Chapter 2

Where We Go From Here: Program Goals, Structure, and Funding

Addressing the issues outlined in chapter 1 will not be easy, and will require vision, difficult political compromises, restructuring of established program funding and institutional relationships, and, in all likelihood, some changes in lifestyles. However, unless we deal with the problems now, Americans will bear the costs of inefficient and unproductive transportation--through traffic delays, unhealthy air quality, inadequate access to transportation services especially in rural areas, higher prices, and a lower standard of living. Reauthorization of surface transportation legislation offers Congress the chance to shape a new program aimed at maintaining structurally sound, safe transportation networks and developing an efficient intermodal system that promotes a vigorous economy and an improved quality of life.

Although many agree that Federal surface transportation legislation needs revamping, opinions differ on program goals and structure. The Administration led off the legislative process in February with its proposed 1991 Surface Transportation Assistance Act (subsequently referred to as 1991 STAA), introduced as S. 610 and H.R. 1351. This proposed legislation substantially restructures the existing program and reduces the Federal share in almost all programs, although it maintains a highway focus and reemphasizes mass transit resources. Many transportation and environmental interest groups have also made recommendations.[1]

To help Congress sort through the numerous options and the tradeoffs associated with each, OTA developed four generic program models, A, B, C, and D, reflecting a spectrum of goals. Model A is the most similar to the existing program, while Model D represents fundamental changes in program structure. However, all models place higher priority on system preservation, operational improvements, and intermodal linkages than is currently given.

Three models assume a 5-year Federal spending level of $105.4 billion, which is the Administration's budget for highway and transit programs and within the agreed on budget ceiling; Model D proposes higher Federal spending. To illustrate how the policy goals of each model could be implemented through Federal spending, each model includes possible spending allocations for major programs. The intent is not to make recommendations, but rather to provide sample programs with components that can be mixed and matched and that serve as subjects for debate. Briefly summarized below, the models and their illustrative allocations of program funds are described more fully in boxes 2-A, 2-B, 2-C, and 2-D. Essential program components, such as land use and transportation planning, environmental concerns, safety, and research and development (R&D), that will be part of any reauthorization legislation, are presented later in this chapter.

GENERIC PROGRAM MODELS

Model A (see box 2-A) retains the current basic program categories and provides for a strong Federal role, preserving the present single mode (separate highway and mass transit programs) administrative structure. It emphasizes preserving the existing system by modifying project eligibility to fund highway reconstruction, maintenance, and repair. Funding for rural secondary programs is raised substantially. It also widens the funding eligibility of operational improvements, particularly those aimed at congestion relief. To address metropolitan area and urban problems, mass transit, urban highway, and bridge programs receive a higher funding priority than they do currently. *The tradeoffs of this model include: no increase*

[1] Proposals have been developed by the Surface Transportation Policy Project, the Coalition for Transit Now, the Campaign for New Transportation Alternatives, Federal Highways for the Future, the American Association of State Highway and Transportation Officials, and the American Public Transit Association. Most were released in Spring 1991.

Box 2-A--Model A Program Structure

Model A, based on the current structure, has six **major categorical programs.**

Interstate: Complete construction of the planned 43,000-mile system at current match; permit funding of maintenance and operational improvements; set Federal match at 65 percent for construction of new roads or capacity; 80 percent for reconstruction, repair, maintenance, and operational improvements; and 35 percent for toll facilities.

Primary: Retain major features of current program; permit funding for maintenance and operational improvements, including congestion relief; set Federal match at 60 percent for new construction, 35 percent for toll roads, and 75 percent for other program components; and initiate apportionment reform.

Secondary: Increase funding; retain major features of current program; permit funding for maintenance and operational improvement; set Federal match at 60 percent for new construction and 75 for other program components; and initiate apportionment reform.

Urban: Increase funding; retain major features of current program; permit funding for maintenance and operational improvements with priority to congestion relief strategies.

Bridge: Require bridge management program; reform bridge program apportionment; and increase program funding.

Transit: Retain major features of current program; emphasize capital replacement and increase funding to reflect transit's growing role in relieving congestion and environment problems.

Illustrative Expenditures **and Matching Requirements**

Programs	**5-year Federal expenditures** (in billions)[a]	**Federal share (percent)**[b]
Interstate	$35.0	90-65%
Primary	15.0	75-60
Secondary	5.0	75-60
Urban	9.0	75
Bridge	11.0	75
Safety'	2.4	75
Transit	18.0	75-60
Other	10.0	75
Total	**$105.4**	

[a] Research funds come primarily from set-asides from the first four State-aid programs.
[b] Where there is a range, the lower percentage is for new construction.
' Category includes highway and motor carrier safety.

in flexibility to adjust to State and local priorities and no emphasis on intermodal coordination. Existing interest groups and rural areas are more likely to be enthusiastic about this ***model than*** *urban or regional governments and those who feel the present program structure is outmoded.*

Model B (see box 2-B) and program expenditures are based on the 1991 STAA proposed legislation.[2] The National Highway System (NHS), planned to be about 165,000 miles, is the top Federal priority for the 5-year program, absorbing 60 percent of funding, if Interstate completion is included. The purpose of NHS is to connect underserved parts of the country through construction of additional roadways or through upgrading the capacity and service of existing highways. The Urban/Rural Program, designed as a State block grant, receives 25 percent of total funding. The States, with cooperation from local officials, are responsible for allocating Urban/Rural funds and overseeing programs.

The Federal matching share for NHS is substantially higher than for Urban/Rural programs and transit. State apportionment formulas for NHS and Urban/Rural are tied closely to fuel consumption taxes, an index used as a surrogate for highway use. System preservation is emphasized in some situations over new construction, and for the first time funding is provided for maintenance (on Interstate only) and operational improvements to address congestion. Highway system renovation and operational improvements receive a higher match than new capacity construction. Specifically, maintenance of Interstate highways is eligible for funding under the National Highway System program, a needed boost for rural States, and 3-R projects (restoration, rehabilitation, and resurfacing) retain 90 percent Federal funding. However, the fourth R (reconstruction) projects, which usually involve new construction like additional lanes and interchanges, drop from a 90 percent to 75 percent Federal match. State management programs are required for safety, pavement, congestion, and bridges. Highway projects in urbanized areas that increase capacity must be consistent with the State congestion management plan.

Transit funding is held constant for the authorization period, but cuts occur in grant programs for large systems and new starts. The primary source of funding for formula programs is shifted to the Mass Transit Account of the Highway Trust Fund, and a "flexibility" provision permits funding either highway or transit programs from this source. The language concerning land-use planning and air quality compliance is a step in the right direction, but it does not specifically require a State transportation plan and leaves lines of authority undefined.

The tradeoffs associated with this model include: the appropriateness of a program that moves "America Into the **21st** *Century" with an intercity highway plan as the conceptual framework of a national transportation policy; the Federal commitment and spending priorities necessary to support a 165,000-mile national highway system and that allocate only 25 percent of Federal funding to Urban/Rural problems; the low priority given to transit; and the question of whether States can afford substantially higher matching ratios. Transit groups and representatives of urbanized regions are unlikely to support this model.*

Model C is one type of program configuration using transportation and technology analysis reported in *Delivering the Goods.*[3] **Model C exemplifies a transitional program toward a future, fully intermodal system that addresses current mobility and environmental problems (see box 2-C). It emphasizes system preservation, metropolitan and rural needs, developing an integrated, balanced urban and intercity transportation system, and increasing system efficiency. Local decisionmaking is**

[2] For more specific information see S. 610 and H.R. 1351 and supporting documents; U.S. Department of Transportation, Federal Highway Administration "Facts Sheets," 1991; and U.S. Department of Transportation, Federal Highway Administration, ***Moving America Into the 21st Century*** (Washington, DC: 1991).

[3] U.S. Congress, Office of Technology Assessment, ***Delivering the Goods: Public Works Technologies, Management, and Financing,*** OTA-SET-447 (Washington, DC: U.S. Government Printing Office, April 1991), p. 201.

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Box 2-B-Model B (1991 Surface Transportation Assistance Act) Program Structure

Highway provisions establish three major programs:

National Highway System: Consists of Interstate system and at least 100,000 miles of other arteria
be determined by the States and the Federal Highway Administration. Eligible projects include construction,
reconstruction, maintenance for Interstate, operational improvements, intermodal linkages, and to
Federal project approval is required, and 15 percent is transferable to Urban/Rural at a lower
Apportionment is by formula: 70 percent State motor fuel use, and 15 percent each State total public
mileage and land area with adjustments for low density and Federal land holdings. Each State is g
0.5 percent of total program funds.

Bridge Improvement Program: Funds projects based on the relative level of serviceability at
percent Federal share, includes discretionary funds for high-cost projects, and requires insecpti
management system for National Highway System bridges.

Urban/Rural Program: Gives States flexibility in funding and administering projects under br
Federal guidelines. Eligible projects include construction, rehabilitation, operational and managemen
improvements, and planning and startup funds for traffic management and demand management.
be applied to transit projects. Apportionment is based on each State's contribution to the Highway
Fund with a bonus program for innovative solutions to congestion, air quality, or rural access. I
congestion, and bridge and safety management programs are required.

Transit Program:

Holds Federal spending steady, maintains current structure and broadens project eligibility but
operating aid to large cities and appropriations from the general fund; begins to rebuild transit re
development programs

Expenditures and Matching Requirements Based on the 1991 Surface Transportation Assistance Act

Programs	5-year Federal expenditures (in billions]	Federal share[b] (percent)
Interstate Completion	$7.0	90-75 %
National Highway System	44.0	90-75
Urban/Rural	22.0	60
Bridge	11.0	75
Interstate substitution and Federal lands	3.0	
Safety[c]	2.4	60
Transit	16.0	**60-50**
Total	**$105.4**	

[a] Research finds come primarily from set-aides from the first four State-aid programs and the Office of the Secretary of Transportation.
[b] Where there is a range, the lower percentage is for new construction.
[c] Category includes highway and motor carrier safety.

Box 2-C--Model C Program Structure

Highway provisions focus on three programs in addition to Interstate:

National/interstate Highway System: Consists of existing **43,000 Interstate** miles, plus up to 10 percent additional miles in undeserved corridors and regions. Eligible projects include repair, reconstruction, maintenance, operational improvements, traffic management and control, development of intermodal links, and limited new construction. Twenty percent is transferable to Metropolitan and Rural programs. Projects must conform to Federal standards and to adopted State transportation and air quality improvement plans.

Metropolitan Program: Funds surface transportation system improvements in Standard Metropolitan Statistical Areas and other urban areas (population over 50,000). Eligible projects include repair, maintenance, congestion relief, operational improvements, traffic management and control, transit capital and operating costs, intermodal linkages, and some new construction. The programs could be administered by regional metropolitan planning organizations in cooperation with the State; projects must conform to adopted State or regional transportation and air quality improvement plans. A restructured apportionment formula could be based on data collection and analysis programs that establish measures of need, equity, and desired performance.

Rural Program: Funds highway rehabilitation, repair, maintenance, limited new construction, and allows flexibility to address other unique needs of rural areas. Bonuses could be provided for the States with low fiscal capacity.

Bridge Program: Facilitates systematic bridge repair, reconstruction, and preventive maintenance.

Transit Program:

Maintains current structure; increases research and development funding, especially strategies that effectively serve suburban areas, institutionalizes preventive maintenance, and increases funding to reflect transit's role in relieving metropolitan congestion and air pollution.

Illustrative Expenditures and Matching Requirements

Programs	5-year Federal expenditures (in billions)	Federal share[a] (percent)
Interstate	$25.0	**90-70%**
Metropolitan	29.0	**75-60**
Rural	8.0	75-60
Bridge	11.0	**75-60**
Research, planning and special programs	10.0	
Safety[b]	2.4	**75**
Transit	20.0	**75-60**
Total	**$105.4**	

a Where there is a range, the lower percentage is for new construction.
b Category includes highway and motor carrier safety.

strengthened, and State/local long-range planning and financing coordination is required. It could add bonuses for low density and the poorest States.

Federal assistance for completing and maintaining the Interstate highway system and addressing the congestion and environmental issues of metropolitan areas (where almost 60 percent of the population live) are top priorities. The level of investment in rail and bus transit and high-occupancy travel of all sorts is raised to reflect the key role it can play in relieving these problems. Rural interests are protected by maintaining a separate program and funding is increased over current levels for improving rural accessibility and intercity travel and road maintenance.

Because the next 5 years will be a retooling period from a single-mode focus to building and maintaining a more balanced intermodal system, changes in apportionment formulas and matching ratios in this model need to reflect these goals. The *major tradeoffs of this program are that Interstate and regional highway spending, particularly for new construction, is not emphasized, and Federal spending control is considerably less. Although current metropolitan socioeconomic and land-use trends and public policy encourage single-occupancy automobile trips, this model places heavy emphasis on planning and development of intermodal systems and modal alternatives. It assumes that with stronger support at the Federal and State levels, Metropolitan Planning Organizations (MPOs) will overcome some of the political rivalries that limit their effectiveness now, but they may not succeed in this. State long-range planning must consider rural areas whose needs may be downgraded as urban representation in legislatures increases. Many interest groups will dislike the emphasis in this model on more centralized planning.*

Model D takes several further steps toward an integrated national transportation system. The underlying premise of Model D is a unified Federal surface transportation program, under which the U.S. Department of Transportation (DOT) combines the modal administrations of highways, mass transit, and passenger rail into one entity that operates under a unified budget. State transportation agencies would be encouraged to follow a similar pattern.

The majority of Federal funds would be allocated to States in the form of Surface Transportation Grants (see box 2-D). In accordance with State-developed, intermodal system plans, which are reviewed or approved at the Federal level for consistency with State air quality improvement plans, each State would decide how grant funds would be apportioned for highways, rural roads, bridges, transit, and a wide range of high-occupancy travel options. State autonomy would be abridged only if DOT decided the State planning process was deficient or the Interstate system was not being maintained to standards. Close cooperation would be encouraged at all levels of government for the planning, funding, and operations of surface transportation and air and water transport.

As part of program integration, the Highway Trust Fund would be restructured as the Surface Transportation Fund, eliminating the division between highways and transit. In developing an apportionment process for Surface Transportation Grants, Congress could consider factors such as fiscal capacity, incentives for congestion reduction, and the severity of air quality problems.

To tackle the backlog of rehabilitation and maintenance projects and to ensure the economic payoff of improved transportation efficiency, Model D increases funding 20 percent over projected budget ceilings for surface transportation. The new monies reflect the environmental, safety, and broad socioeconomic benefits of more efficient intermodal transportation. Potential sources of revenue would be a gradually increased Federal gas tax, a new tax earmarked for integrated transportation, and timely spending of the existing Trust Fund balances.

The major tradeoffs of this program are that it completes the financial and administrative integration of Federal-aid to surface transportation in one step and transfers most program approval responsibility to the States. Such changes pose major political hurdles since they require restructuring established and familiar program funding and institutional relationships,

130x 2-D--Model D Program Structure

The principal components of this model are an **Interstate Completion** and the **Surface Transportation Grant** Programs:

Interstate Completion Program: Would consist of completing Interstate construction projects already begun or authorized and a limited number of additional miles in underserved corridors. The Federal share is 90 percent. Construction must comply with Federal standards.

Surface Transportation Grant Program: Consolidates funding and program administration for highways, bridges, transit, commuter rail, and intermodal linkages. State Departments of Transportation administer grant finds, which are completely interchangeable once transportation, air quality, congestion, pavement, and bridge management plans are in place. Repair, maintenance, congestion relief, operational improvements, traffic management and control, transit capital and operating costs, intermodal linkages, and some new construction programs in urban and rural areas are eligible for funding.

Administering agents could be metropolitan planning organizations or local governments in towns and counties under 50,000 in cooperation with the State. Projects should conform to adopted State transportation and air quality improvement plans and metropolitan transportation improvement programs. The apportionment formula could be based on data and analysis that establish measures of need and desired performance. Factors such as fiscal capacity, population density, and severity of air quality problems could be considered. Funding is 20 percent higher than current ceilings.

illustrative Expenditures and Matching Requirements

Programs	5-year Federal expenditures (in billions)	Federal share[a] (percent)
Interstate Completion	$14	90-70%
Surface Transportation Grant Program (highway, transit and para-transit, rail, and bridge)	98	75-60
Research, planning and special programs	12	
Safety[b]	3	75
Total	**$127**	

[a] Where there is a range, the lower percentage is for new construction.
[b] Category includes highway and motor carrier safety.

including a significant narrowing of congressional program and project authority. Furthermore, to accelerate repair of existing systems, the model proposes a funding level 20 percent higher than the budget ceiling permits, necessitating changes in congressional priorities.

PUNNING, SAFETY, R&D, AND OTHER PROGRAM COMPONENTS

Compliance with and support for Federal safety and environmental laws are basic components of any reauthorization legislation. Close cooperation between Federal, State, and local transportation and environmental officials will be necessary to achieve compliance with the Clean Air Act Amendments of 1990. Information and planning tools to help transportation officials toward this end, safety programs, and R&D are other essential programs for urban and rural surface transportation.

Land-Use and Transportation Planning

While State land-use and transportation planning are crucial to efficient and productive transportation, few States have effective growth management planning programs. Local decision makers do not have control over activities of neighboring jurisdictions, and without a State requirement, regional consensus on development goals rarely develops. Moreover, State policies frequently limit local authority, especially for revenue raising, thereby thwarting meaningful regional planning and budgeting.

Since most States lack long-range transportation planning programs, MPOs funded by DOT, are largely responsible for the regional transportation planning being done now.[4] They are charged with preparing the federally required Transportation Improvement Program (TIP) which is a region's principal transportation planning instrument. Despite this potentially important role, their performance is generally uneven--hampered by severe budget constraints, local political rivalries, and lack of fiscal independence and State executive and legislative support. To change these conditions at the State and local levels, new surface transportation legislation could:

- **Require States to prepare and adopt a 5-year comprehensive, multimodal State transportation and financing plan (in consultation with MPOs) to guide State investment, development, and air quality improvement programs. Plan components should include land-use and growth management, congestion, safety, maintenance, and rural accessibility. The plan would cover all publicly and privately funded construction and rehabilitation projects. Annual or biennial reviews would ensure a realistic framework for annual updating of local TIPs and development of local plans for nonmetropolitan areas.**
- **Require States to identify a single MPO in each metropolitan statistical area, possibly with coterminous boundaries to those of the regional air quality district. In multi-State metropolitan areas, incentives for a single MPO or a strong regional compact will be needed.**
- **Increase Federal funding for planning, including the required TIP preparation, long-range, land-use planning (growth management in developing regions), and regional data collection and analysis. (See program allocation tables in the four generic models for specific sources of Federal funds.) This capability will be essential for States to allocate resources equitably among urban and rural areas and as a basis for preparing and evaluating air quality improvement plans. Regional congestion relief programs, approved and administered by MPOs, could receive a higher Federal match.**
- **Encourage States to use MPOs to plan for regional transit and commuter rail facilities, as well as ground links with rail terminals and air and seaports.**

Safety

Motor carrier safety and heavy tractor-trailer combination truck safety are discussed in detail in chapter 3, but an in-depth review of other aspects of surface transportation safety

[4] For further information, see U.S. Congress, Office of Technology Assessment, ***Rebuilding the Foundations: A Special Report on State and Local Public Works Financing and Management,*** OTA-SET-447 (Washington, DC: U.S. Government Printing Office, March 1990), chs. 3 and 4.

programs is beyond the scope of this document. However, OTA's research for its transportation safety studies and for Delivering the Goods points to the need for addressing safety by improving the physical condition of roadways and bridges. In addition, vehicle safety activities of the National Highway Traffic Safety Administration (NHTSA) need to be integrated more fully with the safety programs of the Federal Highway Administration (FHWA), especially in the area of human factors. DOT data collection programs for safety purposes and for use in regulatory and program analysis need to be made more systematic and comprehensive, especially in the areas of freight and passenger movements, to further understanding of accident rates.

Funding for highway safety could be raised over current levels to reflect increased vehicle ownership and travel. Priorities for expanded Federal effort include changes to safety programs necessary to accommodate an aging population of drivers and pedestrians, the large disparity between truck and car sizes, and the aging highway network. The Federal program match at 75 percent is a reasonable level, reflecting the Federal responsibility for safety regulation.

The concept of a Federal incentive safety bonus program, as proposed in the 1991 STAA is an excellent one. However, to be most effective, such incentives should be used to promote safety both through highway improvements (such as better signage, railroad grade crossings, and lane changes), and through improvements to driver and pedestrian safety (such as a decrease in drunk driving and the pedestrian injury and death rates). Current programs focus on one type or another, reflecting overly narrow interest group and congressional committee concerns.

Research and Development

At present, Federal R&D is funded primarily through the appropriated budgets for each separate mode (see table 2-l). OTA did not look in detail at surface transportation agency R&D activities related to intermodal surface transportation, but most of the few projects that exist are housed in the Urban Mass Transportation Administration (UMTA); the rest are scattered throughout the department. Congress could consider requiring DOT to undertake a comprehensive, departmentwide, in-depth review of surface R&D programs with the goal of developing a strategic R&D plan. Such an effort is long overdue. DOT's statement of R&D policy[5] is a general, broad statement of principles, not a strategic plan for meeting the future. To make best use of scarce dollars, the work of the Federal Railroad Administration (magnetic levitation), UMTA (mass transit and commuter rail, as well as some smart car/smart highway work), NHTSA, and FHWA must be coordinated and viewed as components of a strategy for moving toward an efficient intermodal transportation system.

Highway R&D

FHWA R&D is funded almost entirely through program set-asides from the Highway Trust Fund, with much of the money funneled to the States or entities outside FHWA. For example, the Strategic Highway Research Program (SHRP) receives 0.25 percent of each State's apportionment. SHRP, whose agenda is weighted heavily toward paving materials durability research, broke new ground by actively involving State DOTS in planning and execution of its R&D program, an effort that is expected to pay off in facilitating technology transfer. The work being done under SHRP is scheduled to be integrated into FHWA's research program at the end of the program's 5-year life. When that occurs, ensuring that program integration and close cooperation with the States continues is vitally important. These programs are of particular importance to States with large maintenance responsibilities.

Other highway R&D programs include FHWA contract and staff research and the Highway Planning and Research Program (HP&R), which is funded through a 1.5 percent State set-aside, out of which the SHRP funds are also allocated. Some aspects of these programs have been disappointing. For example, the HP&R Program provides States with resources for their highway planning and information gathering efforts, but States are able to devote only a small fraction of this money to actual research.

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[5] U.S. Department of Transportation, "A Statement of U.S. Department of Transportation Research and Development Policy," unpublished

Table 2-I-Surface Transportation Research and Development

Agency	FY 1991 funding (millions of dollars)	Funding source	Comments
Federal Highway Administration			
Highway Planning and Research Program	$51[a]	A portion of 1.5 percent set-aside of Federal-aid instruction funds from the Highway Trust Fund	Supports State and local planning, traffic measurement, and other research
National Cooperative Highway Research Program	8	5.5 percent set-aside of HP&R funds	Contract research managed by Transportation Research Board (National Research Council)
Contract and staff research	27[b]	Highway Trust Fund	10 percent inhouse research; balance in contracts
Strategic Highway Research Program	30	0.2 percent set-aside from Highway Trust Fund	Contract R&D focused on highway construction; 5-year program
Federal Railroad Administration	*15*	From appropriated budget	Inhouse and contract R&D (does not include $10 million for magnetic levitation rail initiative)
Urban Mass Transportation Administration	*2*	From appropriated budget	Development projects
National Highway Traffic Safety Administration			
Highway safety, motor vehicle, and other research	23	From appropriated budget	Highway vehicle and pedestrian safety
National Center for Statistics and Analysis	13	From appropriated budget	Data collection and anafysis

[a]Total funds forthe Highway Planning and Research (HP&R) Program are about $153 million, two-thirds of which is used for planning. The portion used for research is $53 million.
[b]Total indudes $8.8 million for intelligent vehicle/highway systems and R&D.
SOURCE: Office of Technohxjv Assessment, 1991, based on information from the Federal Highway Administration and the U.S. Department of Transportation.

Transit R&D

Federal support for transit R&D has been drastically cut back over the past dozen years, plummeting from $52 million in 1980 to $2 million in fiscal year 1991. Projects ranging from studies of the effects of fare increases on transit ridership (the results of these are still used today) to subway tunneling techniques fell by the wayside. A cooperative research program between the Federal Government and transit agencies never received full support and was dropped in the mid-1980s.

UMTA's plans now include a Transit Planning and Research Program that includes both national (or Federal) and State and local components.[6] Funding is planned to be almost 3 percent of the total transit program appropriation, with one-third retained by DOT for a national planning and research program and two-thirds to States for planning and research and a revived cooperative research program.[7] These plans seem carefully structured and well worth congressional support.

New Technologies

Despite the development by entrepreneurs of promising new technologies, few have actually been applied on Federal-aid projects. Moreover, companies trying to introduce new technologies often find the process time-consuming, cumbersome, and eventually unproductive or even defeating. Since it had the backing of its European parent, the company described in box 2-E was better able to devote resources to convincing public officials in the United States of the worth of its product than many of the small companies that have contacted OTA to express

manuscript, January 1991.
[b]U.S. Department of Transportation, Urban Mass Transportation Administration, "Planning and Research: A New Urban Mass Transportation Administration Program, [w]unpublished manuscript, March 1991, p. 2.
[7]Ibid., p. 7.

Box 2-E--Novophalt: A Tough Road

As Federal priorities shift from building new highways to rebuilding existing facilities, employing new technologies to increase the useful lives of the Nation's roads and bridges would seem to be a cost-effective approach. Technologies, such as cathodic protection and new techniques of repaving roads, although somewhat more costly to installI, could potentially save lives and billions of dollars by slowing infrastructure deterioration. But despite their availability, government timidity and cumbersome public procedures often prevent using such technologies during rebuilding.

The polymer modified asphalt binder, Novophalt, is one example of a new technology whose introduction has been impeded by the complicated approval process of the Federal Government and the reluctance of most public officials to stray from familiar paths. The binder, which increases pavement durability, consists of paving-grade asphalt cement and up of 4 to 6 percent virgin or recycled polyolefins. Developed in Europe, Novophalt has been used there since 1976 and was introduced to the United States 10 years later.

Although it costs an estimated **4 to 8** percent more per project than conventional asphalt mixtures, the company estimates that its product can extend pavement service life from 50 to 100 percent. If life-cycle cost estimates are used, Novophak officials argue, their product could potentially reduce costs up to 50 percent from those of conventional asphalt.[1] Studies by different Federal agencies appear to bear out the company's assertions. A report released by the Federal Aviation Administration (FAA), while not mentioning the product by name, said that polyethylene-modified asphalt may benefit runways where rutting, fatigue cracking, or thermal cracking presents a problem.[2] The Army Corps of Engineers also found asphalt concrete with the same properties as Novophalt to provide"superior overall performance."[3]

To demonstrate the merits of its product, the company has conducted 22 demonstration projects in North America on airport runways and highway reconstruction projects. In one such project, where the material was used in reconstruction of city streets in Manhattan, it performed much better than standard asphalt over the same period of time. Armed with such positive results, Novophalt officials hoped to win a contract for paving a new airport runway. However, their proposal was met with resistance by managers at the local **airport** authority, who were unfamiliar with the technology and had not read the FAA report about the performance of polyethylene-modified asphalt.[4] When the company sought a contract to repave sections of a local parkway system, Federal Highway Administration officials asked Novophalt to conduct yet another demonstration project in the area, despite their successful demonstrations for numerous State Departments of Transportation.

The company's experience is illustrative of the difficulties entrepreneurs face when trying to introduce a new technology into the public works arena, although Novophalt, as a foreign proprietary technology, faced some additional problems despite its U.S. demonstrations. Quite aside from questions of international competition, Federal agencies are wary of foreign technologies because of different operating conditions and perceived scarcity of data.[5] Furthermore, **public** officials **are concerned about the risks of** price changes or supply problems associated with purchasing a proprietary technology from a private source. Even though the FederaI Government encourages private industry to develop new technologies, the reluctance of officials to contract for proprietary innovations makes public works technology development an unprofitable venture for most companies.

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1 Walter **Tappeiner, Novophalt** America, Inc., personal communication, Apr. **11,** 1991.

2 U.S. Department of Transportation, Federal Aviation Administration, "Polyethylene Modified **Asphalt Cement,"** Engineering Brief No. 45, **AAS-200,** Feb. 21, 1990. f-

3 A. F. Stock and G. **Anderton,** "An Assessment of the Resistance to Permanent Deformation of **Modified** Asphalt Mixes$" paper presented at **Eurobitume,** Madrid, Spain, October 1989, p. **451.**

4 Hugh **Mields,** consultant, personal communication, Apr. 11, 1991.

5 U.S. Congress, Office of Technology Assessment, ***Delivering the Goods: Public Works Technologies, Management, and Financing, OTA-SET-477*** (Washington, DC: U.S. Government Printing Office, April 1991), p. 201.

their frustration over the futility of their efforts. Future R&D activities in DOT must make evaluation of the operating and cost-effectiveness of new technologies a priority, to begin moving the best of them into wider use. As one example caused by past inattention to the importance of technologies, the types of automated toll collection facilities now speeding drivers through toll facilities in Dallas, Texas, New Orleans, and Oklahoma have been available for some time, yet have only recently been implemented. FHWA has belatedly begun to emphasize Intelligent Vehicle/Highway Systems (IVHS) programs, but their benefits are still unrealized in numerous metropolitan regions with terrible congestion problems that IVHS could address. Demonstration projects, originally designed and used to test new technologies, now consist of many projects that break no new technical ground. Too often, they are used to fund improvements or construct a new local facility, giving demonstrations, originally a good idea, a bad name.

R&D Priorities

Top priorities for short-term R&D are technologies that address maintenance, rehabilitation, and system preservation, including: materials, construction equipment, processes, technologies, and techniques to ease both highway and urban traffic congestion and improve intermodal connections.[8] Materials that improve the longevity of pavement and bridges may cost more initially, but many ultimately prove cost-effective over the life of the facility. Asphalt products using recycled materials such as tires and plastics have proven successful under the right circumstances, and increased research could refine them to make widespread use a feasible option. FHWA'S emphasis on IVHS is an appropriate first step. IVHS technologies for highway operations and better traffic management can help alleviate congestion and also permit some forms of congestion pricing.

However, over the longer term, IVHS activities now under way in UMTA and NHTSA must be fully integrated in the DOT IVHS plan, and IVHS activities must be one component of a larger departmental strategic research program. Other surface transportation technologies that need support, including funding, in the near term include examination of the cost-effectiveness of separate high-speed rail or magnetic levitation train service in the most heavily traveled intercity corridors. Longer term construction and implementation of the appropriate system is likely to be desirable in these corridors to supplement existing services.

Evaluation or demonstration projects will be necessary to move these technologies into widespread use. A comprehensive, preproject review process, such as that employed by SHRP, for proposed demonstration projects could eliminate those with insufficient technical merit.

The natural aversion to risk by most government officials is often compounded with unfamiliarity with current technologies. Increasing the training given to highway officials at all levels of government could make these individuals more amenable to implementing new technologies. Expanding the National Highway Institute, as FHWA proposes, is an important first step for accomplishing this goal.

Long-range planning and R&D that look ahead to future problems simply do not exist at DOT, and this is a serious deficiency. The issue needs a careful scrutiny by Congress and DOT itself. A strategic, departmentwide R&D plan that looks beyond surface transportation is the first step toward implementing the national transportation strategy. Congress may wish to require DOT to address this issue in the near future.

Data Collection and Performance Measures

Accurate baseline data and performance measures are important keys to improving transportation performance. Transportation data collection was severely curtailed during the 1980s, and it will take time to acquire enough information to develop good performance goals. To plan for the future, DOT needs to knowmore about travel patterns, congestion causes, and land-use transportation relationships. As a first

[8] The Federal Highway Administration's draft report, "Research and Technology Program 1992-1996" (updated in August 1990), shows that the agency is moving toward setting priorities for its own research and development program. The report focuses heavily on highways, which limits its usefulness in addressing future transportation needs.

step, DOT plans to conduct a multimodal passenger and freight transportation survey in fiscal years 1992 and 1993. Congressional support for full funding of this effort is crucial. At present we are making decisions about billions of dollars in Federal expenditures based on 15-year-old data that were inadequate to begin with.

Private Sector Investment

Parts of the country with growing populations and relatively healthy economies can attract private investment for public facilities, and California has arranged several privately financed roads under special, carefully crafted agreements. The success of these projects in enduring the lengthy environmental impact statement process or a prolonged, severe economic downturn remains to be seen. Few other examples of such projects exist in this country, although they are more common in Europe. The legal and institutional framework in the United States indicates that public funding for transportation facilities is likely to predominate for the foreseeable future.