Procedure for Predicting and Estimating the Impact of Rail Line Abandonments on Washington Roads

WA-RD 206.1

Final Report
November 1989

Washington State Department of Transportation
Planning, Research and Public Transportation Division

in cooperation with the
United States Department of Transportation
Federal Highway Administration

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

TECHNICAL REPORT STANDARD TITLE PAGE

1. REPORT NO. WA-RD 206.1	2. GOVERNMENT ACCESSION NO.	3. RECIPIENT'S CATALOG NO.
4. TITLE AND SUBTITLE "Procedure for Predicting and Estimating the Impact of Rail Line Abandonments on Washington Roads"		5. REPORT DATE November 1989 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Kenneth L. Casavant[1] J. C. Lenzi[2]		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. WORK UNIT NO. 11. CONTRACT OR GRANT NO. WSDOT Y-3400, Task 15
12. SPONSORING AGENCY NAME AND ADDRESS Washington State University Department of Agricultural Economics Pullman, WA 99164-6210		13. TYPE OF REPORT AN PERIOD COVERED Final Report 14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

[1]Washington State University
[2]Washington State Department of Transportation

16. ABSTRACT

This summary report describes four case studies of rail line abandonment in Washington. These case studies were used to test a conceptual approach to predicting the location and magnitude of road damage caused by rail line abandonment. The procedure developed in the study worked well, especially as modified in the report to include District personnel in the analysis of potential road impacts. Proactive use of this procedure is dependent on continual monitoring of potential rail line abandonment candidates. Similar procedures should be developed to predict impacts on energy, environment, safety, and economic development.

17. KEY WORDS road damage, rail line abandonment, prediction, impacts	18. DISTRIBUTION STATEMENT No restrictions. This document is available to the public through the National Technical Information Service, Springfield, VA 22616.

19. SECURITY CLASSIF. (of this report)	20. SECURITY CLASSIF. (of this page)	21. NO. OF PAGES	22. PRICE
None	None	41	

DOT FORM 310-022 (11/86) -1216-

PROCEDURE FOR PREDICTING & ESTIMATING THE IMPACT OF RAIL LINE ABANDONMENTS ON WASHINGTON ROADS

by

Kenneth L. Casavant
Department of Agricultural Economics
Washington State University
Pullman, WA 99164-6210

and

J.C. Lenzi
Planning Office
Washington State Department of Transportation
Olympia, WA 98504-5201

J.C. Lenzi, Technical Monitor

FINAL REPORT

Research Project Y3400
Task 15

November 1989

Prepared for Washington State Department of Transportation and in cooperation with U.S. Department of Transportation, Federal Highway Administration, and Federal Railroad Administration.

TABLE OF CONTENTS

Sections:

List of Figures:

List of Tables:

DISCLAIMER

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Washington State Department of Transportation, the Federal Highway Administration, or the Federal Railroad Administration. This report does not constitute a standard, specification, or regulation.

PROCEDURE FOR PREDICTING AND ESTIMATING THE IMPACT OF RAIL LINE ABANDONMENTS ON WASHINGTON ROADS

SUMMARY

Many regulatory and economic changes have facilitated the abandonment of rail branch lines. The impacts of abandonment vary in magnitude and location. Mode shifts from rail to highway and corresponding increased volumes are causing increases in costs of road maintenance and reconstruction -- costs borne by the public, but caused by private decisions.

Previous studies reflect a characteristic of these impacts, that is, the potential magnitude of impact, physical and financial, on nearby roads has not been determined prior to the rail line abandonment. This report develops and tests a procedure to determine these impacts in an "ex ante" rather than "ex poste" time frame.

The procedure relies on available data to identify rail lines that are potential candidates for abandonment, and to determine what shippers (past, present and potential) exist on the line. Specific information on volume of shipments and transportation characteristics of these shipments is used to determine the estimated physical impacts on identified roads. This information is then incorporated into a determination of the financial cost (increased highway maintenance and reconstruction) associated with the rail line abandonment.

The procedure was developed and tested on four case studies of rail abandonment in Washington, and subsequently finalized with only minor modifications. The results were found to be valid. As a consequence, the

procedure does give planners the ability to predict magnitude and location of road damage prior to a rail line abandonment.

CONCLUSIONS AND RECOMMENDATIONS

Proactive use of this procedure is dependent on continual monitoring by State, County and local personnel of potential rail line abandonments. Without such monitoring, even this procedure can not be beneficial in forecasting potential impacts on highways and roads.

What is also evident from the differing case studies is that the magnitude of damage is heavily dependent on the volume of increased traffic relative to the type of road upon which the commodities will be moved. When additional traffic is added to pavements with high-structural design, little impact is discernible. Yet, county roads that have been constructed for projected low traffic volumes and lesser pavement standards are very susceptible to damage when the commodity movements shift to truck as a result of reduced rail service and eventual rail line abandonments.

Finally, the impacts of rail line abandonment reach past road impacts to other concerns of energy, environment, safety, transport rates and economic development. Similar procedures must be developed so these costs can be considered in conjunction with "private cost considerations" so the total increased cost is known. This must occur so the public can work with private decisionmakers to achieve optimum transportation goals. Using the procedure developed in this study can be a contributing step to decreasing aggregate public and private costs.

INTRODUCTION

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. The access to resources for growth, country development and consolidation depended heavily on these efficient transportation linkages. Railroads were one of the first efficient modes and continue to be a positive 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 transportation system. In particular, the focus of this report is on the railroads. Today these changing conditions in the United States are resulting in the abandonment of rail branch lines. Congress in the late 1970's and early 1980's enacted laws partially deregulating the railroad industry which allowed changes in railroad decisionmaking and substantially eased the process of rail line abandonments. The Railroad Regulatory Reform & Revitalization (4-R) Act, enacted in 1976, "established the principle that a railroad cannot be forced to provide service on a line 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 furthered the process of liberalizing rail abandonments.

These changes have facilitated the abandonment of rail branch lines. Rail abandonment, common in the Midwest since the 1950's, has come to the State of

Washington in full force. Over the past ten years, the extent of the rail network nationally and in Washington has shrunk considerably. Since 1980, 77 rail line segments constituting over 1,150 miles of track have been abandoned in Washington. This abandonment is directly affecting the highways and roads in Washington as it forces more and more shippers to use trucks to carry grain and other commodities to more distant rail lines river ports, or final destinations. And, it appears further abandonments are forthcoming.

The impacts of abandonment vary in magnitude as well as to whom is affected. An important and often unconsidered cost that is ultimately exemplified by the abandonment of a rail line is the damage to roads caused by the traffic shift. Such traffic shifts cause increases in costs of highway maintenance and reconstruction, costs borne by the public, but caused by private decisions. These costs have traditionally not been understood, available, nor quantified prior to an abandonment. Hence, they are not specifically considered by the local decisionmakers or the Interstate Commerce Commission (ICC) in granting a petition to abandon rail lines. However, in the abandonment proceeding for the line from Rosalia to Spring Valley, Washington, abandonment was temporarily restrained by describing potential increased cost impacts on local roads which could result from abandonment. Unfortunately, due to lack of specific financial details on these impacts, local government and/or private sector entities did not pursue purchase of the rail line because they did not have the cost relationships of continued rail operations versus increased highway costs and transportation rates. Further, the ICC could not include non-existent costs in their deliberations. The line was approved for abandonment by the ICC shortly thereafter.

Several studies have provided general estimates of financial and physical impacts of past rail line abandonment on county roads and state highways in Washington. A preliminary examination of these impacts on state highways found rail line abandonment to be having only marginal effect in general, but was creating "pockets of potential problems" (1). 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, resulting from the shift of freight traffic from rail lines to roads. (2). The total estimated financial need to repair roads was about $1.5 billion, for the ten-county study area in eastern Washington (approximately $400 million related directly to rail line abandonment).

The central theme of these findings, and the overall problem is that the potential magnitude of impact, physical and financial, on nearby highways and roads, resulting from traffic shifts reflected ultimately by abandoning a rail line segment, has not been established. These studies have been "ex poste" 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 rail line abandonment as well as develop strategies and financing to offset damages. The purpose of this procedure is primaily twofold. First, it attempts to make the reader aware that there are other infrastructure costs involved with railroad abandonments other than those directly related to the costs supplied by railroads. Secondly, with the development of a model that supplies other infrastructure costs that are likely to occur from a rail line abandonment, it gives decisionmakers better information. In Washington State both counties and port districts are empowered to acquire and operate rail lines. If cost comparisons indicate it may be less expensive to acquire and operate a rail line proposed for abandonment than pay for the increased road costs caused by the shift of traffic rail operations can be initiated by local governments.

OBJECTIVES

The overall purpose of this report is to detail the results of a study identifying increased fiscal road impacts resulting from rail line abandonment. Specific objectives of the study were to:

1) Develop a procedure to allow identification of physical location and financial magnitude of impacts on roads prior to an abandonment.
2) Test the conceptual procedure on past rail line abandonments as case studies.
3) Identify reasons for differing magnitudes of impacts.
4) Reformulate the procedure and outline problems and implementation.

CONCEPTUAL MODEL

Technical Background

There are five major elements that affect the performance of roadways. These are the underlying soil (the subgrade), the pavement structure, traffic loads, traffic volume, and the environment. Pavements are generally divided into two broad types: flexible and rigid. Flexible pavement often consists of an asphalt-type surface layer built on a base and resting on a compacted subgrade or the natural soil foundation. Rigid pavements are composed of a portland cement concrete slab placed on a subgrade or subbase. The essential difference between the two is the manner in which they distribute the load over the subgrade. Asphalt passes the force down through the layers directly below the load. Concrete or rigid pavement functions more like a board or plank, spreading the force over a larger area. Rigid pavements generally withstand repetitive loading better than flexible pavements and normally have a longer life cycle between necessary repairs.

The speed of pavement deterioration is affected by the number and type of loadings and the environment, principally the moisture and freeze-thaw cycle which create internal stress that limit a pavement's life. As the environment causes pavement deterioration, this process can be accelerated by heavy traffic.

The life of a pavement is directly affected by the pavement design relative to traffic volumes and loads. It is not just the maximum size of a load that is critical, but the number of loads applied to the pavement that is important. Loads are evaluated using the common measures of Kips (1,000 lbs.) and ESALs. ESALs are equivalent single-axle loads rated at 18,000 lbs. such that all loads, both single and tandem (dual) axles, are expressed in the number of ESALs that will pass over a pavement during its design life cycle.

The force inflicted on a pavement depends on gross vehicle weight (GVW), per axle weight and the distance between axles (measured by the bridge formula). The general relationship between vehicle axle weight and damage is shown in Figure 1. Damage increases in a greater proportion than the increase in weight, thus overloaded grain or lumber trucks are especially tough on roads not designed for those loads. The overall impact of the increased weight and traffic volume on

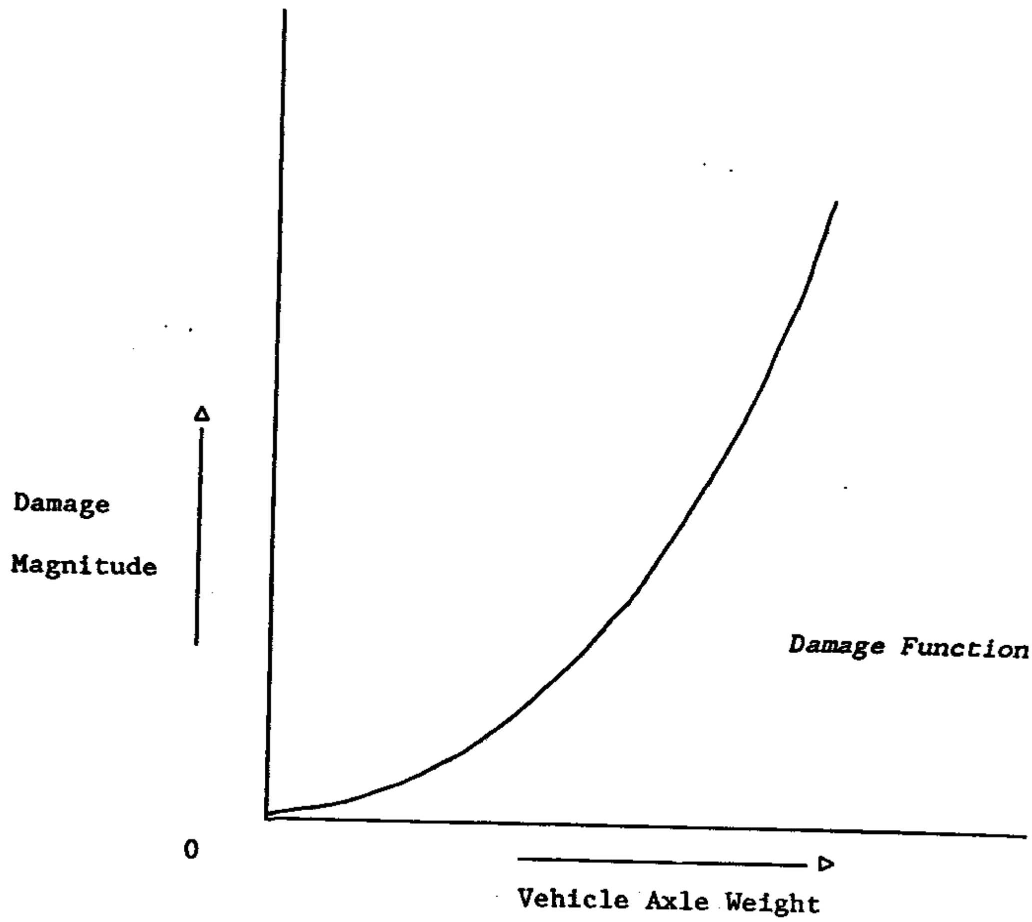


Figure 1. Roadway Damage and Vehicle Axle Weight

pavement life is shown in Figure 2. The shaded area reflects the increased maintenance and reconstruction costs necessary to achieve the desired road life. It is this impact that is generated by the increased incidence of ESALs and environmental effects on the state highways and county roads in the state of Washington.

At times, the loss of rail service adds only a relatively small number of trucks to the local road network on a daily basis. This incremental increase in truck traffic may appear quite small in comparison to the existing truck traffic. However, in rural areas, this minor truck traffic increase results in damage increases of a significant magnitude. Rural roads were often built with lower pavement structural design standards, are older in age and were not built for today's heavier (often overloaded) trucks. This is contrasted with the Interstate and urbanized state highways which are constructed to withstand heavier loadings and adverse environmental conditions.

Financial Impacts

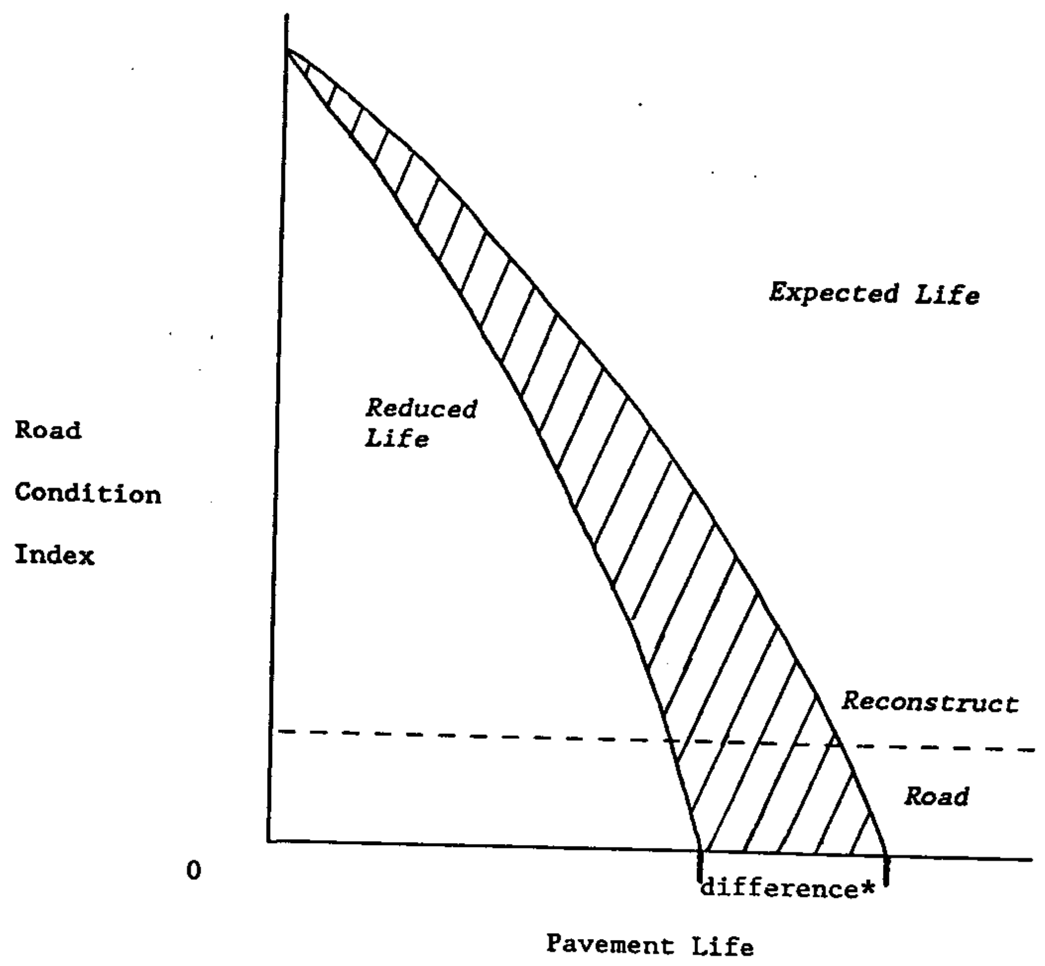
Specific impacts by highway segment can be initially quantified by using an equation developed by the South Dakota Department of Transportation's Planning Division, listed as follows:

$$(M_o - M_n)_H = (T)(V)(L) \times [0.00251331]$$

where:

$(M_o - M_n)_H$ = Increased Annual Highway Maintenance Cost ($)

T = Number of one-way truck trips per year diverted from rail



*Equates to increased or earlier roadway repair/reconstruction that must be done sooner than normal life cycle design.

Figure 2. Weight and Pavement Life

V = Average gross vehicle weight per round trip (tons)

L = Length of haul (round-trip miles)

This approach, however, looks only at increased highway maintenance cost and does not include reconstruction costs.

The Pavement Management System (PMS) of WSDOT has been used in numerous studies of road impacts over the past five years. This system, based on the results of the AASHTO Road Tests, but adapted for Washington, uses specific information on the condition of each road segment. Scattergrams of the yearly condition for each segment were used to construct a best-fit curve which identifies the realized relationship of road life to wheel loads (related to ESALs per year). With expected normal vehicle trips and volume levels determining the specific expected pavement section deterioration rate, this rate (curve) is then adjusted by the additional truck trips and volumes associated with nearby traffic shifts to highways resulting from rail service deterioration and eventual rail line abandonment. The resultant new pavement performance curve identifies the financial cost of the changed pavement life expectancy.

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: 1) the information needed, 2) its characteristics, and 3) its source.

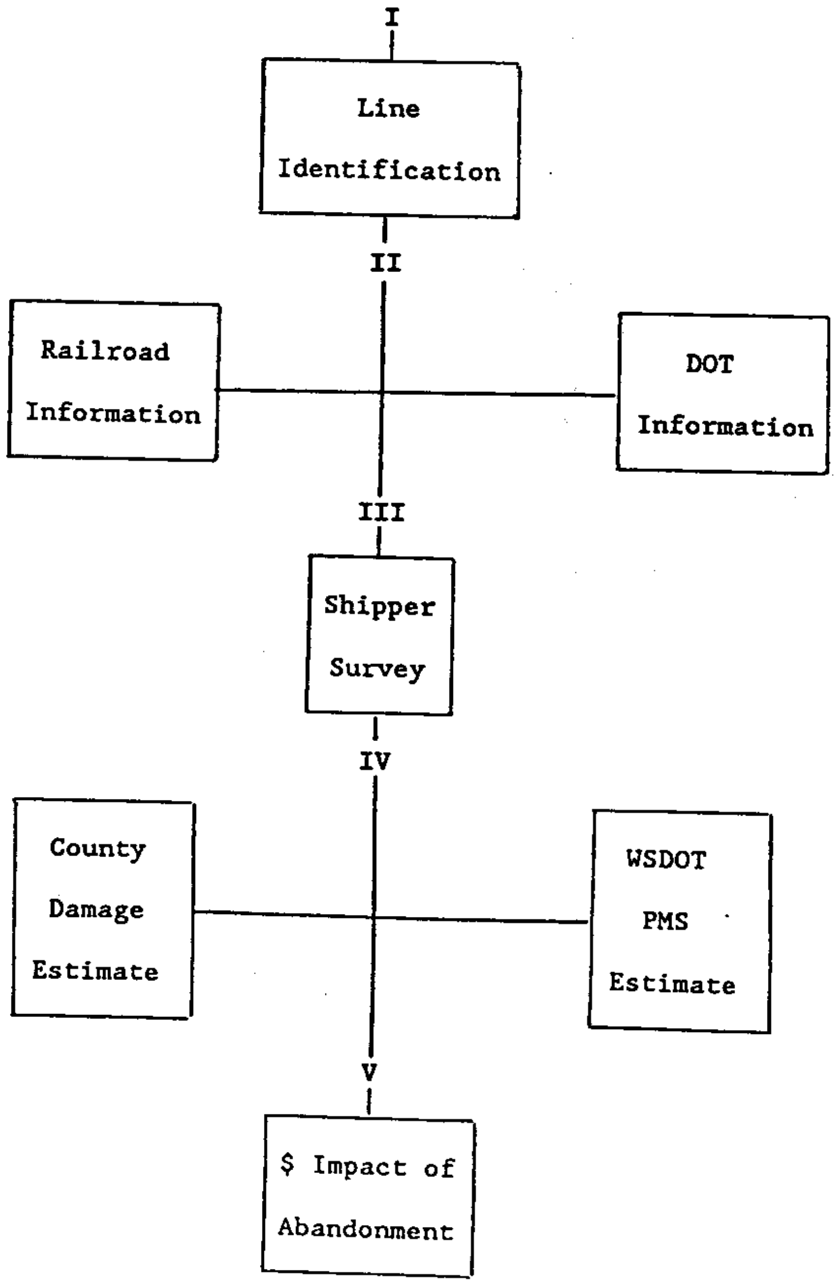


Figure 3. Procedure Model

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 rail 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 those rail lines put in Category I on carrier System Diagram Maps. These obvious choices can be supplemented in an expanded time horizon by monitoring light density rail lines and those that have undergone deferred maintenance by the railroad. Other sources of line identification are analyses such as those done in the Palouse Empire Regional Rail Study (5) or the Wilbur Smith Study for the Washington State Rail Development Commission (3).

Stage II:

The shippers presently being served on the rail 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 time required will increase if the number of shippers is large, the following approach seems reasonable. The most direct source of such information is the listing of shippers obtained from the carrier. Additional sources of more detail on potential rail car movements on the railroad include the Department of Transportation; the State Departments of Agriculture, Trade and Economic Development, etc.; and counties and cities 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.

<u>Stage III</u>:

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 financial magnitude of the road impacts. Shipper volume expected and routing, if abandonment were to occur, will be identified. Our work and interviews have determined that all shippers can estimate volume and determine confidently how they will move the product if abandonment occurs. The traffic pattern before, and expected after rail line abandonment, will be determined by specific road segment. The seasonality of potential movements and the determination of new alternative market possibilities (and traffic patterns) can also be assessed accurately. Further information collected at this stage of the procedure includes the types of vehicles to be used, respective weights, configurations, and potential incidence of overloads, etc. Finally, the composition, condition and jurisdiction of the affected roads can also be identified.

The principal source of this information will be interviews or surveys of shippers identified in Stage II. The condition of the specific highway and road segments can be obtained from the State Department of Transportation personnel, often from their Pavement Management System (PMS) or from local county/city road engineers, as appropriate. Field inspections may be used to supplement other sources.

Stage IV:

The information developed above can then be presented to city/county engineers and State Department of Transportation 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 highway and road segment. This information can then be developed into an estimate of financial consequences for each segment of roadway, utilizing maintenance and reconstruction cost estimates of city, county and state engineers.

Stage V:

This is the culmination of the financial evaluation. Cost estimates by segment are aggregated into an estimate of total roadway damage caused by projected freight movements that shift from the rail line abandonment under analysis to available roadways. The aggregate figure can be segmented into a state versus county jurisdiction, a county-by-county basis, etc.

CASE STUDY APPLICATIONS

The procedure outlined in this report was applied in four rail branch line abandonments in Washington that took place over the past eight years. The four case study locations are shown in Figure 4. This allowed testing of the procedure under significantly different situations. The largest abandonment, in terms of miles of track, the Columbia River to Mansfield line in central Washington, was the initial case study to be completed (4).

MANSFIELD LINE

Situation:

This rail 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. The Columbia (MP O.O) - Mansfield (MP 60.7) rail line, referred to in this report as the Mansfield line, was a Burlington Northern Railroad (BN) branch line. It was put on the BN's System Diagram Map in late 1982, and was authorized for abandonment in January 31, 1985, by the Interstate Commerce Commission. The line was salvaged (removed) in 1986. The line had been served by BN one day per week or on an "as requested" basis. It had an estimated net liquidation value of $1,163,000 in 1984. Box cars were used on th line, rather than covered hopper cars, because of the condition of the line. The line consisted of light rail, predominantly less than 90 lb./yard (42 miles of 68 lb., 11 miles of 77 lb. and 7 miles of 80 lb.), had numerous 12 degree curves, and a generally descending grade from Mansfield to Columbia (Wenatchee). 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 (263,000 pounds gross) hopper cars at 25 mph. This would have necessitated relaying the entire line with 115 lb. rail, installing rail anchors, replacing one-half of the ties and placing new ballast.

Estimated 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 basis, rather than economic, but since

ICC considers such data as relevant, it is appropriate for this discussion. It has been noted that the line would have required substantial rehabilitation to stay in service. Therefore, once these rehabilitation costs are factored into the calculations, the rail line would reflect a significant deficit/loss.

Elimination of the rail line made the development of a viable trucking alternative necessary. This was accomplished when Central Washington Grain Growers (CWGG), the principal shipper on the line, developed a multiple rail car loading facility at Coulee City (Figure 5) that they supplied by trucks.

CWGG made attempts from 1982-84 to form a Columbia-Mansfield Railroad, Inc., a wholly-owned subsidiary. Because of the predicted impacts of the abandonment in Douglas County, there was a local effort to aid CWGG in maintaining rail service. The local interest in the problem resulted in the Washington State Legislature establishing enabling legislation for the formation of a special rail district authority for counties. The question of forming a district was put before the voters in Douglas County and rejected by a small margin, 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 (B/C) ratio of 1.71 to any funds designed to rehabilitate the line.)

Stage I:

This rail line was obvious in its disposition towards abandonment. The line consisted of lightweight rail, numerous bridges and had only one agricultural shipper. The Railroad System Diagram Maps, as well as the low density volume movement on the line (260 thousand gross ton-miles per mile) were indicators of

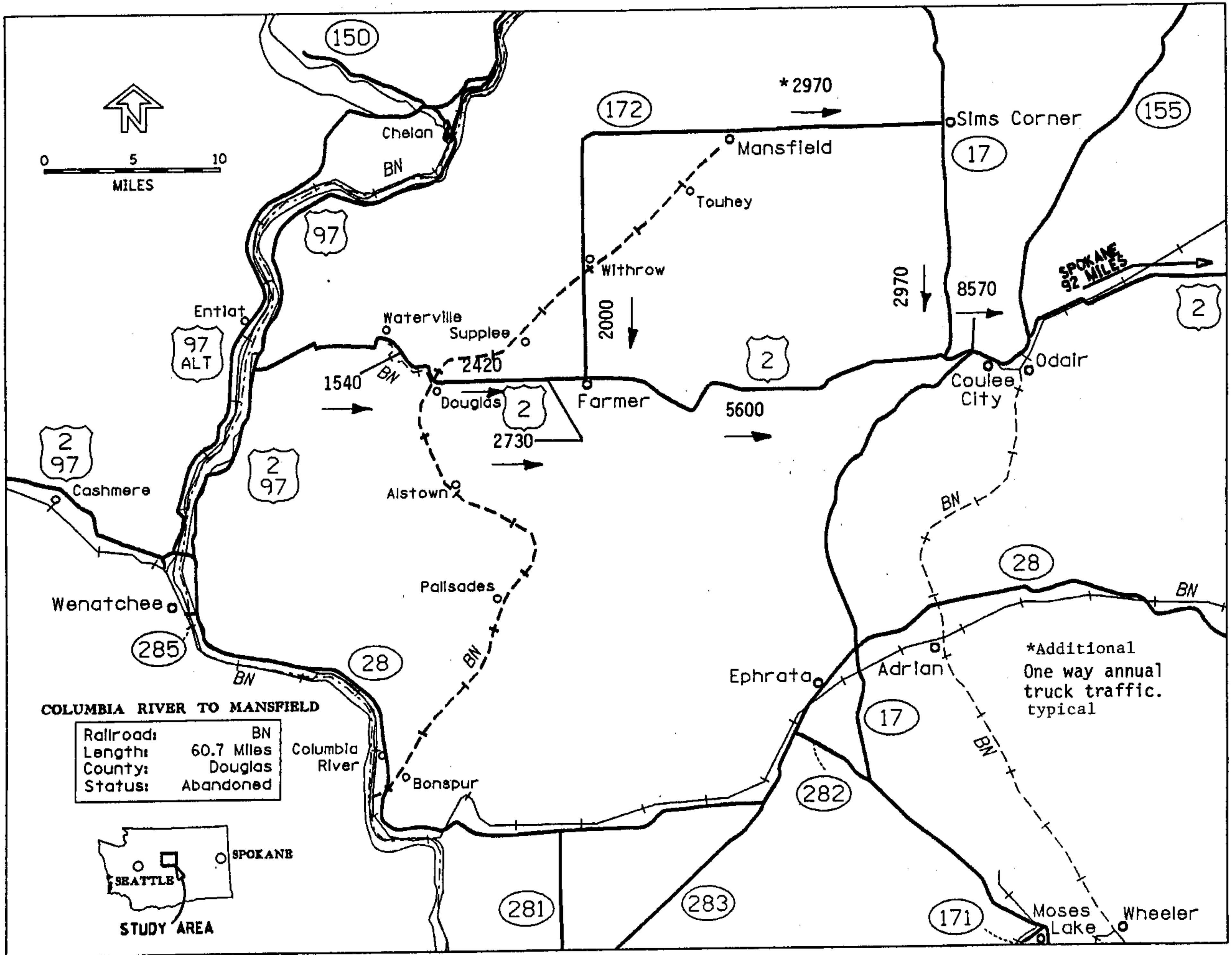


FIGURE 5. MANSFIELD LINE

the need to examine the line. Additionally, the 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 the Waterville Plateau and surrounding Douglas County, as handled by the CWGG. The wheat volume handled by the CCGG averaged 8.6 million bushels from 1973-1987. Over the last few years this has decreased to 8.5 million bushels. For purpose of road damage analysis the 8.5 million bushel figure was used. This aggregate figure was apportioned out to the seven locations based on capacity of the elevators, historical shipping levels and discussions with CWGG.

The traffic pattern resulting from that origination pattern resulted in the distribution shown in Table 1. The interviews conducted with the shippers, engineers, etc., indicated that all grain movement is now by trucks. These trucks operate with 48 ft. trailers and 18 ft. pups and generally operate at the legal

Table 1. Origination Traffic Pattern

NUMBER HIGHWAY ROUTE:	ANNUAL INCREASE IN ONE-WAY TRUCK TRAFFIC:	TRUCK WEIGHT (LBS.)	CONFIGURATION:
2 (Waterville to Jct. SR-17)	varies by segment	GVW 80,000 "	48' trailer with 18' pup
2 (Jct. SR-17 to Coulee City)	8,570	"	"
172 (Withrow to Farmer)	2,000	"	"
172 (Mansfield to Sims Corner)	2,970	"	"
17 (Sims Corner to SR-2)	2,970	"	"

maximum weight. The impacted roads are all state highways (SR numbers including US2) 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-September. About 70 percent moves in two periods: October-November and January-February. The remaining months move about 5 percent each. Road restrictions and government policies do force some of this seasonal pattern.

Stage IV:

Projected maintenance and construction impacts due to the increased trucking on these highways were made by the Materials Lab of the Washington State Department of Transportation. The Pavement Management System (PMS) was utilized to project the increased wheel loads (related to ESALs) and the respective impact on each roadway segment of the added traffic. Highway rehabilitation costs over a twenty-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 resulting in increased costs are shown in Table 2. Further, increased transportation shipping costs resulting from trucking to Coulee City were in excess of $0.10 per bushel.

Stage V:

The annual increased cost of road maintenance and reconstruction caused by the Mansfield abandonment was estimated in 1982 to be over $379,000 (1982 dollars). In order to test the validity and accuracy of this procedure, the actual

Table 2. Estimated Increased Costs

ROUTE/YEAR:	MILES:	ADDITIONAL AVERAGE COST/ MILE/YEAR	ADDITIONAL COST/YEAR:
2 (Waterville to Jct. SR-17)	37	$ 1,427	$ 53,076
2 (Jct. SR-17 to Coulee City)	4	871	3,049
17	14	10,733	149,618
172 (Mansfield to Farmer)	22	5,299	117,856
172 (Mansfield to Sims Corner)	12	4,469	55,416
TOTAL ANNUAL ESTIMATED INCREASED COST:			$379,015

costs of increased maintenance and construction on these routes were obtained from the appropriate District Office of the WSDOT. The results indicate a reasonable and even strong correlation between the projected highway impacts and actual expenditures, as shown in Table 3. In all cases, the actual expenses relative to projected expenses seem to simply reflect partial inflationary pressures over the time period. This suggests that the PMS is providing a reasonable estimate of the increased road expenditures necessitated by the added traffic, thus supporting the usefulness of the procedure.

ABERDEEN TO MARKHAM LINE

Situation:

This 10.26 mile-long segment of the Burlington Northern extends in a westerly direction from south Aberdeen in western Washington (Figure 6). The line is served by a local train operating out of Aberdeen with service provided as needed. The line is in fair condition, comprised of 100 and 90 lb./yard rail allowing train speeds of 25 miles per hour.

There is one major shipper on the line, Ocean Spray Cranberries, Inc. This firm has consummated an agreement with BN to continue rail service to their plant, allowing continued inbound movement of corn syrup from Iowa and rice hulls from Arkansas. All outbound product presently moves by truck.

Stage I:

The BN filed an application to abandon this rail line with the ICC on July 27, 1984. The abandonment was approved on January 11, 1985. The net

Table 3. Cost Comparison

ROUTE:	PROJECTED COST: (1982)	ACTUAL DISTRICT EXPENDITURES: (1988)
SR 172 (Mansfield to Farmer)	$ 117,856	$140,000
SR 172 (Mansfield to Sims Corner)	55,416	60,000
SR 2 (Waterville to Coulee City)	56,125	70,000
SR 17	149,618	168,000
TOTAL:	$379,015	$438,000

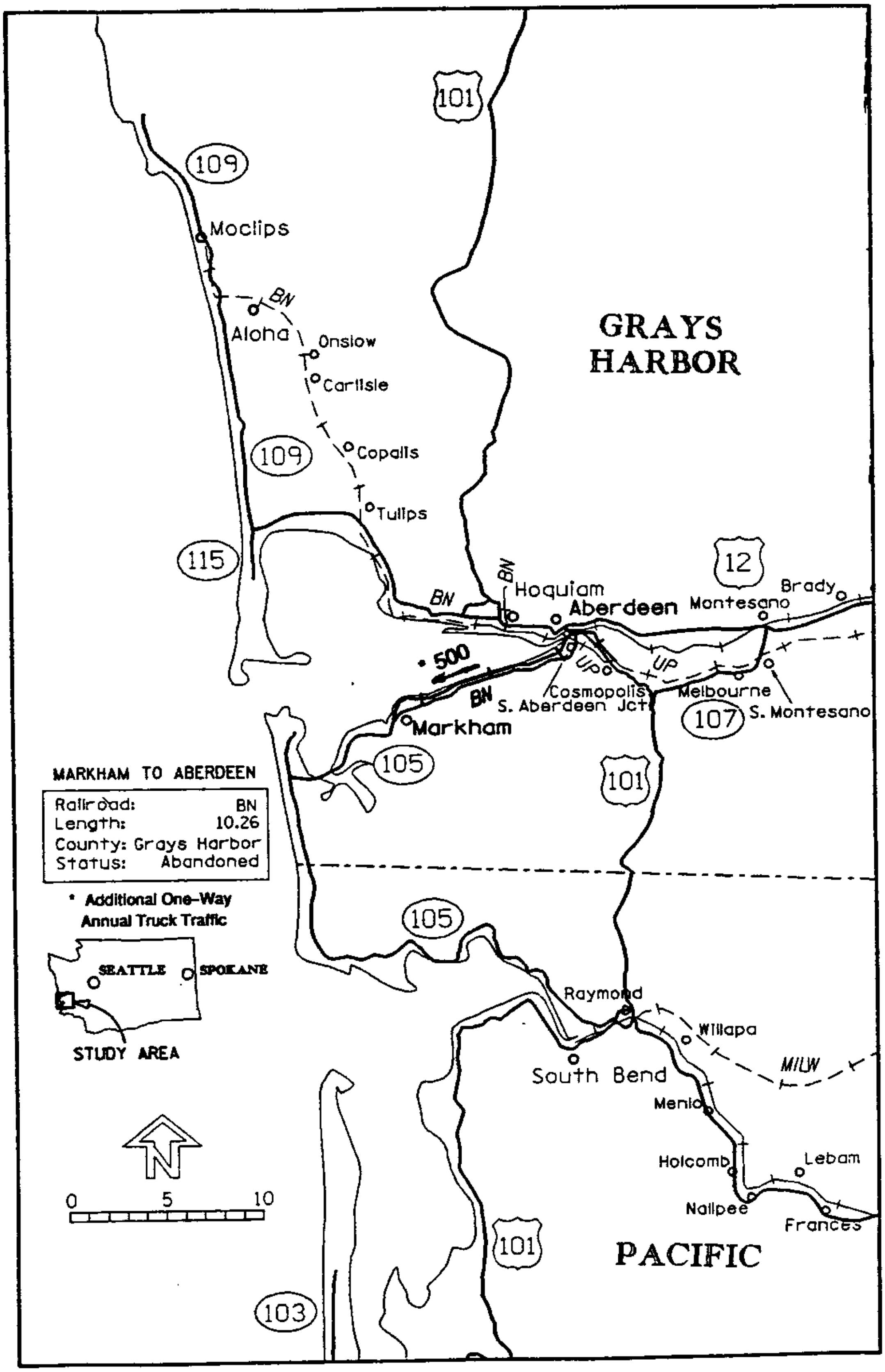


FIGURE 6. ABERDEEN TO MARKHAM LINE

liquidation value was $250,000. The traffic volume in 1982 was only 14,000 gross ton-miles per mile with traffic decreasing steadily from 1978 to 1983. 1983 operating costs and revenue figures showed a net operating loss of $45,000, exclusive of opportunity costs. It was estimated that abandonment of service would result in cost increases of approximately $100,000 per year for the major shipper with a possible shrinkage in the plant's distribution area.

Stage II:

For this line the major shipper, Ocean Spray Cranberries, was easily identified. No other shippers, major or minor, existed for this rail line segment. No historical shippers were identified by the BN, local government officials, or visual inspection of the area.

Stage III:

The potential traffic that would move over local roads if abandonment occurred consists of the truck equivalent of approximately 150 rail tanker cars full of corn syrup per year and about 5 rail boxcars per year of rice hulls. If inbound rail service were lost, a reloading facility for transferring the product to trucks would have had to be built in Aberdeen. This transfer facility would have had to be heated to discharge the corn syrup. Trucks moving the product would have been 80,000-pound semi's with a 45 foot trailers. The estimated increase in truck traffic was 450-500 trucks per year. Some seasonality in traffic would occur. The last week of September to the first week of October is a short, intense harvest and production period.

The road that would have been impacted is State Highway Route 105, from MP 48.76 to MP 37.34 -- a distance of 11.42 miles. The road is asphalt concrete pavement with a 7-inch thickness and a gravel base that varies from 20 to 30 inches in depth.

Stage IV:

The projected impacts from this increased truck movement were evaluated by the Pavement Management System of WSDOT, but no discernible increase in deterioration nor additional costs could be identified. The increased truck traffic is simply too small a part of the total truck traffic on this state highway. No other county or local roads would be affected.

Stage V:

No increase beyond normal road maintenance or reconstruction can be expected because of the high pavement design standard of the highway and the low traffic volume increase. However, from discussions with plant personnel, it is clear that transportation rate increases would have occurred and possibly affected distribution.

DAVENPORT TO ELEANOR LINE

Situation:

This Burlington Northern rail line, (Figure 7) 17.5 miles in length, was abandoned on January 18, 1983. It had a net liquidation value at the time of $647,500, based on an average of $37,000 per mile. The speed limit on this line

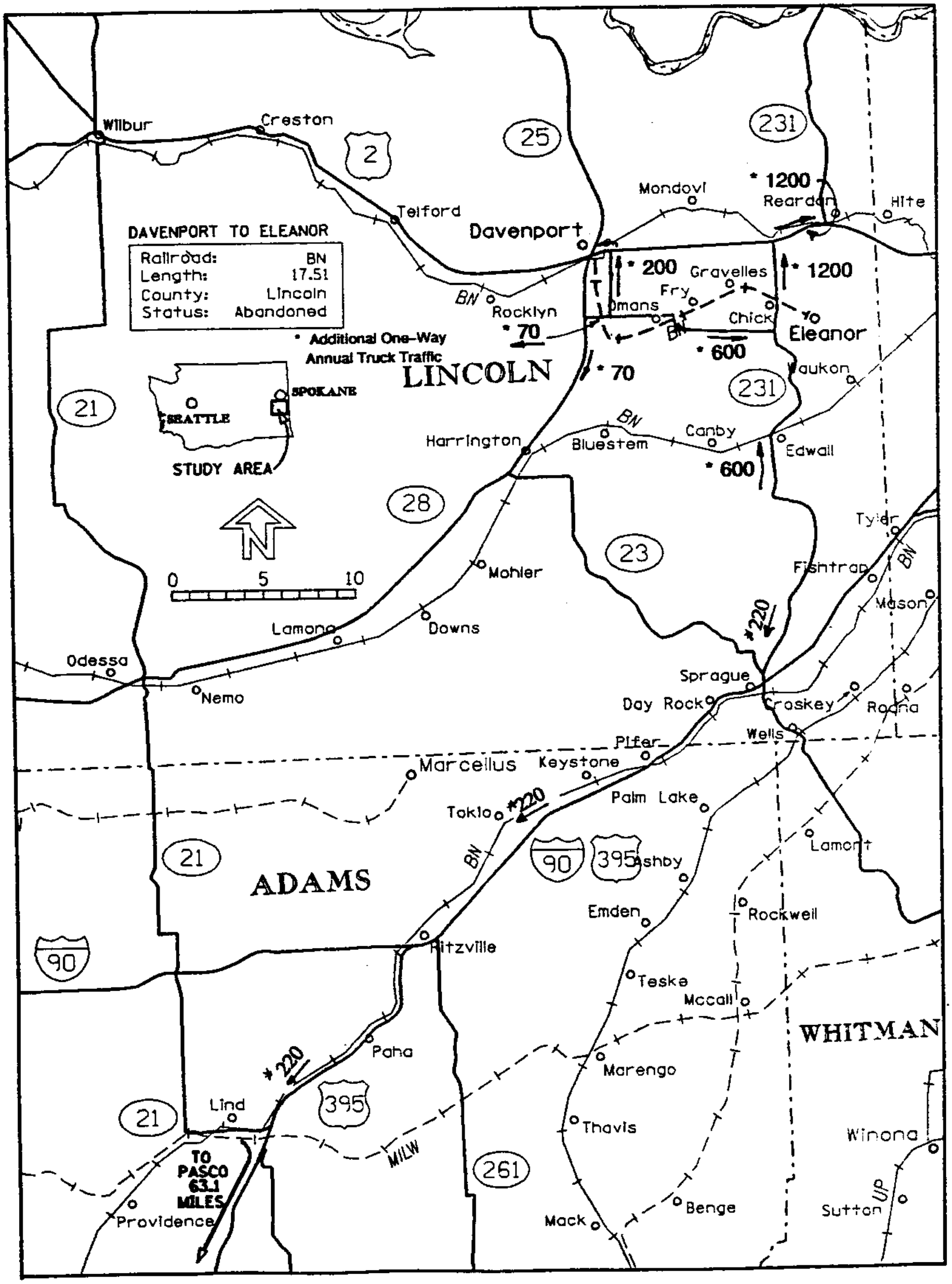


FIGURE 7. DAVENPORT TO ELEANOR LINE

had deteriorated to 10 miles per hour over 14.5 miles of the track and, on the remaining three miles trains could operate at 25 miles per hour. The line condition was poor, with 12.5 miles of 56 lb./yard rail and 5 miles of 90 lb./yard rail. Only 40 foot boxcars could be moved on the line in its condition. BN estimated that it would cost approximately $2 million to rehabilitate the line to accommodate fully loaded jumbo (100 ton) hopper cars (263,000 pounds gross) moving at 25 miles per hour.

This line was served one day per week or on "as requested" basis. The shippers, in an attempt to assist BN in reducing costs, had refrained from requesting cars from December to April, thus eliminating the need for snow removal. The shippers also attempted to group their shipments, when possible.

The long-term prospects for the profitable operation of this line appeared poor with a $27,000 loss in 1980 that continued until abandonment occurred in 1983. Trucking became the substitute service mode with increased transportation shipping costs of $.07 per bushel.

<u>Stage I</u>:

This line, similar to the Mansfield line, was a clear candidate for abandonment. The physical condition of the line, incapable of handling fully loaded 100 ton hopper cars, and the low traffic volume of 31,000 gross ton-miles per mile meant expenditures to reconstruct the line were ill-advised. When it was put in Category I of the BN System Diagram Map, its future was evident.

Stage II:

This line is in a rural, sparsely populated area of eastern Washington. Only three elevators move grain on the line: Reardon Grain Growers operates elevators at Eleanor and Gravelles Spur and Davenport Union Warehouse Company has an elevator at Omans. The two elevators of Reardon Grain Growers have a storage capacity of 400,000 bushels each, with an average volume of 600,000 bushels moving through the elevators annually. The Oman elevator moves about 270,000 bushels annually.

Stage III:

Significant changes have occurred in traffic flow since the abandonment. The Omans elevator grain now moves 75 percent of the time by rail from the Davenport facility, with the other 25 percent going by truck to the Snake River for barge movement to the lower Columbia River export elevators. Reardon Grain Growers now moves their grain by truck to Reardon for reloading for rail movements with some minor amounts of grain also going to the river by truck. Both of these firms move about one-half of their wheat between April and May and the other half from August to October. Little movement occurs in the winter due to roads being posted and snow conditions.

Movement occurs by trucks with 48 foot trailers and 18 foot pups, weighing 80,000 to 105,000 lbs. per load. The increased traffic volume varies by road segment, ranging from 70 to 1,200 loads per year on state highways and 70 to 600 loads on local roads.

Stage IV:

Information on the physical impact of this increased traffic was obtained from WSDOT officials and local/county engineers. For the state highways no discernible increase in deterioration was identified as a result of this traffic. This was checked through PMS calculations and verified by a review of actual field maintenance expenditure records. On the local roads this situation was the inverse; annual increased costs on the roads that were used by shippers totalled \$103,420 (\$6,400 per mile average) with ranges of \$1,662 per mile to \$18,710 per mile.

The significant difference between local and state highways damage increases arises because of the variation in road quality (pavement structural adequacy). The state highways have 3 to 10 inches of pavement over 4 to 10+ inches of base. Local roads, on the other hand, were gravel or a thin 2-inch bituminous surface treatment over a 4 to 5-inch base.

Stage V:

The above information revealed that it is county roads that are experiencing more of the physical and financial impact of freight movement shifts to local roads due to the loss of rail service and eventual rail abandonment. Even with elevator managers trying to avoid overloads and movements over posted roads, the annual increased road costs are over \$100,000 per year.

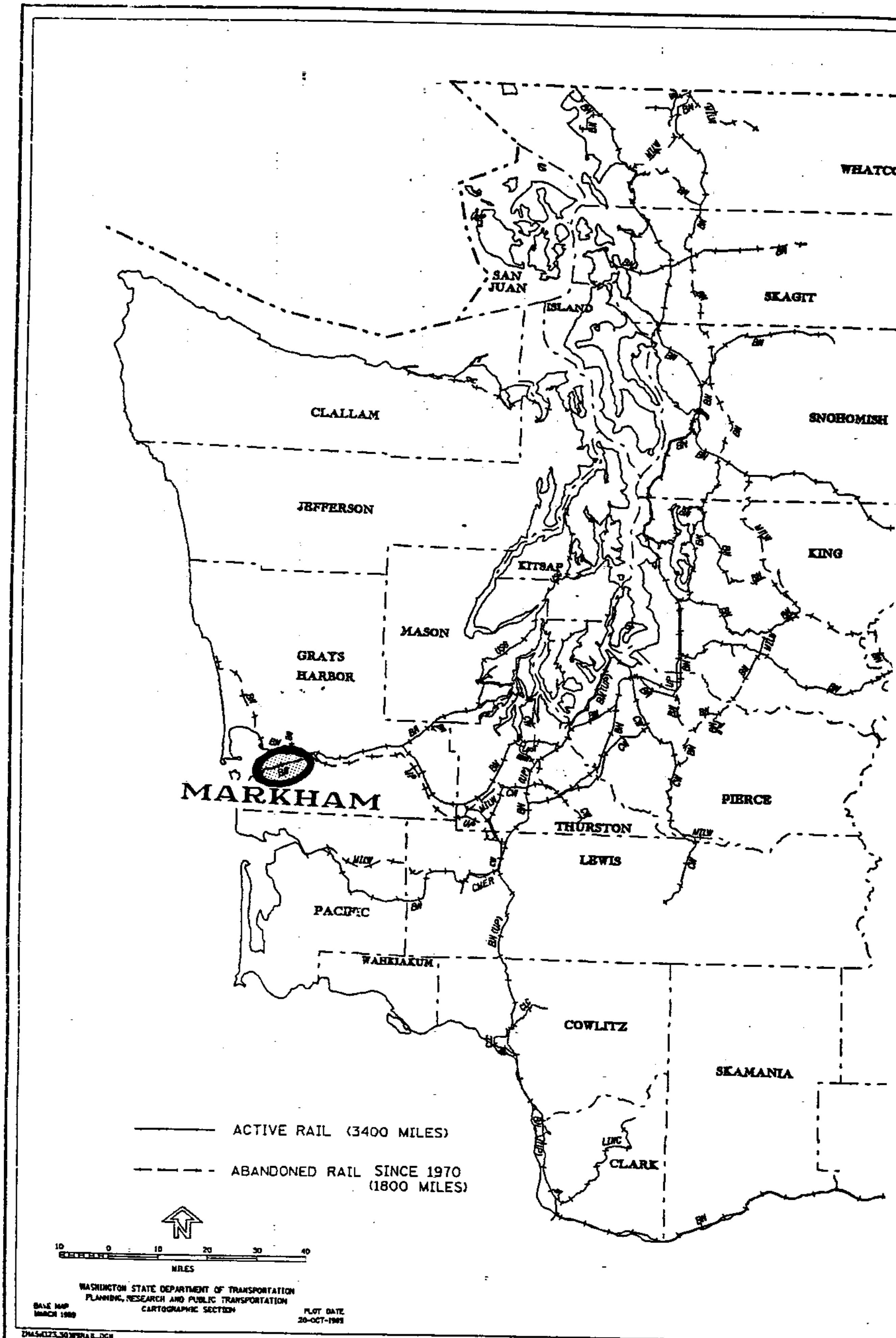
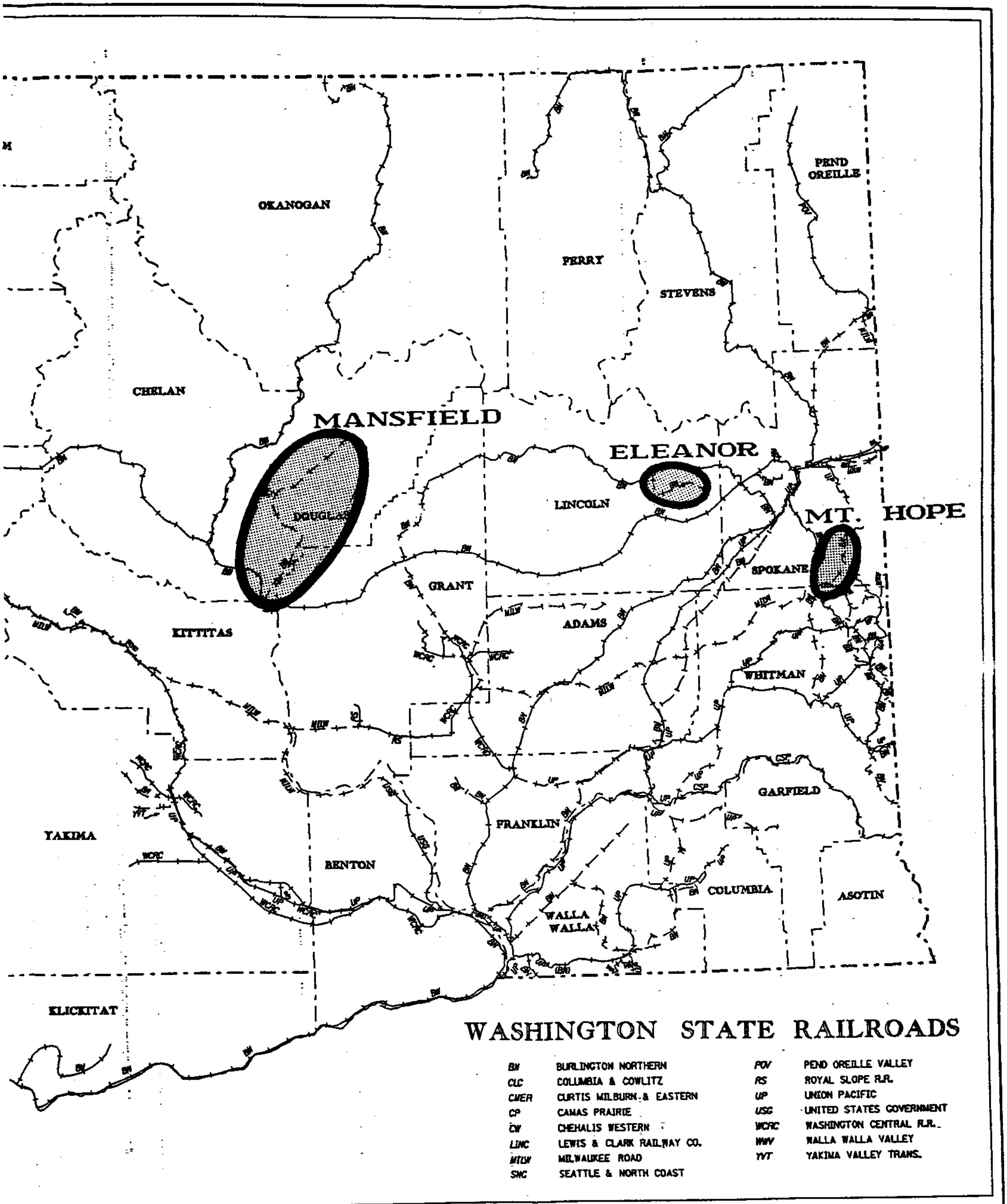


FIGURE 4. SELECTED CASE STUDIES


MANSFIELD
ELEANOR
MT. HOPE
OKANOGAN
FERRY
STEVENS
PEND OREILLE
CHELAN
DOUGLAS
LINCOLN
SPOKANE
GRANT
ADAMS
KITTITAS
WHITMAN
GARFIELD
YAKIMA
FRANKLIN
BENTON
COLUMBIA
ASOTIN
WALLA WALLA
KLICKITAT
WASHINGTON STATE RAILROADS
BN BURLINGTON NORTHERN
CLC COLUMBIA & COWLITZ
CMER CURTIS MILBURN & EASTERN
CP CAMAS PRAIRIE
CW CHEHALIS WESTERN
LINC LEWIS & CLARK RAILWAY CO.
MILW MILWAUKEE ROAD
SNC SEATTLE & NORTH COAST
POV PEND OREILLE VALLEY
RS ROYAL SLOPE R.R.
UP UNION PACIFIC
USG UNITED STATES GOVERNMENT
WCRC WASHINGTON CENTRAL R.R.
WWV WALLA WALLA VALLEY
YVT YAKIMA VALLEY TRANS.

MT. HOPE TO ROSALIA LINE

Situation:

This case study has several interesting characteristics that made it useful in testing the procedure. First, this rail line has two segments, each abandoned at different times (Figure 8). Secondly, the Rosalia to Spring Valley line segment abandonment request was originally denied by the ICC, based on the potential impacts of abandonment on local rural roads. At the rehearing of the proceeding the rail line abandonment was finally granted because the potential financial impact on roads could not be quantified.

The overall segment is 20.5 miles long and is located in eastern Washington, extending northeasterly from Rosalia to Mt. Hope. The 14.9 mile segment between Spring Valley to Mt. Hope, with a net liquidation value of $387,500 in 1983, was the first abandoned in February, 1983, followed by the 5.6 mile Rosalia to Spring Valley segment, with a net liquidation value of $186,437 in April, 1986. This 20.5 mile line was served from Rosalia twice a week and could accommodate 100 ton hoppers for about 50 percent of the line. The remainder of the rail line could only handle single box cars. Since the 1983 abandonment of the Spring Valley to Mt. Hope and the 1986 abandonment of the Rosalia to Spring Valley segment all movements are by truck.

Stage I:

Once again, the BN System Diagram Map was the indicator of potential abandonment. However, the shippers on the line and the local communities had

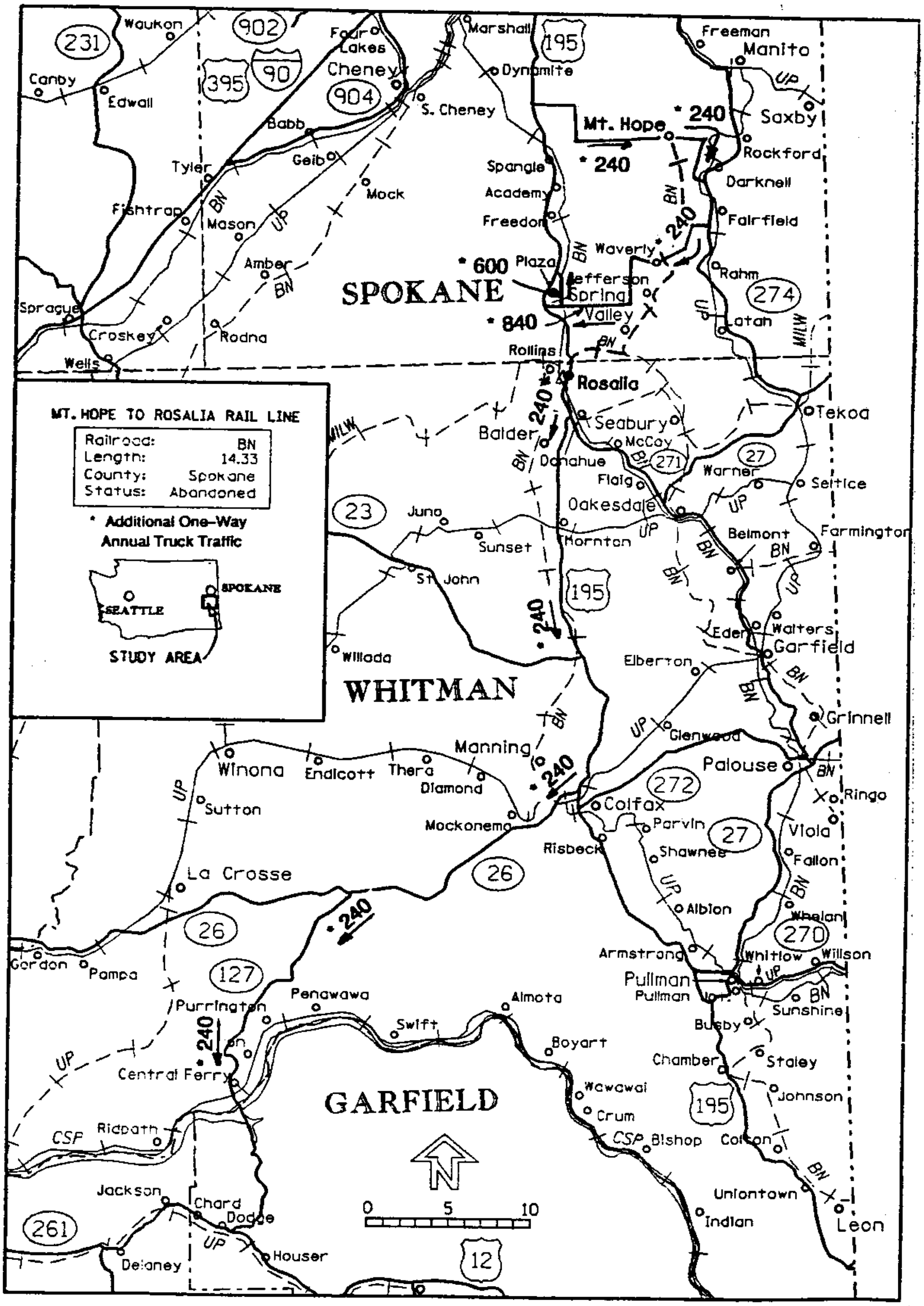


FIGURE 8. MT. HOPE TO ROSALIA LINE

also been forewarned by the BN. The condition of the line (7.5 miles of 90 pound/yard rail and 13 miles of 70 pound/yard rail) was rated as fair to poor. Approximately four miles of track in the Spring Valley to Mt. Hope were rated at Class I (10 mph) and 11 miles were Class II (25 mph). Inefficiencies as noted by these truck conditions, coupled with deferred maintenance by the railroad on the line, portend candidacy for abandonment.

Stage II:

There were initially seven shippers on this line. By the time of the 1983 abandonment, only three elevators (owned by two cooperative grain companies) were still operating at any significant level on the line. The other companies were chemical and fertilizer outlets whose marketing channels had moved them away from rail usage. Rockford Grain Growers is on the Spring Valley to Mt. Hope line, and Rosalia Producers, Inc. is on the Rosalia to Spring Valley segment; both are grain marketing firms with no farm supply activities in these facilities. The isolated location of this rail line effectively precludes other business development.

Stage III:

The traffic that was previously moved exclusively by rail is now moving on roads due to the abandonment. This traffic is from the two elevators. Rockford now ships 240,000 bushels per year (60 percent between May and July and 40 percent from August and beyond) to Central Ferry on the Snake River. Rosalia Producers moves 300,000 bushels per year in the last nine months of the year, with a significant low period in the first three months -- a seasonality that has become more pronounced in recent years. This grain is moved by truck to

Rosalia or Plaza for shipment out of multi-car loading facilities. Both firms use 80,000 pound semi-trucks to move the grain. Road restrictions do affect seasonal movement and access to markets.

Stage IV:

The traffic shifts were projected to cause up to 240 one way truck trips annually on state highways and up to 840 one way annual truck movements on the local roads as identified by the shippers. There were 63 miles of state highways and 21 miles of local roads that were potentially impacted. However, the state highway estimates of damage were that no discernible damage would occur (the traffic level was less than one truck per day). Again, this was verified through PMS and actual maintenance expenditure records.

County roads, however, reflected significant impacts, averaging increased costs of $18,114 per mile with a range of $9,000 to $21,000 per mile. The differences in road damage and thus financial impacts arise from traffic level and pavement design. State highways were asphalt concrete pavement or bituminous surface treatment 3 to 7 inches in depth over a 6 inch crushed rock base. County roads were barely 2 inches of asphalt or bituminous overlay over old gravel roads or old portland concrete pavement.

Stage V:

The increased annual cost of road maintenance and reconstruction on county roads was determined by county engineers to be $380,400. These costs were based on actual expenditures by the county's Public Works Department. It is evident from these and other case studies that much of the damage occurs on the local highway system.

EVALUATION AND MODIFICATION OF THE PROCEDURE

The procedure tested in these case studies and detailed in this final report performed well, but some modifications to the procedure were identified that would provide better damage estimates. The modified procedure, as indicated in Figure 9, should include the corroboration of PMS findings by surveying the WSDOT Headquarters and District Engineering Office and County/City engineering personnel, as appropriate. In these case studies it became apparent that the "hands on" knowledge of the local personnel provided a complete picture of road impacts. This addition to the procedure should be incorporated into Stage IV.

Shipper identification in Stage III should be broadened to include past and potential shippers in the inventory (IIIA and IIIB in Figure 9). Supplementary discussions and information indicates potential that some historical ex-shippers could be planning to return to railroad usage; similarly, some firms, identified, for example, by such entities as the Chambers of Commerce, Economic Development Councils, etc., were considering moving into the areas and were potential rail shippers. These firms could increase the net potential damage to roads if rail service were to be unavailable.

This research project developed and evaluated a procedural model that performed within acceptable limits of accuracy. As applied in these case studies, it gave a range of documented increased road costs that range from $4,400 to

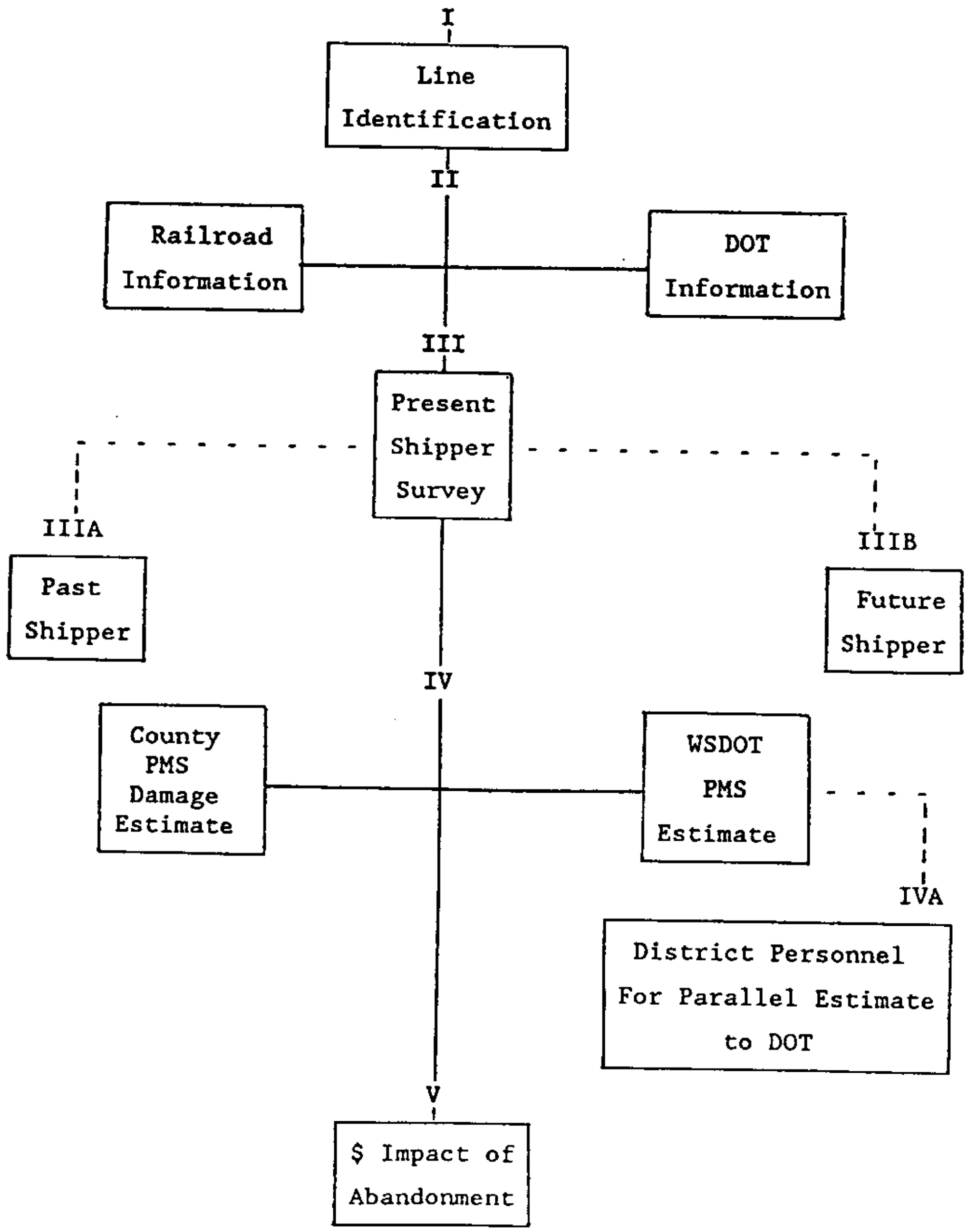


Figure 9. Modified Procedure Model

$7,200 per mile, based on the information used to assess financial impacts. The annualized cost of $4,400 per mile for state highways, coupled with the tonnage moved, allows a per ton-mile estimate to be developed. These estimates range from $.01 to $.06 per ton-mile with the average cost being $.05 per ton-mile. The range in impact occurs because of the differing environment and seasonal movements, pavement design and traffic volumes and weights (e.g., overloading of trucks) in each case study.

County road impacts were more severe, due mainly to the lower pavement design standards. The $7,200 per mile average, coupled with the tonnage moved, resulted in roadway damage estimates of $.02 to $.09 per ton-mile with an average of $.075 per ton mile.

In summary, the procedure developed, tested and modified in this research effort gives planners the ability to predict damage to roads prior to 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 in forecasting potential impacts on highways and roads.

What is also evident from the differing case studies is that the magnitude of damage is heavily dependent on the volume of increased traffic relative to the type of road upon which the traffic will be moved. When additional traffic is added to rigid, well-structured pavement with high structural design, little impact is discernible. Yet, county road that have been constructed with lesser design standards for projected low traffic volumes are very susceptible to damage by ril line abandonment. With an understanding of these previously unconsidered costs of road damage and its relationship to loss of rail service and eventual railroad abandonment, local decisionmakers can make a determination of which mode is the most economical. If rail is the most economical, it appears plausible that it should be retained. It is abundantly clear that all modes must be examined more closely with the understanding that interrelationships between modes do exist and that to view a mode in isolation does not satisfactorily address the transportation system.

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

ACKNOWLEDGEMENTS

The authors would like to acknowledge the cooperation of grain elevator firms and Ocean Spray Cranberries, Inc. in providing traffic and commodity data. Ralph Roderick compiled many of the data files. Newt Jackson, Tom Nelson and Denver Tolliver aided in the conceptual approach to determine pavement damage functions. WSDOT personnel and County Public Works Directors and Personnel identified costs attributable to branchline abandonments. Overall funding support was received from the Washington State Department of Transportation, and the WSDOT's Federal Highway Administration and Federal Railroad Administration.

REFERENCES

(1) Borris, Bonnie, Ken Casavant, Jonathan Newkirk, and Frank Dooley, Oct. 1986, "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.

(2) Casavant, Ken L., Bob Sanders, and J.C. Lenzi, April 1987, "A Review of Impacts on Washington County Roads of Grain Transportation Changes." Washington State Department of Transportation, Final Report WA-RD 135.1.

(3) Taylor, Richard, Aug. 1, 1988, "Likely Abandonments." Draft of Working Paper to the Rail Development Commission.

(4) Casavant, Kenneth L. and J.C. Lenzi, 1989, "Predicting Financial Impacts on Rural Roads of Potential Rail Line Abandonments." Transportation Research Record, National Science (forthcoming).

(5) Casavant, Ken L., J. C. Lenzi, Ron Kerr, Richard Taylor, and James Jackson, Jan. 12, 1988, "An Evaluation of the Viability of a Regional Railroad System in the Palouse Region of Washington and Idaho." Paper presented at 67th Annual Meeting of the Transportation Research Board, Washington, DC.

(6) Keller, Theodore E., 1983, Railroads, Freight and Public Policy. Washington DC: The Brookings Institution.