## Targeting Federal Assistance

The fact that federal costs are set at fixed shares in most forms of infrastructure implies that national benefits are equal for every project within each mode. In reality, some projects offer greater national benefits than others. One way to improve the targeting of federal assistance would be to vary the share of federal costs according to the expected benefits of each project. This could be accomplished by negotiating the federal share on a project-by-project basis or by defining different shares for different subclasses of projects ("tranches"). The greatest drawback would be the administrative costs involved in conducting many negotiations. Negotiating aid could also make federal aid less stable over time, adding an element of risk to state and local investment planning.

Targeting could also be improved by restructuring programs so that benefits would go directly to the intended beneficiaries. For example, one purpose of urban mass transit is to provide mobility to poor people; this assistance could be furthered by issuing transportation vouchers rather than subsidizing all ridership on mass transit systems. On the other hand, when a program serves a number of purposes (for example, mass transit is also intended to promote urban economic development and reduce congestion and pollution), it may be more efficient to provide services rather than cash.

## Assigning More Responsibilities to State and Local Governments

State and local planners may be able to make better decisions than national authorities, given their proximity to local problems and conditions. This advantage will continue only so long as their decisions do not have a significant impact outside their jurisdictions. Where the benefits of infrastructure programs accrue predominantly outside a state's jurisdiction, the federal government may have to act in the interests of other states.

For programs aimed at creating strictly local benefits, state and local governments may be the appropriate level of decisionmaking. Some may argue that mass transit, for example, is not a national infrastructure problem, but a local one. The original intent of the federal mass transit program was to help municipalities assume responsi-

bility for bankrupt private systems. With that goal accomplished, additional transit investments arguably could be funded at the state and local levels. Similarly, state and local governments already finance all aspects of port development other than dredging. These services could be contracted from the private sector rather than provided on a subsidized basis by the Corps of Engineers.

Even when the benefits of infrastructure programs are primarily local, however, asking states and localities to take on greater financing responsibility might be inconsistent with the social goals of these programs (such as income redistribution or regional economic development). Moreover, increasing state control over infrastructure spending would tend to substitute state spending preferences for federal preferences.

## Fostering Greater Intermodal Competition

Investment in all classes of infrastructure could be improved by having federal grants foster competition among infrastructure programs for public and private resources. Among the approaches examined here are:

- Allowing states to trade in some portion of their categorical grants in any one account for funds in another account, perhaps on less than a dollar-for-dollar basis.

- Merging the major parts of all infrastructure programs into one broad-purpose "public infrastructure" block grant.

- Creating a national infrastructure financing facility that could perform a range of roles, from formal screening of all large-scale federal projects to financing large facilities on a project-by-project basis.

All of these options would seek to tailor federal infrastructure spending more closely to local conditions. They would give more weight to local interests in allocating funds among infrastructure programs. Most of them would accomplish this by giving states and localities greater flexibility in apportioning funds among infrastructure categories. Easing conditions on the use of federal funds

implicitly assumes either that the national benefits of all infrastructure programs are equal or, more likely, that federal interests can be better pursued by allowing greater variation in the response to local infrastructure problems.

Another argument in favor of greater state and local control is that categorical programs no longer need to be as narrowly defined as they formerly were. Nearly all categorical grant programs for infrastructure were originally designed to create national systems and to marshal state involvement. In large measure, both of these goals have been achieved. Moreover, as capital markets have become more diverse and borrowers more sophisticated, a broader set of projects can now be funded locally.

To be effective, however, these options would require reorganizing the federal and state infrastructure bureaucracies, which have been designed to evaluate only projects within particular infrastructure categories. At the extreme, of course, merging all programs into a single infrastructure system might deny the legitimate differences among modes or overlook the fact that some level of investment in each is a stipulated national goal regardless of economic merit.

Finally, many of the benefits of greater competition for resources among the infrastructure modes could be achieved by requiring federal program managers to present more explicit statements of goals, to make more frequent evaluations of past projects, and to use common standards in measuring such variables as the cost of accidents, the value of health improvements, the value of time lost to delay, or the discount rate. Under the current budgeting system, agencies are allowed to plan programs on the basis of the current level of services offered. But circumstances change, as do rates of return and the degree to which agency missions have been accomplished. Requiring agencies to prepare more detailed "sector plans" that took explicit account of the returns on their proposed investments would allow the Congress to make decisions among alternative programs and thus improve the allocation of national resources devoted to infrastructure.

CHAPTER I

# HIGHWAYS

The national highway system is in place. Federal leadership during "the Interstate era" helped to double the capacity of the national road system. During the 1990s, the traditional federal role of shouldering most of the risks, as well as the costs, of highway development may no longer be necessary in view of the high economic benefits now apparent in sound highway maintenance and investment policies. Federal policies need to change their focus from constructing a highway system to keeping roads in good order and the costs of road transport low. One alternative would be to withdraw federal assistance. Another would be to concentrate on encouraging states and localities to undertake projects with the greatest economic benefits.

## THE CHANGING FEDERAL ROLE

Federal interest in developing a national highway system dates from early in the automobile age. Financial support was first provided to the states by the 1916 Rural Post Roads Act, which authorized federal grants to pay for up to half the costs of constructing rural roads used to deliver the mails. At that time only about one-tenth of the roads were paved, and only about 4 million automobiles were registered--about one for every 30 people.

The 1916 act set out some broad principles that have persisted. A large share of highway development costs was to be borne by the federal government, but the ownership, management, and maintenance of highway networks would remain with the states. Federal highway spending was authorized for multiyear programs in order to support multiyear construction, and federal engineering and other criteria were established for the projects eligible for aid. The aid was to be apportioned among the states according to formulas based on area, population, and other broad factors.

At first, federal highway programs were financed from general revenues. The states were the first to adopt user taxes for highways: as early as 1916, some $26 million of the $87 million in state highway spending came from this source. In 1932 the federal government followed the states in imposing a tax on gasoline fuels, and although the revenue was not formally earmarked for highway programs until 1956, spending and gasoline tax revenues tracked closely in following years. After the Highway Trust Fund was set up in 1956, user financing became a basic principle of the federal highway program.

Changes in the program since the early days have, for the most part, altered the yardsticks for granting aid, or the amounts available, but not the underlying federal and state roles. Even the Federal Aid Highways Act of 1956 adhered to these broad principles in setting up the national plan to construct the Interstate system and its complementary main road networks. Program changes in the 1982-1984 period raised the level of federal financing and taxes, and apportioned the burden of taxes more in line with the costs different users impose, but left unchanged the responsibilities of federal and state highway departments in managing the national highway system.

Two significant federal incursions into highway management and operations occurred in the early 1970s. First, following earlier studies and legislation, the 1966-1970 period saw a host of new laws covering vehicle standards, traffic operations, and highway design that firmly established a federal interest in safe highway operations. Second, about the same time, the federal programs were broadened to cover major highway maintenance. A program of federal aid for bridge rehabilitation was authorized in 1970 (under highway safety legislation), and federal funds were made available for so-called "3R projects" (restoration, resurfacing, or rehabilitation) on federal-aid highways beginning in 1974. By and large, this expanded federal role was paid for out of reduced spending on construction elements of the federal program and by additional spending from federal funds.

Current law continues these themes. The Surface Transportation and Uniform Relocation Assistance Act of 1987 reauthorized the federal-aid highway program much as it had been throughout the 1980s, and extended authorization for completing the Interstate highway system through 1993. Table 1 describes the current program. Federal

## TABLE 1. FEDERAL PROGRAMS FOR HIGHWAYS, 1987-1992

| Program | Budget Authority 1987-1992 (Billions of current dollars) |
|---|---|
| **Highway Trust Fund** | |
| Federal Highway Administration | |
| Interstate construction | 17.0 |
| Interstate restoration, resurfacing, rehabilitation, and reconstruction | 14.1 |
| Interstate substitute projects | 3.7 |
| Primary system | 11.6 |
| Primary minimum[a] | 0.3 |
| Secondary system | 3.0 |
| Urban system | 3.8 |
| Indian reservations | 0.4 |
| Forest highways | 0.3 |
| Public lands highways | 0.2 |
| Park roads and parkways | 0.3 |
| Minimum allocation[a] | 4.1 |
| Emergency relief | 0.6 |
| Bridge replacement and rehabilitation | 8.2 |
| Hazard elimination | 0.9 |
| Railroad-highway crossings | 0.8 |
| Demonstration projects and studies | 0.9 |
| Highway-related safety grants | 0.1 |
| Highway safety R&D | 0.1 |
| Subtotal, FHWA | 70.0 |
| National Highway Traffic Safety Administration | |
| Highway traffic safety | 0.7 |
| Operations and research | 0.2 |
| Subtotal, NHTSA | 0.9 |
| Total, Highway Trust Fund | 70.9 |
| **Federal Funds** | |
| Railroad-Highway Crossings | 0.1 |
| Waste Isolation Pilot Project | 0.1 |
| Total, Federal Funds | 0.1 |
| Total, 1987 Act | 71.0 |

SOURCE: Congressional Budget Office, based on the Surface Transportation and Uniform Relocation Assistance Act of 1987.

a. The Act authorizes such sums as may be necessary. Estimates are based on information provided by FHWA.

spending for operations and maintenance covering research, safety, and 4R work--is now just over 40 percent of all federal aid.[1] Moreover, the federal interest in operational issues extends even farther, through federal priorities favoring projects that incorporate safety-effective design features and through federal studies of operations and maintenance problems.

## ACHIEVEMENTS OF THE HIGHWAY PROGRAM

Both the short-term and long-term goals of the federal government in the highway sector have been mostly achieved. The Interstate system is virtually finished; the rehabilitation work needed is well in hand. But increasingly the highways are not financed by taxes on highway users, and the priorities set for capital spending are often unrelated to the merits of the investment projects.

An assessment of the achievements of the national highway program involves two questions:

- Is the system complete? The basic objectives of highway development set out in 1956 were to provide users in all regions with access to trade and travel opportunities through the highway network.

- Does highway transportation cost the right amount? Are highways maintained so as to minimize the overall costs of highway transportation, and do highway users pay for the damage they do to roads and for the other costs they impose on the system?

### System Development

The goal set out in 1956--to develop a national highway network based on Interstate, Primary, and Secondary highway systems--has largely been attained. In the 70 years of federal highway financing, the

1. The fourth R, reconstruction, was added in 1982.

overall length of the highways has changed little, from 3 million miles to just under 4 million. But access to highways in this country (measured as route miles per capita) stands at about three times the level in Japan and Britain and one and one-half times that in the much more densely settled countries of Europe. Outlays in this century to improve the quality of roads--principally by paving them and by constructing multilane limited access routes--have totaled $1 trillion (in 1982 dollars), and 40 percent of this has come from federal budgets. These outlays have about doubled the capacity of the highway system, thereby further increasing the availability of highway transportation services.

The capacity of the existing major network is broadly sufficient for its traffic. Nationally, 85 percent of rural highway capacity is unused and the main urban networks are only 40 percent used on average. But 45 percent of urban interstates and one-third of other main urban arterial highways have use rates above 70 percent.[2] These high levels of urban traffic congestion are found primarily in the systems of only nine states--Alabama, California, Connecticut, Georgia, Massachusetts, New Jersey, New York, Pennsylvania, and Texas.

Highway managers are demonstrating diminishing interest in construction projects. Beginning in 1970, federal policies permitted or encouraged trade-ins from highway construction in urban areas to transit projects, and also allowed federal aid to be transferred among highway systems (though not between urban and rural apportionments).[3] Under the Interstate withdrawals program of 1973-1984, for example, states traded in or withdrew from construction some 343 miles of planned Interstate highways, leaving only 940 miles in remaining gaps on the designated system. Since 1976, over $6 billion has been transferred from Interstate construction to transit projects.

Finally, the system has been able to assimilate innovations in highway technology that lower the cost of transport. The national truck network covers 181,000 miles of Interstate and Primary highways and can carry the largest double trailer trucks between the largest road freight centers without requiring major reconstruction. The

2. Federal Highway Administration, *Highway Statistics 1986* (1987), Table HM-61.

3. Federal Aid Highway Acts of 1970 (P.L. 91-605) and 1973 (P.L. 93-87).

structural adequacy of the highway system to cope with developments in trucking technology is not seriously questioned.

## Highway Transport Costs

There are two indications that national highway spending could be reallocated in ways that would lower transportation costs. First, much of the federal highway maintenance budget is spent where it is little needed and has relatively little effect on reducing highway transportation costs. Second, dedicated highway taxes are not high enough to cover all of the maintenance spending, and truckers in particular underpay for the damage they cause to roads.

Returns on Highway Maintenance. Federal Highway Administration (FHWA) data show a broad improvement in highway pavement conditions since 1983 (see Figure 1). This reversed a general slump in pavement ratings after 1981. Most of the Interstate network has been restored to generally better condition than in the mid-1970s, while all other parts of the network are at least slightly better than in 1975. Moreover, the urban Interstates, by far the busiest sectors (measured in millions of vehicle miles of travel per year), are generally in better shape than other systems, which was not the case in 1983.[4]

Such broad improvements in the condition of highways translate directly into lower costs for highway transport. The Federal Highway Administration estimates that reductions in vehicle operating costs have been as much as 3 percent to 5 percent on urban Interstates and freeways, and just under 2 percent overall.[5] Nationally, this means that the $652 billion outlay for highway transportation in 1986 ($216 billion for freight, and $436 billion for passenger travel) would have been $7 billion to $8 billion higher without the improvement in highway pavements. If the time savings from faster journeys are valued at around $5 billion a year, the return on highway rehabilitation in 1984 and 1985 was 43 percent (see Table 2).

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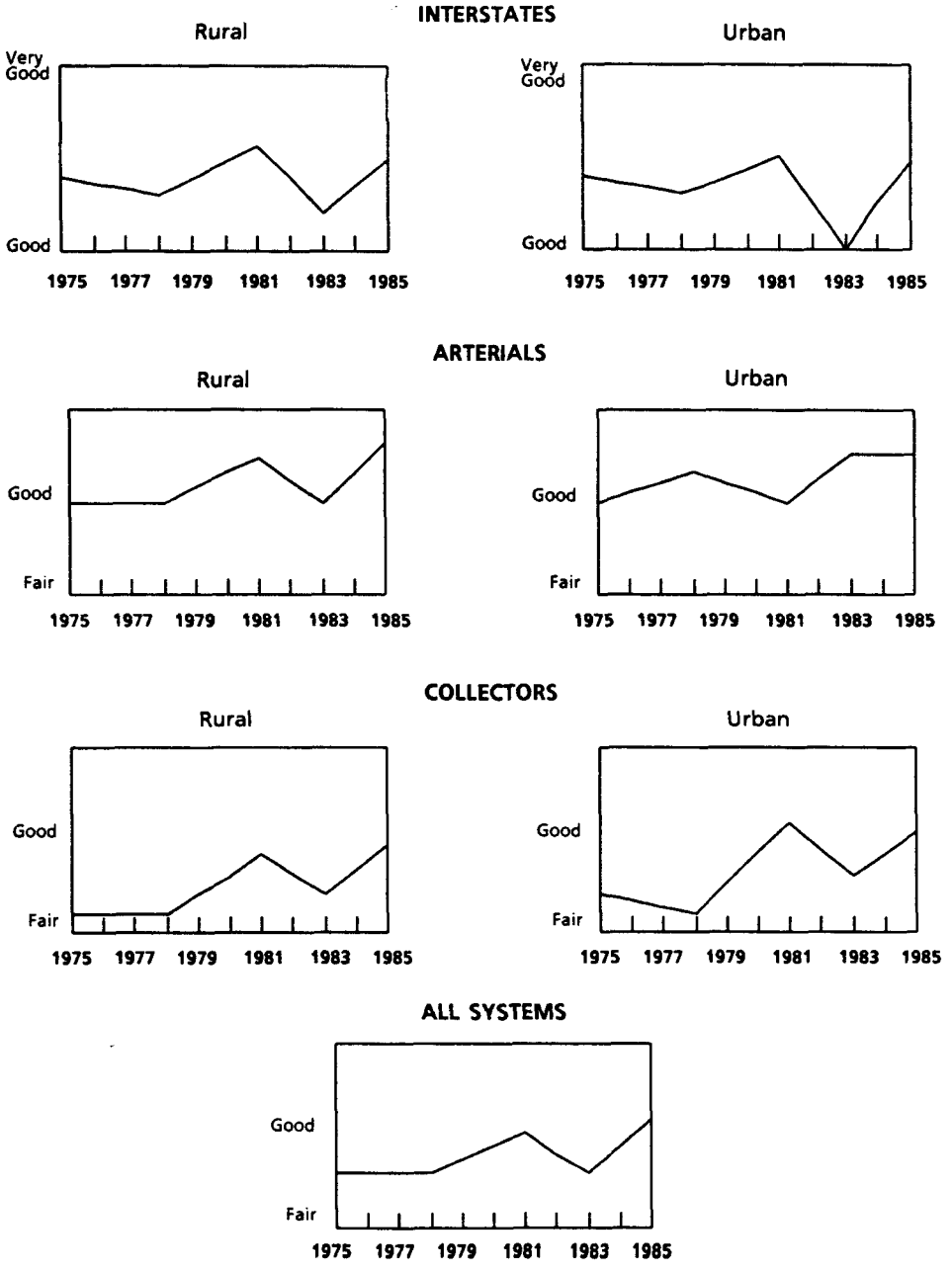
4. The data do not cover local roads, but they include 360,000 miles of mostly minor collector roads as well as the federal-aid network. Hence, they are representative of the most used portions of the national network.

5. Federal Highway Administration, *The Status of the Nation's Highways: Conditions and Performance*, Report of the Secretary of Transportation to the United States Congress (June 1987).

Figure 1.
Changes in Average Highway Pavement Conditions, 1975-1985




SOURCE: Federal Highway Administration.

Such returns on investment reflect real reductions in the costs of doing business in any community. Thus they measure increases in personal and business income that become available, as a result of highway projects, for financing investment and consumption purchases generally. The lower costs of transportation may also open up new business opportunities. But these increases in income are obtained from tax spending that, in the absence of a highway program, could also be used for general consumption and investment purposes, or for attracting new businesses to a community. To benefit from highway spending, the repayment in terms of reduced transportation costs should afford at least as good a return as if the same amounts had been spent for other purposes.

TABLE 2. INVESTMENT AND RETURNS ON HIGHWAY MAINTENANCE, 1984-1985 (In billions of 1986 dollars)

| Highway System | Vehicle Miles of Travel (Billions) | Capital Maintenance Cost, 1984-1985[a] | User Cost of Travel, 1985[b] | Percent Return on Investment[c] |
|---|---|---|---|---|
| **Rural Systems** | | | | |
| Interstates | 154.1 | 3.4 | 72.8 | -4 |
| Other Principal Arterials | 145.9 | 3.4 | 71.1 | 16 |
| Minor Arterials | 136.9 | 3.3 | 68.1 | 28 |
| Major Collectors | 163.2 | 2.3 | 90.5 | 7 |
| Minor Collectors | 43.3 | 0.8 | 27.0 | 57 |
| All Rural Systems | 643.4 | 13.1 | 329.4 | 16 |
| **Urban Systems** | | | | |
| Interstates | 216.4 | 4.5 | 91.4 | 31 |
| Other Freeways and Expressways | 97.4 | 1.1 | 41.4 | 117 |
| Other Principal Arterials | 279.0 | 2.5 | 203.9 | 136 |
| Minor Arterials | 201.7 | 1.4 | 147.2 | 50 |
| Collectors | 89.5 | 0.6 | 65.0 | 130 |
| All Urban Systems | 884.1 | 10.0 | 548.8 | 75 |
| All Systems | 1,527.5 | 23.1 | 878.3 | 43 |

SOURCE: Congressional Budget Office, based on data from the Federal Highway Administration.

a. Includes capital disbursements for reconstruction, major widening, 3R (restoration, resurfacing, or rehabilitation), bridge rehabilitation and replacement, safety construction, and other rehabilitation. Thus it includes all capital disbursements except those for new construction.

b. Includes costs for vehicle operation, accidents, and property damage, as well as estimates for the costs of time spent during travel.

c. Based on a 10-year life for the rehabilitation and reconstruction projects.

As can be seen from Table 2, the rates of return on highway maintenance varied considerably among the different highways, and, in the case of rural Interstates, the returns were negative. Capital maintenance generally yields a much greater return on urban highway systems than on rural systems--75 percent compared with 16 percent--although returns for rural minor arterials and collectors (roads linking the main county centers to arterial highways) compare favorably with those on urban roads. The negative returns for the rural Interstates, and relatively low returns for other rural principal arterial roads, are explained by the very high costs for engineering work on them and the excess capacity available on these routes. While together accounting for only 17 percent of the rural federal-aid system mileage, and 12 percent of rural highway traffic, these main intercity highways receive half of the national rehabilitation budget for rural highways. In other words, more spending by counties and less by states for rural highway rehabilitation would increase the total payoff from highway spending.

Who Pays? Another issue in highway maintenance costs is whether users pay their fair share. In general, they do not. First, federal taxes undercharge heavy trucks for the damage they do to roads. Second, general revenues are increasingly being used to finance highway spending in place of taxes on highway users. Both of these underpayments are incentives to increased use of the roads, adding to public maintenance budgets and to operating costs for road users in general.

Fuel and other highway taxes are easy to collect--even very high rates for these taxes, as in Europe, seem to affect traffic levels very little--and the amount to be paid varies roughly with distance traveled, so that those who use highways the most pay more. But payments based on use do not vary closely with pavement damage. Road damage increases exponentially with the weight per axle of a vehicle. Given the mix of truck configurations in use, this means that the road damage caused by the largest trucks can be as high as 16 times that from smaller trucks, although the federal taxes levied range only up to six times higher. This means that all trucks above about 65,000 registered gross tons underpay. In 1982 and 1984, truck taxes were realigned to increase payments from heavy truck users, but the recovery rate for combination trucks remains at around three-quarters of the cost of the highway damage they cause. By the same token, some smaller vehicles overpay compared with the costs of their

road damage, while arithmetically, of course, all user groups other than heavy trucks must overpay slightly in relation to their fair shares of the tax burden.

Since 1984, the FHWA has been studying weight-distance taxes that combine a weight-based fee with measures of highway use. Its report, due in 1988, is expected to show that weight-distance taxes for trucks would be administratively feasible at reasonable cost, and a great deal fairer than the current mix of taxes.[6] Eleven states have weight-distance taxes: Arizona, Arkansas, Colorado, Idaho, Kentucky, New York, New Mexico, Nevada, Ohio, Oregon, and Wyoming.

Another source of highway funding is general revenues. Cumulatively, since 1957, the highway account has collected $191 billion in taxes and disbursed $195 billion for highway programs. But an additional $3.2 billion has been spent from general revenues on other highway programs, 70 percent of it in the 1980s.

The importance of highway spending outside the trust fund can be seen in Table 3. Had all federal highway spending since 1957 been charged to the Highway Trust Fund, its cash balance, which has remained at around $9 billion to $10 billion during the 1980s, would have been only slightly more than $1 billion at the beginning of 1988. At current levels of spending, the fund itself would require added revenue by 1990.

The importance of general tax sources becomes even greater when the activities of state and local governments are taken into account. Federal Highway Administration data show that in 1957, tax collections from highway users totaled $6.5 billion, or 73 percent of the $8.8 billion spent on highways by all levels of government; in 1987, these dedicated taxes covered only 65 percent of national highway budgets. State and local governments have been paying the difference out of their general funds. If the highway account were accumulating cash, this would represent a subsidy from state and local taxpayers to the federal government, rather than an excess of payments by highway users.

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6. Federal Highway Administration, *Feasibility of a National Weight-Distance Tax* (forthcoming).

## THE OUTLOOK

In coming years, the national highway system will face a growing need for rehabilitation programs, but a much reduced need for new construction. New highways will be largely confined to rapidly devel-

TABLE 3. ALTERNATIVE ESTIMATES OF FEDERAL HIGHWAY TAXES AND SPENDING (In billions of dollars)

| | | Actual Trust Fund | | | Trust Fund and Other Federal Highway Programs | | | |
|---|---|---|---|---|---|---|---|---|
| Fiscal Year | User Taxes | Highway Trust Fund Outlays | Interest (Actual) | Balance (Actual) | Federal Fund Outlays | All Outlays | Interest (Reesti-mate) | Balance (Reesti-mate)[a] |
| | | | | **Actual** | | | | |
| 1957-1959 | 5.6 | 5.1 | [b] | 0.5 | 0.6 | 5.7 | [b] | (0.1) |
| 1960-1969 | 36.1 | 35.3 | 0.2 | 1.5 | 0.1 | 35.4 | [b] | 0.7 |
| 1970-1979 | 62.2 | 55.6 | 4.5 | 12.6 | 0.3 | 56.9 | 3.7 | 10.6 |
| 1980 | 6.6 | 9.2 | 1.0 | 11.0 | 0.3 | 9.5 | 0.8 | 8.6 |
| 1981 | 6.3 | 9.2 | 1.1 | 9.3 | 0.2 | 9.4 | 0.8 | 6.3 |
| 1982 | 6.7 | 8.0 | 1.1 | 9.0 | 0.2 | 8.2 | 0.7 | 5.5 |
| 1983 | 7.8 | 8.8 | 1.1 | 9.1 | 0.3 | 9.1 | 0.6 | 4.8 |
| 1984 | 10.5 | 10.4 | 1.0 | 10.2 | 0.4 | 10.8 | 0.5 | 5.1 |
| 1985 | 11.6 | 12.8 | 1.3 | 10.4 | 0.3 | 13.1 | 0.6 | 4.2 |
| 1986 | 12.3 | 14.2 | 1.1 | 9.5 | 0.2 | 14.4 | 0.3 | 2.4 |
| 1987 | 11.8 | 12.8 | 0.9 | 9.4 | 0.2 | 13.0 | 0.2 | 1.4 |
| 1988 (est.) | 13.0 | 13.5 | 0.8 | 9.8 | 0.2 | 13.6 | 0.1 | 0.9 |
| 1980-1988 | 86.6 | 98.9 | 9.5 | 9.8 | 2.3 | 101.1 | 4.7 | 0.9 |
| 1957-1988 | 190.6 | 194.9 | 14.1 | 9.8 | 3.2 | 198.1 | 8.4 | 0.9 |
| | | | | **Projected** | | | | |
| 1989 | 13.2 | 13.5 | 0.9 | 10.4 | 0.2 | 13.7 | 0.1 | 0.4 |
| 1990 | 13.3 | 13.9 | 0.9 | 10.7 | 0.2 | 14.1 | [b] | (0.3) |
| 1991 | 13.6 | 14.5 | 0.9 | 10.6 | 0.2 | 14.7 | 0.0 | (1.4) |
| 1992 | 13.8 | 14.8 | 0.8 | 10.5 | 0.2 | 15.0 | 0.0 | (2.5) |
| 1993 | 14.0 | 15.3 | 0.8 | 10.0 | 0.2 | 15.4 | 0.0 | (4.0) |
| 1989-1993 | 67.9 | 72.0 | 4.3 | 10.0 | 0.8 | 72.8 | 0.1 | (4.0) |

SOURCE: Congressional Budget Office, based on budget data and data from the Federal Highway Administration.

a. Balances in parentheses are negative. In practice, trust fund accounting would require additional revenue (from taxes or transfers of federal funds) or spending cuts to avoid negative balances.

b. Less than $50 million.

oping regions, or to those areas with severe urban traffic congestion. The growing rehabilitation needs will spring from the ordinary capital cycles of highways, and the increasing age of the network. Overall spending for highways, and the mix of construction and rehabilitation, will vary considerably among regions.

The rising rehabilitation needs do not indicate a lack of routine highway maintenance in the past. A 1986 CBO study found that in the early 1980s well over 80 percent of federal-aid mileage was in fair condition or better; a figure of just under 50 percent would have been expected for highways of similar age receiving only routine maintenance.[7] Since then, highway conditions have improved on the whole. But highways tend to remain in near-new condition for much of their useful lives and then to deteriorate rapidly from the cumulative effects of age and traffic damage. Major maintenance--4R work--tends to follow the same lumpy pattern as construction, with a 15- to 20-year lag. Current spending levels do not reflect the prospective changes in highway conditions, and hence offer no guidance for future spending.

## Maintenance Strategies

The question of how much to spend on highways has many answers. Taking maintenance first, the Federal Highway Administration's 1987 report discusses strategies ranging from a continuation of current spending, costing around $12 billion to $13 billion a year in 1985 prices, to a program for fixing all deficiencies that would cost $33 billion to $36 billion a year.[8] Any of these strategies would provide a high rate of return on investment (in terms of user cost savings, as discussed earlier). But the estimated rates of return decline as investment increases. Table 4 shows estimated rates of return on each of five maintenance strategies, and the incremental returns for increasing spending levels. These estimates indicate that national economic benefits from highway maintenance could be increased by raising highway budgets above current levels and improving all highways to minimum standards. At the extreme, however, the extra cost of fixing

7. Congressional Budget Office, *Federal Policies for Infrastructure Management* (June 1986).

8. Federal Highway Administration, *Status of the Nation's Highways.*

all engineering deficiencies in highways would exceed the consequent reductions in transportation costs.

These results follow from the patterns of the incremental returns to investment. First, maintaining real 1985 spending rates of just over $13 billion a year through the year 2000 (nationally, on all 4R projects) would clearly be a good investment. The spending, which would cumulate (after allowing for traffic growth) to $250 billion to $264 billion over the 16-year period, would reduce transport costs by an estimated $255 per thousand vehicle miles of travel; this reduction would provide a 39 percent return on the investment, which is comparable with the returns measured earlier for actual 4R spending during 1984 and 1985. Expanding spending to maintain current highway conditions would also provide high returns: additional transportation savings of $61 per thousand vehicle miles of travel or an incremental return of 33 percent to 40 percent, depending on traffic growth rates.

A glance at the next two strategies--maintaining current user costs or achieving minimum standards--shows the importance of targeting. Both would require similar expansions of investment from the "maintain current condition" strategy--that is, they would require extra spending of about $9 billion to $11 billion a year, cumulating over 16 years to outlays of $450 billion to $550 billion. Even if current highway conditions are maintained, transportation costs are still expected to rise above current levels--because of congestion, for example. But extra spending focused on maintaining current user costs (that is, on those improvements that would actually restore transportation costs to current levels) would provide a poor return of only 1 percent, while directing the spending to upgrading substandard segments to minimum standards (which would reduce costs below current levels) would provide a return in the range of 3 percent to 7 percent on the investment. While the latter return would be less than the spectacular returns of the first two strategies, it would exceed the expected federal cost of borrowing (adjusted for inflation).

The difference in returns from the latter two strategies can easily be explained: spending to maintain current user costs would direct extra spending to improving relatively good stretches of road, while not touching the substandard segments that do not meet current

TABLE 4. PROSPECTIVE RETURNS ON INVESTMENT FOR FIVE HIGHWAY MAINTENANCE STRATEGIES, UNDER LOW AND HIGH TRAFFIC GROWTH (Using 1985 prices)

| Maintenance Strategy | Investment Cost, 1985-2000 (In billions of dollars)[a] Cumulative | Per Year | User Savings Per 1,000 Vehicle Miles[b] | Return on Investment (Percent) |
|---|---|---|---|---|
| **Low Traffic Growth** (2.15 percent growth a year in vehicle miles) | | | | |
| Maintain Current Spending | 250 | 13 | 255 | 38 |
| Maintain Current Highway Conditions | 279 | 15 | 316 | 38 |
| Maintain Current User Cost Levels | 446 | 24 | 344 | 30 |
| Achieve Minimum Standards | 497 | 26 | 357 | 28 |
| Fix All Deficiencies | 617 | 33 | 360 | 25 |
| **High Traffic Growth** (2.85 percent growth a year in vehicle miles) | | | | |
| Maintain Current Spending | 264 | 13 | 255 | 39 |
| Maintain Current Highway Conditions | 315 | 16 | 316 | 38 |
| Maintain Current User Cost Levels | 498 | 25 | 355 | 30 |
| Achieve Minimum Standards | 546 | 27 | 365 | 29 |
| Fix All Deficiencies | 708 | 36 | 370 | 25 |

SOURCE: Congressional Budget Office, based on data in Federal Highway Administration, *The Status of the Nation's Highways: Conditions and Performance* (June 1987).

a. Investment costs are assumed to increase in proportion to traffic growth, under each strategy. The per year costs shown are for 1985, the first year of investment under each strategy.

(Continued)

standards; spending to achieve minimum standards, on the other hand, would direct the extra resources to improving conditions on those high-cost segments that do not meet current standards. In addition, as shown in a study by the Transportation Research Board, incorporating safety improvements in 3R projects in rural high-traffic areas can have a high payoff in reduced accident rates and reduced severity of accidents.[9]

9. Transportation Research Board, *Designing Safer Roads, Practices for Resurfacing, Restoration and Rehabilitation*, Special Report 214 (Washington, D.C.: The Board, 1987).

TABLE 4. Continued

| Maintenance Strategy | Incremental Investment and Savings Above Previous Strategy: Investment Per Year | Incremental Investment and Savings Above Previous Strategy: User Savings Per 1,000 Vehicle Miles | Incremental Return for Increasing Investment (Percent) |
|---|---|---|---|
| **Low Traffic Growth** (2.15 percent growth a year in vehicle miles) | | | |
| Maintain Current Spending | 13 | 255 | 38 |
| Maintain Current Highway Conditions | 2 | 61 | 40 |
| Maintain Current User Cost Levels | 9 | 28 | 1 |
| Achieve Minimum Standards | 11 [c] | 41 [c] | 3 |
| Fix All Deficiencies | 7 | 3 | -4 |
| **High Traffic Growth** (2.85 percent growth a year in vehicle miles) | | | |
| Maintain Current Spending | 13 | 255 | 39 |
| Maintain Current Highway Conditions | 3 | 61 | 33 |
| Maintain Current User Cost Levels | 9 | 39 | 1 |
| Achieve Minimum Standards | 11 [c] | 49 [c] | 7 |
| Fix All Deficiencies | 9 | 5 | -80 |

b. Savings in this column show savings in 2000 when compared with the trend in transport costs that would follow from deteriorating road conditions under a "No Maintenance" strategy.

c. Incremental investment and transport cost savings for this strategy are measured from the "Maintain Current Conditions" strategy, and not from "Maintain Current User Cost Levels."

Finally, extending investment further by the extra $7 billion to $9 billion a year needed to fix all deficiencies would have a negative return--that is, the benefits for users would be less than the costs of the improvements.

## Building New Highways

Returns to new construction can be expected to show similarly variable results. A previous CBO report estimated that closing the gaps in the Interstate system would yield returns of 5 percent or less on over

40 percent of the projects (measured by cost), but would be well over 12 percent for nearly 35 percent of the projects, as of 1984.[10] Similarly detailed estimates cannot be made for other highway systems without a list of candidate projects. In general, prospective returns on new construction in urban areas, particularly on projects to relieve existing traffic congestion, can be expected to be higher than on those providing new intercity connections to the Interstate network, simply because of differences in unused road capacity in the two cases.

Returns on construction projects in general (which benefit relatively little traffic) can be expected to be lower than returns on the "maintain current conditions" maintenance strategy (which benefits all highway users).[11] A broad estimate for capacity-related improvements in urban areas, for example, shows expected returns on investment of around 9 percent to 15 percent, compared with the 40 percent estimate for maintaining current conditions. In determining priorities for overcoming urban traffic congestion, however, other alternatives should be compared with highway construction--such as transit development or land use adjustments, or noninvestment solutions including traffic management, opening bus lanes to all high-occupancy vehicles, and road pricing through tolls.

Construction of new urban highways may often be the only practicable solution to mounting urban traffic congestion because of difficulties in working out a consensus among the different jurisdictions in an urban area as to an alternative strategy that would reduce traffic bottlenecks without new highway construction. Road pricing, for example, though in theory a promising method of managing urban road capacity, has been successful in only one case--in Singapore.[12] Experiments sponsored by the Urban Mass Transportation Administration during the late 1970s sought to replicate the Singapore scheme in Berkeley, Honolulu, and Madison, but the attempts were aborted by political and institutional difficulties. A more comprehensive road-pricing system for Hong Kong, using transponders fitted

10. Congressional Budget Office, *Federal Policies for Infrastructure Management.*

11. On the other hand, some construction projects may offer higher returns than the additional spending needed to achieve minimum standards on all federal-aid highway segments.

12. A comprehensive review of road pricing experience and research is given in Kenneth Button, ed., "Road Pricing," *Transportation Research*, Special Issue, vol. 20A, no. 2 (March 1986).