

Abridgment

A Model for Management and Public and Private Finance of Rural Road Systems

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ABSTRACT

The Forest Service, U.S. Department of Agriculture, directly manages one of the largest and most varied transportation systems in the world and may be an appropriate model for general management and public and private financial management of rural road systems. The Forest Service system includes approximately 321,000 miles of roads, foot trails, airfields, aerial tramways, waterways, and cableways with low-volume roads making up most of the system. Examined in this paper are the policies and requirements of the Forest Service as a possible model for rural road management and planning, and for cooperative public and private financing. Because the economies of rural areas are generally natural resource based, these policies and requirements should be applicable in some form to rural road systems worldwide. National forest management plans contain the public's objectives for private sector development and public use of forest resources. The national forest road systems are planned and managed to support these objectives. The public and private sectors then cooperate in the financing of construction and maintenance of national forest roads. Explicit development objectives require uniquely supportive road systems in order to properly exploit natural resources. The private sector constructs and maintains roads from which the public can also benefit. This model is an appropriate example for coordinating economic development and roads expansion in rural areas with limited public financial resources.

Although it is not a transportation agency, the Forest Service, U.S. Department of Agriculture, directly manages one of the largest and most varied transportation systems in the world and may be an appropriate model for general management and cooperative public and private financial management of rural road systems. The Forest Service system includes approximately 321,000 miles of roads, foot trails, airfields, aerial tramways, waterways, and cableways. Low-volume roads make up the predominant part of the transportation system and most are located in the western United States in national forests. National forest roads often carry less than 100 vehicles per day and traffic volumes vary significantly by season and use. Of the 321,000 miles of roads, 27 percent is currently closed to all traffic, 29 percent is maintained for passenger car use, and 44 percent is maintained for high clearance (including two- and four-wheel drive) vehicles (1,p.37).

The Forest Service is a natural resources management agency that is responsible for managing the national forest road systems for use, protection, development, and management of national forest lands, and for providing access to natural resources extraction for the private sector and to recreational activities for the public. The national forests contain 87 million acres of commercial forests and 41 million acres of rangeland. The forests also contain 2.5 million acres of surface water (2,pp.3-1 - 3-3). These land and water resources support commercial timber harvesting, energy and nonenergy minerals mining, commercial ranching, fishing and trapping, and an assortment of public outdoor recreation activities, including boating, hunting, and skiing. The agency has a tradition of public and private cooperation in resources development and transportation of goods and services.

Users of national forest roads are as varied as the major activities occurring on national forest

lands. The transporting of forest products and minerals, recreationists traveling to and from the forest sites, landowners commuting from within or near national forests, and administrative-related travel make up the bulk of traffic on forest roads. In situations where the Forest Service and other public road agencies have mutual jurisdiction, local commercial traffic, busing of school children, and mail delivery may also be involved.

The objective of this research is to examine the policies and requirements of the Forest Service as a potentially more widely applied model for management and cooperative public and private finance of rural roads. Because the economies of rural areas in general are natural resource based, Forest Service policies and requirements may be applicable in some form to the management of other rural road systems in mixed capitalist, developed, and developing countries.

Other rural jurisdictions are faced with similar concerns for providing adequate roads to support economic development. It has been suggested that, if misallocation of resources and economic stagnation are to be avoided (3,4), transportation planning by developed and developing countries should be done in concert with specific economic development and social objectives. Public and private financing of roads could be beneficial to developing rural areas, but the role of such cooperation should be more clearly defined when economic development and social objectives are incorporated into the planning process.

FOREST SERVICE ROADS MANAGEMENT: PLANNING AND ANALYSIS

Each national forest is required to develop an integrated land and resources management plan every 15

years. The management plan is the basis for each national forest's management program, including roads management. The plans and programs are guided by nationally established goals and locally established issues of resources production and protection, environmental quality, and social and economic impact. These plans identify the potential for resource outputs and examine management program alternatives for resources production. One of the primary criteria for evaluation of management program alternatives is to maximize present net value of resource outputs (5,p.F-2).

Each management program alternative must have a road system associated with producing a mix of outputs at minimum costs. These costs include monetary costs as well as physical, biological, social, and economic effects (6,p.7).

National forest resources that are accessed for the first time by road provide most of the calculated benefits to the economic analyses of road investments in management plans. These resources consist of timber, energy and nonenergy minerals, and recreation activities. The "willingness-to-pay" values of these resources are treated as the benefit values of a road providing first-time access. Timber benefit values, for example, consist of the "stumpage value," the value on the stump as determined by the bid price for timber by timber companies. The stumpage value becomes a direct monetary return to the United States Treasury. This stumpage value minus the costs of producing and protecting the resource is the benefit value of access to the resource area (7,pp.F-13 - F-14). For those national forest road projects that are reconstructions of existing roads or are constructions of alternative roads and do not provide first-time access, the benefits consist of reduced user, maintenance, and operating costs.

Selecting the most appropriate road system may require analyses of several options to meet a management program alternative's resource mix. The anticipated quantities of resource outputs for each management program alternative are converted into trips and allocated over the links in the road network. After the estimated traffic has been allocated throughout the network, a roads management alternative is developed, concerning road standards, facility construction, maintenance, and operation. For example, a resource management program emphasizing timber production may require restrictions on recreation traffic and specific standards of construction. Each management program alternative may result in unique trip generations and distributions throughout the road network (8,pp.20-21). A selected management program will then require the implementation of an appropriate road system for the anticipated traffic.

IMPLICATIONS FOR RURAL ROADS MANAGEMENT PLANNING

The implications of the Forest Service experience for other rural road systems are that economic and social objectives can and should be seriously incorporated into a roads management planning process. Although other rural areas may not have the organizational unity and the relatively homogeneous land uses or ownership that national forests have, rural jurisdictions should attempt the integration of economic development with roads management. Development of mineral resources, prime agricultural lands, or industrial areas can place differing requirements on a developing road system.

An entire road system may be evaluated in terms of several economic development scenarios. The scenario most likely to occur with promotion of the public and private sectors may require a road system

different from the one in place. The system should then be modified and managed in coordination with development objectives.

The projected traffic in a rural area may not be sufficient to justify road improvements on the basis of reduced user costs. A "value-added" approach can be used for measuring the benefits of increased production of natural resource, agricultural, or manufacturing outputs resulting from a road investment. This approach determines the difference in net income to developers, manufacturers, and transporters of outputs with or without a road investment. The appropriate value-added approach may range from estimates and hand-accounting of benefits to samples of enterprise budgets and linear programming analyses of shadow prices (9,pp.19-46; 10).

MANAGEMENT AND FINANCE OF NATIONAL FOREST ROADS

Appropriated Funds and Purchaser Credit

Once the planning of resources management and of road systems has been accomplished, agency cooperation with other public and private bodies takes place, not only in the development and use of forest resources but in the finance of roads needed to support commercial and public activities. The Forest Service is often involved in cooperative road work and ownership with other jurisdictions, if such work or joint ownership is essential to providing access to national forests or other lands managed by the Forest Service (11). Of even greater significance, however, are the relationships between the Forest Service and private firms in the financing and management of roads.

The Forest Service does build national forest roads from appropriated funds, but purchasers of timber for commercial purposes are authorized to build and maintain roads as well (12). Timber purchasers built 5,733 miles of roads in fiscal year 1983 on national forests, while the Forest Service built 2,016 miles with appropriated funds (13, p.133). The cost of these purchaser-built roads was about \$131 million and for appropriated roads the cost was about \$252 million; purchaser roads are generally built to lower design standards and consequently cost less to build.

The timber purchaser may receive credit for the cost of road work subject to the terms of a timber sale contract. This purchaser credit may consist of a sum deducted from the timber purchase amount if the road is to be used later for national forest management purposes. The purchaser is required to build only the minimum standard of road needed to harvest and remove timber or other products, subject to environmental regulations (14). If the Forest Service requires a higher standard road for future resource protection or administrative purposes, the Forest Service may enter into a cooperative agreement with the purchaser. In this case, the Forest Service may construct a road with a combination of purchaser credit and government funds or furnish the materials or funds to the purchaser for construction (15).

Management of Cooperatively Financed Roads

The Forest Service must actively manage its road systems because of the variations in use by season, traffic composition, and location. The agency may restrict certain types of traffic at certain times or close roads altogether for land management and safety reasons (16). For example, if public recreation use is high during one season, then timber hauling may be restricted and vice versa. Road

closure is the most extreme management step and the agency must coordinate that with other jurisdictions, the general public, and private landowners. When there is no need for a road for a certain period, the road may be closed, which protects natural resources and maintains the investment in the road and public safety. For example, roads constructed for seasonal or intermittent use are closed to minimize road and environmental damage and to maintain public safety. Roads that are not maintainable may be closed until reconstruction or obliteration. Short-term roads (i.e., those used only for a timber harvest), may be closed until obliteration is completed (17).

The agency may not restrict access to property owners within a national forest. Many parcels within a national forest are privately owned and the agency must allow access to them for the owners. Those who may use roads during restricted or closed conditions must adhere to rules of use, to conditions of a special permit, and may even have to pay a bond to repair any possible damage. Existing mining laws allow miners the right of entry into national forests for minerals exploration and development. A special use permit to miners may require them to perform maintenance or make payment for maintenance expenditures caused by mining-related traffic (18). In any case, commercial users are responsible for all traffic-related maintenance commensurate with their uses.

The Forest Service is responsible for maintenance necessitated by national forest administrative and recreation activities. Levels of maintenance for a road are generally determined by the amount of average daily traffic (19) on roads ranging from closed intermittent service roads of any standard to double-lane, paved roads that provide a high degree of user comfort (20).

IMPLICATIONS FOR RURAL ROADS MANAGEMENT AND FINANCE

Other rural jurisdictions could rely on public and private cooperation to build and maintain responsive road systems. Roads would more readily accommodate the changing spatial patterns of economic development if private developers were to directly finance the construction of portions of the public roads system. Rural jurisdictions could share the costs of new roads with developers, based on the expected composition of traffic (e.g., development-induced or general public traffic). A new development may require a higher standard of road than the current one because of increased traffic volumes. Construction of the higher standard road could be financed by the private development. It may be argued that the private sector in the United States already pays for roads through property and fuel taxes. There is often little immediacy or spatial sensitivity in the public sector's allocation of tax revenues to roads in areas of potential or actual development. It is also perceived in many states and localities that the financial burdens of such taxes have become excessive.

The private sector can be motivated to participate in public roads financing when tax benefits or profits exist. Outright private ownership of transportation facilities has been newly researched, discussed, and promoted in the literature (21). It is questionable whether traffic volumes would be high enough, the public's transportation objectives narrow enough, and the institutional constraints small enough for privatization of most rural road systems except in limited areas of private land development.

SUMMARY AND CONCLUSIONS

The Forest Service has developed policies and requirements for integrated resources and roads man-

agement and for cooperative public and private financial management of roads. National forest management plans contain the public's program for private sector development and public use of forest resources. The national forest road systems are planned and managed to support those objectives. The public and private sectors cooperate extensively in the financing of construction and maintenance of national forest roads.

The general and financial management of national forest road systems in the United States provides a unique but applicable model for the general and financial management of other rural road systems. Although myriad land uses, ownership patterns, public agencies, and economic priorities in rural areas may complicate the application of such a model, the components of the model are based firmly on the concepts of a mixed capitalist economic system. Yet, it is rare when economic development objectives and roads expansion are formally managed by the public sector in financial cooperation with the private sector. Institutional and legal constraints to extensive public and private cooperation exist in this as well as other countries and would have to be lessened for wider application of this model to take place.

ACKNOWLEDGMENT

The author wishes to thank Jerry Knaebel and Peter Ashton of the Forest Service, U.S. Department of Agriculture, for their helpful comments on an earlier draft of this paper.

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The opinions and findings expressed in this paper are those of the author and do not necessarily reflect those of the Forest Service, the U.S. Department of Agriculture, or the Transportation Research Board.

Publication of this paper sponsored by Committee on Taxation, Finance and Pricing.

Cost-Effective and User-Oriented Sizing of Rural Roads

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ABSTRACT

Analyzed in this paper are two important aspects of road sizing: the common approach to selecting the 30th highest hourly volume for design hourly volume (DHV) for all types of road uses; and the development of a cost-effective annual average daily traffic (AADT) criterion for upgrading two-lane rural highways. The study's most important feature is that the road type variable is used in a more detailed and objective manner than in past studies. The highway system for Alberta, Ontario, Canada is investigated and the roads are classified into six types according to trip characteristics (e.g., trip purpose and trip length distribution). Based on other road design and traffic data, and economic cost statistics from Alberta Transportation, a detailed economic analysis is carried out. The main conclusions of this study are that: (a) the type of road use is a significant variable that must be considered for appropriate sizing of roads from the economist's and user's perspectives; (b) to provide a more uniform service to the users of various road facilities, it is more appropriate to use a range of highest volume hours for the design of different types of roads; (c) the total highway cost is minimized typically at a volume-to-capacity ratio of 0.35 regardless of the type of road use; and (d) the typical AADT values at which two-lane rural roads would need upgrading vary from a range of 1,750 to 2,500 for highly recreational routes to 6,500 to 8,500 for commuter routes.

During the recent years of budgetary constraints, highway authorities have attempted to achieve the greatest use from the dollar spent. There is an increasing concern about many of the past approaches to highway design and improvement programming that have typically been subjective in nature and generally lacking in economic rationalization (1,2). The sizing of roads, for example, has not been definitive under Alberta Transportation policy to date. The major parameters considered in the past

have been (a) the traditional 30th highest hourly volume for designing a new facility, (b) the average annual daily traffic (AADT) volume and safety considerations for upgrading an existing facility, and (c) the use of level of service B for all applications including the urban and suburban areas that fall in the Alberta Transportation jurisdiction.

Another point of concern regarding the current practice in Alberta and other Canadian provinces is that, in general, the basis for road-sizing criteria