Predicting Financial Impacts on Rural Roads of Potential Rail Line Abandonments

KENNETH L. CASAVANT AND J. C. LENZI

Private decisions by railroads to abandon rail lines are having significant impacts on public costs. Specifically, the increasing amount of rail line abandonments are exacerbating road deterioration, with resultant increase in costs of road maintenance and reconstruction. At this point the magnitude of financial impact on roads of such abandonments has been identified only in an "ex post" fashion. Information on road damage is needed by policy makers *before* such abandonment. In this paper, a procedure is developed that can be used to predict such road damage before its occurrence. A conceptual model is presented and then applied in a case study in Washington State. The model was slightly modified, based on the case study experience, and was found to achieve its purpose in an efficient fashion. It is suggested that similar procedures be developed to also predict safety, pollution, and economic development impacts of rail line abandonment.

The economic development of the state of Washington and the United States was caused by and based on the development of a multimodal transportation system. This system required massive investment but produced efficient movement of commodities. The access to resources for growth, country expansion, and consolidation depended heavily on these efficient transportation linkages. Railroads were, and continue to be, an efficient contributor to the development of the nation's dominant industries: agriculture, forest products, and industrial products. An important contribution to the efficiency of the overall transportation system was the competition between and among the modes of transportation.

The modes are still competitive, but this competition is affected by recent changes occurring in the railroad system. Today many changing conditions in the United States are resulting in the abandonment of rail branch lines. Before the 1980s, the railroad system was under tight economic regulation, even while experiencing low or negative rates of return on investment, undergoing mergers, and filing bankruptcies. Legislation in the late 1970s and early 1980s partially deregulated the railroad industry, which allowed flexibility in railroad decision making and substantially eased the process of rail line abandonment. The 4-R Act, legislation enacted in 1976, "established the principle that a railroad cannot be forced to provide service on which it loses money" (and costs in this case are specified to include a return on investment). Provisions of the Staggers Act of 1980 reaffirmed the liberalization of rail abandonments in two ways. First, a time limit of 225 days from the date of application, including appeals, was established. Previously, the long, costly proceeding before the Interstate Commerce Commission (ICC) over abandonment was a deterrent to abandonment (*1*). Second, under Staggers it was further specified that the railroad's return on investment should include the opportunity cost of railroad capital.

These changes have facilitated the abandonment of rail branch lines. Rail abandonment, common in the Midwest since the 1950s, has come to the state of Washington in full force. Over the past 10 years, the extent of the rail network nationally and in Washington has shrunk considerably. Since 1980, 63 rail line segments constituting over 1,100 mi of track have been abandoned in Washington. This abandonment is directly affecting the highway mode of transportation because it forces more and more shippers to use trucks to carry grain and other commodities to more distant rail lines or river ports.

Discussions with Burlington Northern and Union Pacific officials suggest more requests for abandonment are forthcoming. Recent filings in Washington indicate an additional 209 mi are under consideration for abandonment in 3 years (Category I on the Systems Diagram Maps). Moreover, a recent study of the Palouse Empire Region's rail system by the Idaho and Washington Departments of Transportation found the entire 540-mi system to be a likely candidate for abandonment in the future (*2*). Further, a current study by Wilbur Smith Associates for the Rail Development Commission of Washington State found that 26 lines, totaling 1,098 mi or 31 percent of the state's system, are potential abandonment candidates (*3*). Thus, the impacts of such abandonments may be increasing in magnitude in the future.

The impacts of abandonment vary in magnitude as well as in who is affected. The most immediately discernible impact is the transportation costs faced by the shippers undergoing a rail line abandonment. Associated impacts concern the loss of quality of service (flexibility) caused by rail line abandonment. Seasonal movements over roads constrained with weight limits or even closures could result in lost market opportunities. Further, the loss of the competitive environment surrounding rail and truck modes has caused rates to move toward or above the cost of service. Loss of such competition may upset the negotiating balance between shipper and remaining carrier. In most instances of rail line abandonment, the total demand for transport is quite inelastic (especially in rural agricultural areas), and the net price to producers simply decreases. Other impacts could be loss of employment in

K. L. Casavant, Department of Agricultural Economics, Washington State University, Pullman, Wash. 99164-6210. J. C. Lenzi, Transportation Planning Office, Washington State Department of Transportation, Olympia, Wash. 98504.

industries or firms forced to close or relocate, energy consumption increases, safety, economic development, and so on.

An important impact of the abandonment of a rail line is the damage to roads caused by the traffic shift. Such traffic shifts cause increases in costs of maintenance and reconstruction, costs borne by the public but caused by private decisions. These costs traditionally have been neither available nor quantified before an abandonment and, hence, are not specifically considered by the ICC in granting a petition to abandon. However, in the abandonment proceeding for the line from Rosalia to Spring Valley, Washington, abandonment was temporarily restrained by describing potential impacts on local roads that could result from abandonment. However, because of a lack of specific financial detail on these impacts, the line was later approved for abandonment.

Several studies have provided estimates of impact of past rail line abandonment on roads—both county and state highways—in Washington. A preliminary examination of impacts on state highways found that rail line abandonment in general has only marginal effect but is creating "pockets of potential problems" (*4*). A subsequent examination of impacts on county roads found rail line abandonment had caused $5 million and $6 million of damage to roads in Lincoln and Spokane counties, respectively (*5*). The total estimated financial need to repair roads was about $1.5 billion, for the 10-county study area in eastern Washington (approximately $400 million related directly to rail line abandonment).

However, the central theme of these findings, and the overall problem, is that the potential magnitude of impact—physical and financial—on nearby rural roads resulting from abandoning a line segment has not been established. These studies have been ex post facto and a process is needed to predict and estimate the size of such impacts so policy makers, planners, and local and state government officials can adequately prepare for (and defend against) rail line abandonment, as well as develop financing to offset damages.

OBJECTIVES

The authors' purpose in this paper is to report on a study identifying fiscal road impacts resulting from rail line abandonment. Specific objectives are to

1. Develop a procedure to allow identification of physical location and financial magnitude of impacts on roads before an abandonment;
2. Test the conceptual procedure on a past rail line abandonment as a case study; and
3. Reformulate the procedure and outline problems and implementation.

CONCEPTUAL MODEL

The damage resulting from increased traffic is directly related to the weight and frequency of such movements. The load weight impact depends on the gross vehicle weight (GVW), per axle weight, and distance between axles (measured by the bridge formula). The general relationship between vehicle weight and damage is shown in Figure 1. Damage increases in a greater proportion than a given increase in weight; thus, overloaded grain, lumber, or freight trucks are especially hard on roads not designed for those loads. The overall impact of the increased weight and traffic volume on pavement life is shown in Figure 2. The shaded area reflects the increased

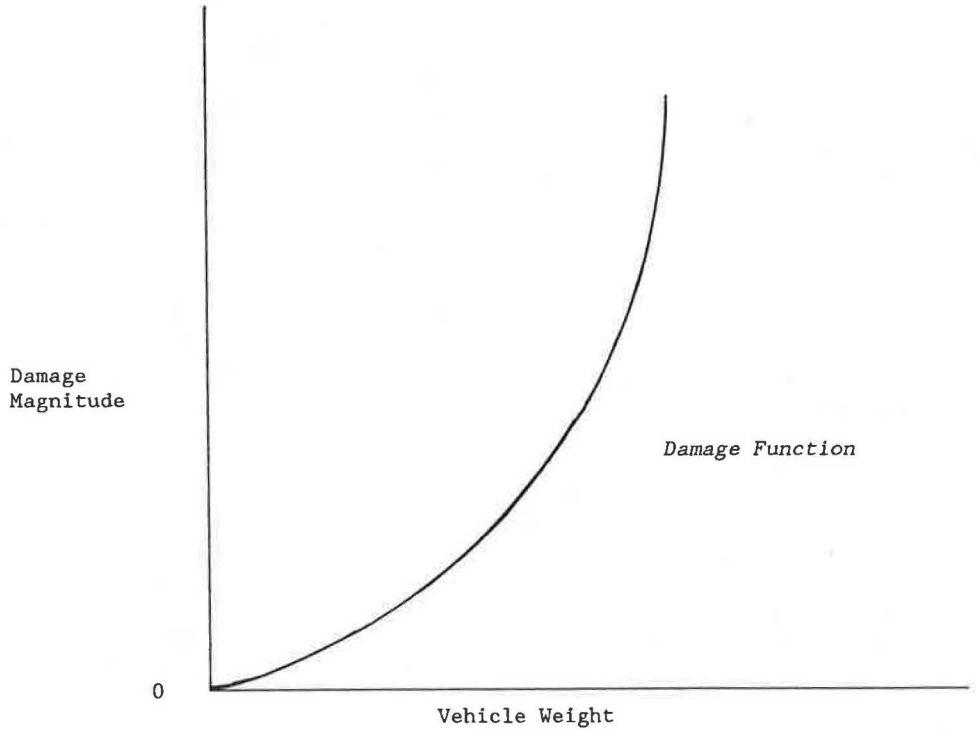

FIGURE 1 Roadway damage and vehicle weight.

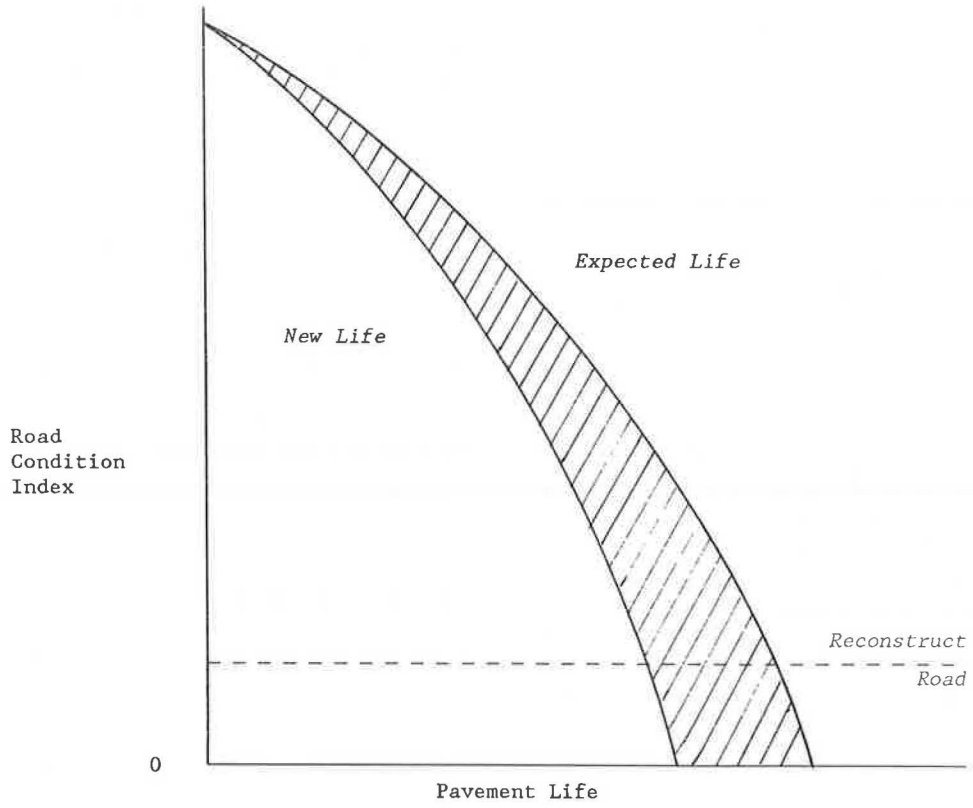

FIGURE 2 Weight and pavement life.

maintenance and reconstruction costs necessary to recapture the desired road life. It is this financial impact that the procedure outlined in this paper is designed to predict.

PROCEDURE MODEL

The general approach used to identify and predict impacts of potential abandonment is schematically presented in Figure 3. At each stage of the procedure it is necessary to identify (a) the information needed, (b) its characteristics, and (c) its source.

Stage I

The information developed at this stage is designed to identify lines that should be evaluated because of their potential or imminent abandonment. The actual number of lines included in the planner's evaluation will depend on the planning time horizon of each situation where the procedure is applied.

The near-term source to identify potential abandonments will be carrier system diagrams and those lines put in the Class I category. These obvious choices can be supplemented in an expanded time horizon by monitoring light-density lines and those that seem to have undergone deferred maintenance. Other sources of line identification are analyses such as those done in the Palouse Empire Regional Rail Study or the Wilbur Smith study for the Washington Rail Development Commission (*3*). Other states have similar ongoing "special interest studies."

Stage II

The shippers presently being served on the line under evaluation will then be identified. This inventory will include the major shippers, by both physical volume and revenue to the carrier, as well as minor shippers as time and expense permit.

Although the difficulty will increase if the number of shippers is large, the following approach appears to be reasonable. The most direct source of such information is the listing of shippers obtained from the carrier. Additional sources of more detail on potential movements on the railroad include the state departments of transportation (SDOTs), agriculture, economic development, and so on and county and city public works and planning departments. County commissioners and chambers of commerce and others who deal directly with business firms can provide general, and sometimes specific, information that is current. All of this information can be supplemented by visual inspection of the line and interviews with the shipping community.

Stage III

This stage is critical to the procedure's success. Specific information on volume of shipments and transportation characteristics of shipments is needed to determine the location and magnitude of the road impacts. Shipper volume expected on the line, if abandonment were not to occur, will be identified. Our work and interviews have determined that all shippers can, in their own estimation, determine confidently how they will move the product if abandonment occurs. That traffic

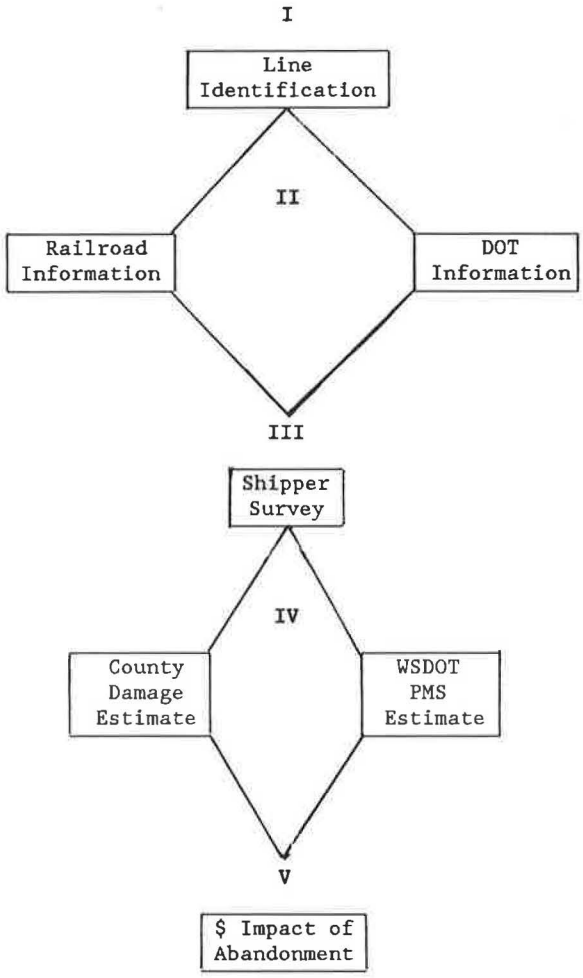

FIGURE 3 Procedures model.

pattern now, and expected after abandonment, will be determined by specific road segment and mode of movement. The seasonality of potential movement and new alternative market determination (and traffic patterns) will also be discussed. Further information collected at this stage of the procedure includes the types of vehicles to be used, respective weights, configurations, incidence of overload, and so on. Finally, the composition, condition, and jurisdiction of the affected roads will also be needed.

The principal source of this information will be interviews or surveys of shippers identified in Stage II. The condition of the specific road segments will be obtained from the SDOT Pavement Management System (PMS) or from county road engineers, as appropriate. Field inspections may be used to supplement other sources.

Stage IV

The information developed in Stage III will be presented to county engineers and SDOT engineers for evaluation of the physical impacts. Through the use of damage functions, the physical deterioration caused by the increased traffic is determined for each road segment. This information is then developed into an estimate of financial impact on each segment of road, using maintenance and reconstruction cost estimates of county and state engineers.

Stage V

Stage V is the culmination of the financial evaluation. Cost estimates, by segment, are aggregated into an estimate of total damage caused by the rail line abandonment under analysis. The aggregate figure can be segmented into a state versus county jurisdiction, a county by county basis, and so on.

CASE STUDY APPLICATION

The procedure outlined in this paper is being applied in four branch line abandonments in Washington that took place over the past 8 years (*6*). The largest abandonment, in terms of miles of track, was the Columbia River to Mansfield line in central Washington, which was the initial case study to be completed. This line had substantial documentation available because efforts to set up a short-line railroad had been initiated by the principal shipper, Central Washington Grain Growers (CWGG).

Situation

The Columbia (mile post 0.0) to Mansfield (mile post 60.7) rail line, referred to in this report as the Mansfield line, was a Burlington Northern (BN) branch line put on BN's system diagram map in late 1982. The line was authorized for abandonment January 31, 1985, by the ICC, with actual abandonment taking place in 1986. The line had been served by BN 1 day per week or on an as-requested basis. Box cars were used on this line, rather than covered hopper cars, because of the condition of the line. The line was laid with light rail, predominantly less than 90 lb/yd (42 mi of 68-lb track, 11 mi of 77-lb and 7 mi of 80-lb), and had numerous 12-degree curves and a generally descending grade from Mansfield. Few rail anchors were in place on most of the line. In 1983, BN estimated that it would cost $7.2 million to rehabilitate the line to accommodate fully loaded 100 ton hopper cars at 25 mph. This would have necessitated relaying the entire line with 115-lb rail, replacing one-half of the ties, and placing new ballast. Costs of operation, on and off branch, were $1,076,130 with revenues of $1,213,665 in 1982, yielding a net return to BN of $137,535. Granted, such an estimate is based on an accounting, rather than economic, basis but because ICC considers such data as relevant, the estimate is appropriate for this discussion.

Elimination of the rail line made the development of a viable trucking alternative necessary. This was accomplished when CWGG, the principal shipper on the line, developed a multiple-car loading facility at Coulee City (see Figure 4).

CWGG made attempts in 1982 to 1984 to form a Columbia-Mansfield Railroad, Inc., a wholly owned subsidiary. Because of the impacts of the abandonment in Douglas County, there was a local effort to aid CWGG in maintaining service. The local interest in the problem resulted in the Washington legislature establishing enabling legislation for the formation of a special rail district authority for counties. The question of

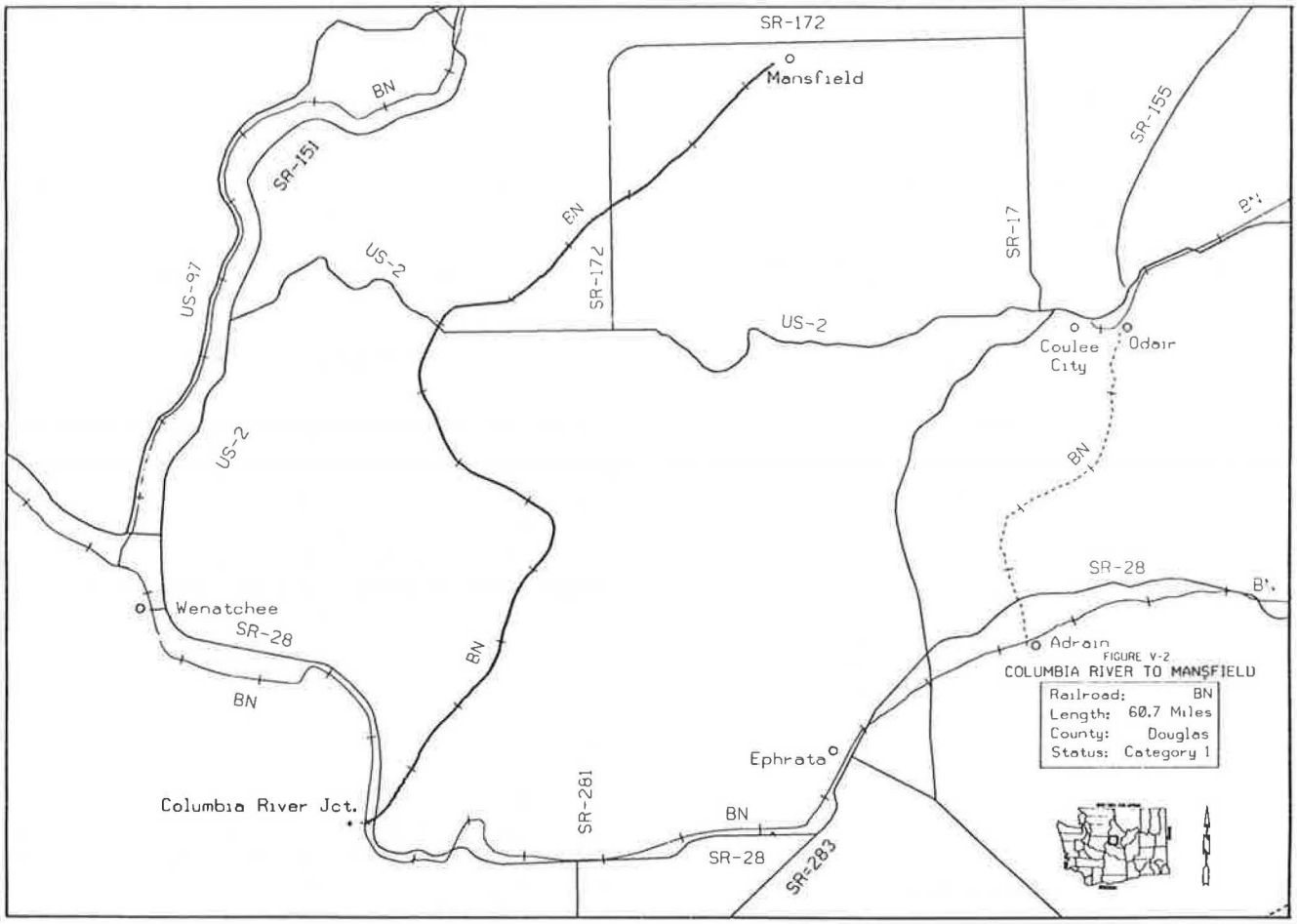

FIGURE 4 Mansfield line general area.

forming a district was put before the voters in Douglas County and rejected by a small margin of four votes in November 1983, after which the line was finally abandoned. (It is interesting that the Washington State Rail Plan identified a benefit/cost ratio of 1.71 to any funds designed to rehabilitate the line.)

Stage I

This line was obvious in its disposition toward abandonment. The line consisted of lightweight rail and numerous bridges and had only one agricultural shipper. The system diagram maps and the light density on the line (200 thousand gross ton miles per mile) were indicators of the need to examine the line. Additionally, BN worked with the shipper, warning about the problem early, and gave time for the shipper to seek alternatives to abandonment.

Stage II

Identification of shippers was straightforward. The major shipper on the line was CWGG, a large grain marketing cooperative that had houses (elevator facilities) at seven locations. No other historical or potential shippers were identified. Retail businesses relied on trucking for delivery of their inventory. No new industrial or commercial possibilities were evident.

Stage III

The traffic moving over state highways as a result of the abandonment is effectively the wheat production of Douglas County, as handled by CWGG. The wheat volume handled by CWGG averaged 5.2 million bushels from 1973 to 1987. Over the last 10 years this has decreased to 5.1 million bushels. For the purpose of road damage analysis, the 5.1 million bushels figure was used. This aggregate figure was apportioned out to the seven locations based on capacity of the elevators and historical shipping level.

The traffic pattern resulting from that origination pattern resulted in the distribution shown in Table 1. The interviews conducted with the shippers, engineers, and so on indicated that all movement is now by trucks; these trucks use 48-ft trailers with 18-ft pups and generally operate at the legal maximum weight. The impacted roads are all state highways (SR numbers) with only minor collection occurring on county roads.

Seasonality of wheat movement was evident. Only 10 percent of the annual volume is moved during harvest time, August through September. About 70 percent moves in two

TABLE 1 HIGHWAY TRAFFIC PATTERN AS A RESULT OF THE ABANDONMENT OF THE MANSFIELD RAIL LINE

Number Highway Route:	Increase in Truck Traffic:	Truck Weight: (lbs.)	Configuration:
2 (Waterville to Jct. SR-17)	varies by segment	GVW 80,000	48 ft. trailer with 18 ft. pup
2 (Jct. SR-17 to Coulee City)	8,570	"	"
172 (Withrow to Farmer	1,820	"	"
172 (Mansfield to Sims Corner)	2,970	"	"
17 (Sims Corner to SR-2)	2,970	"	"

periods: October through November and January through February. The remaining months move about 5 percent each. Road restrictions do force some of this seasonal pattern.

Stage IV

Projected impacts to maintenance and construction on these highways were made by the Materials Lab of the Washington State Department of Transportation (WSDOT). The pavement management system (PMS) was used to project the equivalent single axle loads and the respective impact on each road segment of the added traffic configuration. (See Casavant and Lenzi (*6*) for a development of the PMS damage identification procedure.) In general, optimum rehabilitation costs over a 20-year period were compared using prior and post traffic volumes of abandonment. The differences in costs were averaged per mile per year for each highway section, then totalled for the entire year. The damage estimates were as shown in Table 2.

Stage V

The annual cost of road maintenance and reconstruction caused by the Mansfield abandonment was estimated to be over $379,000. In order to test the validity and accuracy of this procedure, the actual costs of increased maintenance and construction on these routes were obtained from the respective district office of the WSDOT. The results, summarized in Table 3, indicate a reasonable and even strong correlation between the projected impacts and actual expenditures. In all cases, the actual expenses relative to projected expenses appear to simply reflect partial inflationary pressures over the time period. This suggests that the PMS is providing a reasonable estimate of the increased road maintenance expenditures necessitated by the added traffic.

PROCEDURE EVALUATION

The procedure tested in the case study and reported in this paper performed well, but some modifications to the procedure were identified that would provide better damage estimates. The modified procedure, as indicated in Figure 5 should include the corroboration of PMS findings by surveying the district engineering office and county engineering personnel, as appropriate. In this case study it became apparent that the "hands on" knowledge of the district personnel provided a fairly complete and specific picture of road impacts. This parallel estimate should be incorporated into Stage IV of the procedure.

Shipper identification in Stage III should be broadened to include past and potential shippers in the inventory (IIIA and IIIB in Figure 5). The case studies under way reveal that some historical ex-shippers could be planning to return to railroad usage; similarly, some firms, identified by such entities as the chambers of commerce, were considering moving into the

TABLE 2 MANSFIELD RAIL LINE ABANDONMENT DAMAGE ESTIMATES

INCREASED COSTS			
Route:	Miles:	Average Cost/ Mile/Year:	Cost/Year:
2 (Waterville to Jct. SR-17)	37	$ 1,427	$ 53,076
2 (Jct. SR-17 to to Coulee City)	4	871	3,049
17	14	10,733	149,618
172 (Mansfield to Farmer)	22	5,299	117,850
172 (Mansfield to Sims Corner)	12	4,469	55,416
TOTAL ANNUAL INCREASED COST:			$379,009

TABLE 3 MANSFIELD RAIL LINE ABANDONMENT DAMAGE ESTIMATES COMPARED TO ACTUAL EXPENSES

Route:	Projected Cost (1982)	Actual District Expenditures (1988)
SR 172 (Withrow to Farmer)	$ 32,059	$ 40,000
SR 172 (Mansfield to Sims Corner)	55,416	60,000
SR 2 (Waterville to Coulee City)	56,119	70,000
SR 17	149,618	168,000

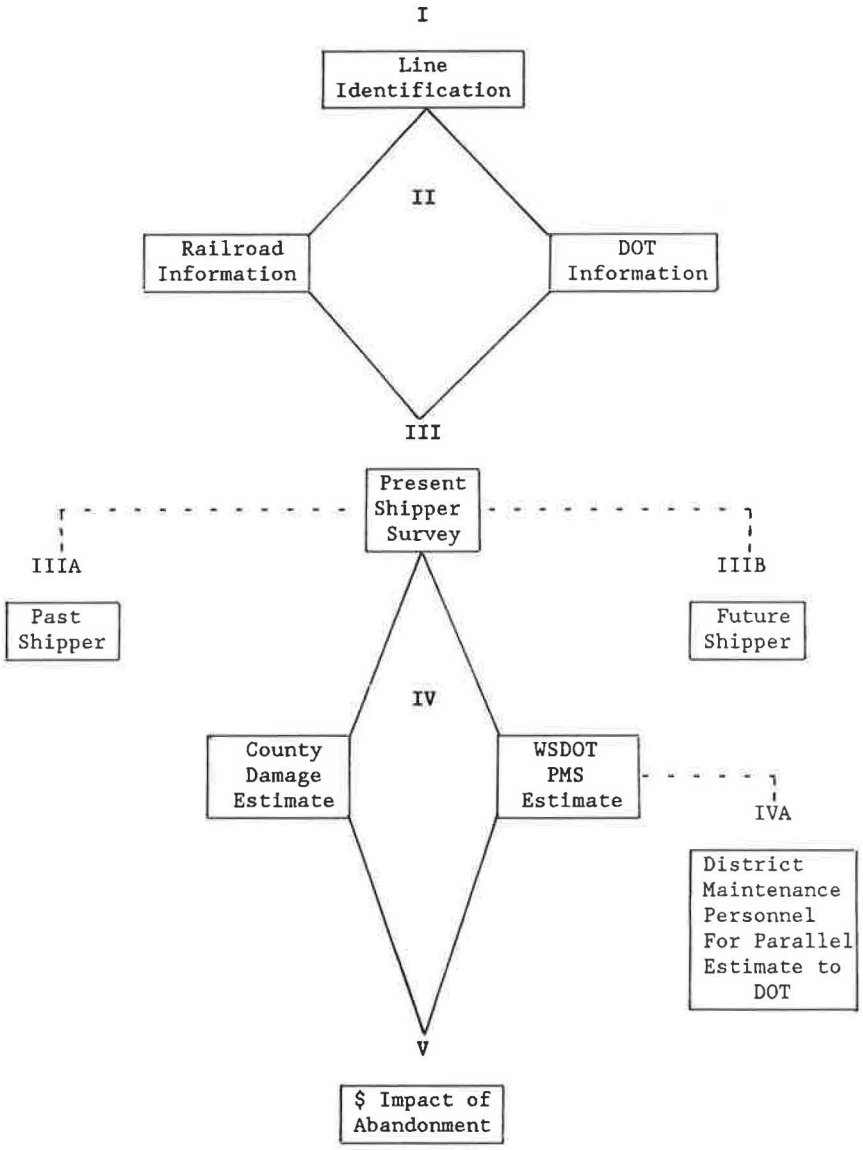

FIGURE 5 Modified procedures model.

area and were potential shippers. Both of these firms could increase the potential damage to roads if abandonment were to occur.

In summary, the procedure developed, tested, and modified in this research effort gives planners the ability to predict damage to roads before a rail line abandonment. But proactive use of this procedure is dependent on continual monitoring by state, county, and local personnel of probable rail line abandonments. Without such a "warning," even this procedure is not beneficial to planning.

Finally, the impacts of rail line abandonment reach past road impacts to other concerns of energy, environment, safety, and economic development. Similar procedures must be developed so that these "public" costs can be interjected into "private costs consideration" so the public can work with private decision makers to achieve societal goals. Using this procedure can be a contributing step to decreasing aggregate public and private costs.

ACKNOWLEDGMENTS

Partial support for this research was obtained from the U.S. Department of Transportation, FRA and FHWA, Washington, D.C., and Washington State Department of Transportation Research Office, Olympia, Washington.

REFERENCES

1. T. E. Keeler. *Railroads, Freight and Public Policy*. The Brookings Institution, Washington, D.C., 1983.
2. K. L. Casavant, J. C. Lenzi, R. Kerr, R. Taylor, and J. Jackson. An Evaluation of the Viability of a Regional Railroad System in the Palouse Region of Washington and Idaho. In *Transportation Research Record 1177*, TRB, National Research Council, Washington, D.C., 1988, pp. 16–26.
3. R. Taylor. *Likely Abandonments*. Draft of Working Paper to the Rail Development Commission, Wilbur Smith Associates, Columbia, S.C., Aug. 1, 1988.

4. B. Borris, K. Casavant, J. Newkirk, and F. Dooley. *A Preliminary Assessment of the Impact on Washington Highways of Rail Line Abandonment and Other Transportation Changes in the Washington Grain Industry*. Washington State Department of Transportation, Olympia, Oct. 1986.
5. K. L. Casavant, R. Sanders, and J. C. Lenzi. *A Review of Impacts on Washington County Roads of Grain Transportation Changes*. Final Report WA-RD 135.1. Washington State Department of Transportation, Olympia, April 1987.
6. K. L. Casavant and J. C. Lenzi. *A Procedure to Predict Selected Impacts on Roads of Rail Line Abandonment*. Draft Report. Washington State Department of Transportation, Olympia, Feb. 1989.

Publication of this paper sponsored by Committee on Application of Economic Analysis to Transportation Problems.