pavement on tollways is generally appreciably better.

Specifically, the results show that, when other factors affecting pavement condition are held constant, the condition of toll sections of the Interstate system averages 17 percent better than that of the nontoll sections. Pavement condition was also found to be affected by age; the older the roadway surface, the more deteriorated its condition. Pavement condition was also found to worsen as the percentage of truck traffic using a facility in off-peak periods increases. The results did not, however, show a statistically significant relationship between pavement condition and climate, but difficulties in measuring variations in climate may well have influenced this result. Similarly, differences in location (rural *versus* urban) and in the volume of actual traffic relative to a road's design capacity did not have a statistically significant influence on pavement condition.

TABLE A-1. ORDINARY LEAST SQUARES REGRESSION ESTIMATES FOR DETERMINANTS OF HIGHWAY PAVEMENT CONDITION, CROSS-SECTION DATA, 1982

	Log Pavement Condition (Dependent Variable)
Constant	3.883 (42.425)
Toll Dummy (1 = toll)	0.157 (7.091)
Log Pavement Age	-0.103 (-5.230)
Volume/Capacity Ratio	-0.0003 (-0.913)
Percent Truck Traffic (offpeak use)	-0.005 (-4.792)
Climate Dummy (1 = cold & wet)	-0.016 (-0.217)
Rural/Urban Dummy (1 = urban)	-0.003 (-0.154)
R^2	0.0692
F Value	13.343

SOURCE: Congressional Budget Office.

NOTE: "T-statistics" are given in parentheses. Logs are natural logs.

405

CONGRESSIONAL BUDGET OFFICE
Second and D Streets, S.W.
Washington, D.C. 20515