STATE-WIDE RAIL PLANNING: ITS DEVELOPMENT AND IMPLEMENTATION IN AGRICULTURAL STATES

by

Denver D. Tolliver
Research Associate

UGPTI Staff Paper No. 34

December 1982

STATE-WIDE RAIL PLANNING: ITS DEVELOPMENT AND IMPLEMENTATION IN AGRICULTURAL STATES

BY

DENVER D. TOLLIVER
RESEARCH ASSOCIATE

UPPER GREAT PLAINS TRANSPORTATION INSTITUTE
NORTH DAKOTA STATE UNIVERSITY
P. O. BOX 5074
FARGO, NORTH DAKOTA 58105

DECEMBER 1982

FORWARD

Since the passage of the Railroad Revitalization and Regulatory Reform Act of 1976, State governments have assumed an interest in maintaining and promoting adequate rail service within their boundaries. These activities, consisting of providing technical assistance to shippers, carriers, and communities, as well as providing financial assistance for the rehabilitation of deteriorated rail lines, are known collectively as state-wide rail planning.

The rail planning process itself is quite broad and policy-oriented. The technical aspects of rail planning, however, are quite specific and technical in nature. This paper presents an overview of the rail planning process in agricultural states and describes the analytical procedures which underlie the process.

I. INTRODUCTION

During the decades following World War II, the railroad industry entered a phase of long-term decline. As the nation shifted to a service-oriented economy, demand for the transportation of bulk commodities, the railroads' bread-and-butter, declined relative to what it was previously. At the same time, intermodal competition, fueled in part by large capital expenditures for through or interstate highways, cut-away the railroad's traffic base in the area of time-sensitive commodities, such as high-valued manufacturing products. The result was an eroding revenue base, a declining market share, and, consequently, poor internal cash flow and a weakened position in external capital markets. In the 1970's, therefore, the railroad industry wound-up operating essentially the same number of miles of road as it had in the 1950's, with fewer ton-miles of traffic, and with a troublesome cash flow situation.

Railroad's were restricted by regulation, until recent times, from abandoning a large portion of trackage which no longer had the necessary densities to support traffic. The logical alternative to abandonment, under these circumstances, was to defer maintenance on line-segments of lesser density. This was particularly true in grain producing areas, where a proliferation of branch line trackage had occurred during the railroad building era.

Impetus for Rail Planning

With the railroads poor financial posture and deteriorating physical plant, Congress was forced to act in order to prevent large-scale collapse within the transportation system. The Railroad Revitalization and Regulatory Reform Act (4R Act) of 1976 extended the Federal assistance which had been allocated to Conrail earlier to Midwestern and Western states. The Act appropriated monies for the rehabilitation of light-density tracks and for the preparation of state rail plans.

The 4-R Act was followed by the Local Rail Services Assistance Act of 1978. Each state was appropriated monies for the rehabilitation of rail branch lines and for the development of comprehensive statewide rail plans. In order to spend the appropriated funds, however, states had to have an acceptable methodology for analyzing the potential benefits and costs of each particular project, as well as an overall planning methodology.

The Special Case of Agricultural States

Rail planning in agricultural states has been complicated by the many and far-reaching changes which are simultaneously occurring in the grain handling and merchandising system. Branchline abandonment, trainload rate structures, and light-density surcharges have been paralleled by movements towards more centralized loading and marketing of grain and oilseeds. This dynamic environment has resulted in a planning process which is flexible and has created the need for analytical methodologies which are forward-looking and adaptive.

The planning process, in agricultural states and its underlying methodologies, therefore, is one which must consider a range of simultaneous changes and which must be able to analyze the operating and cost efficiencies of a variety of transportation systems. In response to the demands for such a methodology, North Dakota State University, in conjunction with the State Highway Department, developed a rail planning model known as the North Dakota Methodology for Branchline Analysis (NDMBA). Following is a description of the nature and application of this methodology.

In addition to cost savings on existing traffic, rehabilitation will, in theory, result in increased rail share. A proportion of the traffic which was moving by truck under the base case will now move by rail, because of better more efficient service and the possibility of multiple car or trainload rates. This incremental traffic results in a consumer's surplus, or the difference between what a consumer is willing to pay for some amount of service and what he has to pay, which is calculated as:[1]

$$C_s = 1/2\,[(P_0 - P_1)\,(Q_1 - Q_0)]$$

where C_s = change in consumers' surplus

P_0 = shipping rate, base case

P_1 = shipping rate, rehabilitation case

Q_1 = quantity shipped, rehabilitation case

Q_0 = quantity shipped, base case

[1]This description of project benefits draws freely from Mittleider, John F. and Vreugdenhil, Harvey. **An Economic Analysis of Selected North Dakota Branchlines**, Report No. 144, Department of Agricultural Economics, North Dakota State University. May 1981.

The incremental traffic also results in a producers' surplus, or the difference between the producers' price and the cost of providing service, calculated as:

$$P_s = (P_1 - C_1)(Q_1 - Q_0)$$

where P_s = change in producers' surplus

P_1 = shipping rate, rehabilitation case

C_1 = shipping cost, rehabilitation case

Q1 = quantity shipped, rehabilitation case

Q_0 = quantity shipped, base case

These three components describe the change in benefits which occur from rehabilitating the line-segment rather than letting the line continue as it has under the base case, which will eventually result in the cessation of service.

In order to calculate the PEB, net rehabilitation cost must also be calculated. Net rehabilitation cost is defined as the cost of rehabilitating the line-segment, minus the net present salvage value, where the salvage value is discounted from the end of the project life to present year value.

The net cost of rehabilitation is then subtracted from the net present value of the PEB (as calculated above and discounted to present value) to determine the net present value of the project. Whenever the net present value of the PEB exceeds the net rehabilitation cost, the project is considered viable. A benefit/cost ratio may be calculated from these two values which is the ratio of the PEB to the cost of rehabilitation.

Secondary Efficiency Benefits[2]

Secondary efficiency benefits are defined as the changes in the value of goods and services produced which are indirectly a result of the rehabilitation alternative. For example, farmers may receive a higher price and hence a higher profit for their product under the rehabilitation alternative without a corresponding decrease in profit to the elevators. This would be classified as a secondary efficiency benefit of the rehabilitation alternative. A secondary efficiency benefit would not be realized in a situation where a change in the economy is compensated by an opposite change elsewhere in the economy.

The North Dakota Methodology for Branchline Analysis estimates secondary efficiency benefits (SEB) on the basis of input-output analysis (I/0). An I/0 model of the North Dakota economy has been developed by the Department of Agricultural Economics at NDSU. The model relates changes which occur in the basic sector of the economy to the level of activities in other sectors through a matrix of interdependency coefficients. Through this procedure, the effects of the benefits realized through abandonment, in the form of increased consumers' surplus, are projected throughout the economy.

In addition to the multiplication effects of increased consumers' surplus throughout the economy, SEB also arise from the avoidance of highway impacts which would occur due to abandonment. Firms relying on rail service preceding abandonment will be required to truck their product to or from the nearest railhead or truck the entire distance

---

[2]The description of secondary efficiency benefits also draws from **Mittleider, et.al.**, 1981.

from origin to destination, assuming they remain in business and do not relocate. This increased truck traffic may cause additional deterioration of highway structures, reducing the life expectancy of roadbeds and necessitating increased maintenance costs.

Increases in truck traffic will also generate additional revenues in the form of license fees and fuel taxes. These increased revenues are calculated and subtracted from increased highway costs to determine the net cost of additional truck traffic.

V. SUMMARY

This paper has attempted to overview the statewide rail planning process as it developed in agricultural states. The focus of the paper has been on the special methodological considerations which are needed due to the requirement of analyzing and forecasting in a constantly changing environment.

The methodology developed and used by the State of North Dakota for branchline analysis has been overviewed and the theory and structure of the modeling process discussed. This model and this procedure are essentially the same which would be considered elsewhere where grain marketing and transportation conditions are similar.

II. ANALYTICAL PROCEDURES OVERVIEWED

Objectives of the Methodology

The objectives of the NDMBA is to analyze the viability of individual line-segments and, at the same time, to determine both the primary efficiency benefits (PEB) and the secondary efficiency benefits (SEC) resulting from rehabilitation. Given the necessary expenditures for rehabilitation the methodology would forecast the returns to rehabilitation, under one of several traffic assumptions.

Rail Cost Model

One of the critical inputs in the determination of PEB is the estimation of the avoidable costs associated with operating and maintaining the line-segment. In certain instances, estimations of both on-branch and off-branch cost elements can be obtained from the railroad, particularly if the line has already been placed in I.C.C. category three (meaning that an abandonment application will be filed shortly). However, this information is not always available in a timely-fashion, or for line-segments in other than category 3 groupings. In addition, there may be disagreements in calculating procedures between the railroad's data and F.R.A. or state standards.

The NDMBA incorporates a rail model which estimates both on-branch and off-branch cost elements. Operating, maintenance, and capital costs are developed for the on-branch portion including a return on net liquidation value. Adjusted Rail Form A costs are used for the off-branch portion of the movements.

Multiple Car and trainload Capabilities

One of the major differences between the NDMBA and other state methodologies (and one of its major advantages over the use of historical railroad data) is that the model has the capability to estimate avoidable costs for a variety of traffic scenarios. Even if rehabilitated, for example, a branchline may not appear to be viable if the traffic is costed as single-car movements, which is unrealistic in the majority of cases.

The NDMBA builds in adjustments in: (1) switching times, (2) car times at origin and destination, (3) train running time, (4) station and billing costs, (5) train weights and locomotive statistics, and (6) off-branch switching events. These adjustments reflect both the on-branch and off-branch efficiencies of multiple carload traffic.

IV. THE THEORY OF BENEFITS

The benefits which would accrue from rehabilitation comprise three categories: (1) the reduction in cost on existing traffic, (2) consumers' surplus on new rail traffic, and (3) producers' surplus on new rail traffic.

A reduction in cost will occur on the existing traffic base due to rehabilitation, irrespective of the addition of new traffic. More efficient operating conditions will prevail because of rehabilitated track. Trains will move at greater speeds and crew wages, consequently, will be reduced. This is particularly true if a multiple-car or trainload scenario is considered under the rehabilitation case.