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Twenty-second Annual Meeting

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Evaluations of Service Quality of Rural Rail Branchlines

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ABSTRACT

AMERICAN RAILROADS have faced a declining share of freight traffic relative to other modes. Although a variety of reasons have been identified for this decline, most experts agree that a contributing problem is that the rail system is overdeveloped with unprofitable branchlines. Many economic models have been utilized to analyze relative branchline value, but the literature is insufficient in defining quality of service from the user viewpoint. The principal objective of this paper is to determine the rail service needs of shippers on rural branchlines, using a segment of the West Side Branchline located in Southeast Benton County, Oregon as a case study. Personal interviews were conducted with the shippers on this rural branchline to identify rail service attributes and deficiencies in meeting the transport requirements of various resource commodities, particularly agricultural products, wood products and Christmas trees. Several techniques were employed to compare and interpret the responses of the shippers. A "tradeoff analysis" by monotone analysis of variance, was used experimentally in this study and proved to be a useful technique in quantifying judgemental data. It was found that shippers of like commodities expressed similar preferences regarding service needs, often in contradiction to the findings of other studies. Overall, rates, total transit time and car availability were of highest concern to most shippers.

The relative decline of railroad transportation in the United States has been attributed to many causes. At the risk of oversimplification, generally three points-of-view may be identified that attempt to explain why the railroad problem has developed, and how this problem may be rectified.

One perspective is the public's point-of-view. The federal government, after witnessing the bankruptcy of several railroads, adopted several progressive legislative acts to relieve this situation.[1] Federal studies determined that railroads faced an overabundance of intramodal competition and unprofitable branch lines. Thus, as a last resort, the federal government initiated policy to provide for abandonment of unprofitable branchlines as reflected by the 3R Act, 4R Act and the Local Rail Assistance Act and the Staggers Rail Act.

The public recognizes the benefits of maintaining a viable rail system. Rail transportation offers an energy efficient, economic mode of inter-regional movement for many commodities, and helps to stabilize the local economy of many dependent urban and rural communities. The public point-of-view has generally been that railroads have an obligation to provide services, even if unprofitable, to these dependent areas, and that railroad management has been too conservative and ineffective in developing new strategies for system planning, marketing, and sales promotion for a dynamic modern society.

The carriers' point-of-view is substantially different than that of the public sector. At one time, high profits from traffic on some lines would cross-subsidize unprofitable operations on branchlines. However, bankruptcy of formally stable railroads provided evidence that these off-setting profits no longer exist. The railroads feel that traffic has been lost to competing modes due to discriminatory taxing policies, inconsistent public investment and awkward regulations.[2] The most blatant example of inequitable economic regulation is the motor carrier industry which is cross-subsidized by the automobile. Taxation is a nemesis not faced by other modes and states have intentionally and unintentionally taxed railroads with high assessments.

A third point-of-view is that of the shipper. The shipper is typically less concerned with the question of regulation than the public or the carrier, but merely how the highest level of service can be obtained with the lowest cost. The shipper's point-of-view has been generally neglected in the literature, yet without customer satisfaction of service, there is no business. A better understanding of the shipper's point-of-view of what is "good service" yields results that are essentially aimed at improving the rail system regardless if instituted by the carriers or public policy.

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Therefore, the perception of the shipper regarding rail service quality to rural branchlines is the focus of this paper. To determine this a comparison is made of service attributes of rail and its principal competitor, trucks, as perceived by individual shippers of various commodities. Also, an identification of current rail service deficiencies and service characteristics — service level combinations that satisfy the perceived needs of individual shippers on the case study branchline will be determined.

A majority of the information assimilated for the case study was derived through personal interviews with the major shippers on the branchline.

Trade-off analysis (by monotone analysis of variance) was performed on the responses of individual shipper interviews to determine the preferred service characteristics — service level combinations of each shipper.

Branchline Case Study Selection

The branchline chosen for this case study is the southernmost segment of the Willamette Valley West Side Branch of the Southern Pacific rail system. (See Figure 1). This branchline extends south from Corvallis to Monroe and includes the Bailey Branch (essentially a portion of the Corvallis-Monroe line) which runs from Alpine Junction just north of Monroe and west to Dawson. This branchline moves a variety of commodities from several active shippers and stations. A branchline that is dominated by a particular commodity or a particular shipper would not exhibit the wide variety of service level perceptions and service attribute preferences found on the case study branchline. According to other studies, rail branchlines moving high-bulk, low value commodities in rural areas are particularly vulnerable to branchline abandonment.[3,4,5] The primary commodities on the case study branchline are forest products, grain and fertilizer — which are not only high bulk, low value in nature, but also represent the principle rail commodities of the state as well. This branchline also ships significant movements of Christmas trees. The "time-constrained" and "peak seasonal activity" nature of this commodity introduces interesting problems for rail service satisfaction.

The case study area is located in southeast Benton County, Oregon. The study area is within the Willamette River drainage basin, and like most of the valley, the natural resource base is highly conducive to agriculture.

The leading agricultural commodities produced in Benton County art grass and legume seeds, vegetables, grains, specialty field crops and Christmas trees. Those products account for approximately 84% of the county agricultural income.[6]

Forestry products contribute approximately $1,200,000 to the annual county income,[7] but most of the productive areas are located in county areas west and northwest of the case study area. Nearly all the Christmas trees, cereal grains and a significant share of the field seed crops are estimated to be produced in the case study area, thus demonstrating the important role of this area in the county agricultural income.

Branchline and System Operations

The Corvallis-Monroe Branchline is recognized by Oregon Department of Transportation as an FRA Density "A" branchline, carrying approximately one million tons of freight annually.[8] The Bailey Branchline carries less than one million tons annually and thus categorized as a FRA Density "B" branchline. The Baley Branchline density is believed to be much higher than indicated by state records, one shipper claims well over a million tons of traffic a year from his operation alone.

The Bailey Branchline is designated FRA Class 1, thus has a speed restriction of 10 m.p.h. or less. Given the topography, curves and grades, structures, road bed and rail quality and short length (6.9 miles), the class designation is appropriate. The Corvallis-Monroe Branchline exhibits much fewer physical restrictions and therefore, has been designated FRA Class 2, thus speed restrictions of 25 m.p.h. This major segment is 18 miles in length. The case study branchline has service five days per week from Corvallis to Alpine Junction to Dawson. The 1.5 mile segment from Alpine Junction to Monroe receives service on a "on demand" basis.

The branchline obtains switching and intermodal services from the Albany Southern Pacific Traffic Control Office.[9] Southern Pacific operates freight classification yards in Portland and Eugene. A majority of the freight from the case study branchline is southbound and is classified at a "hump-yard" in Eugene. The Southern Pacific main line (Portland to Eugene, 124 miles) operates 30+ trains a day and moves about 30 million gross tons per year making it by far the most active line in the Willamette Valley.[10]

Branchline Stations and Shippers

The Corvallis-Monroe-Dawson branchline currently has five active stations:

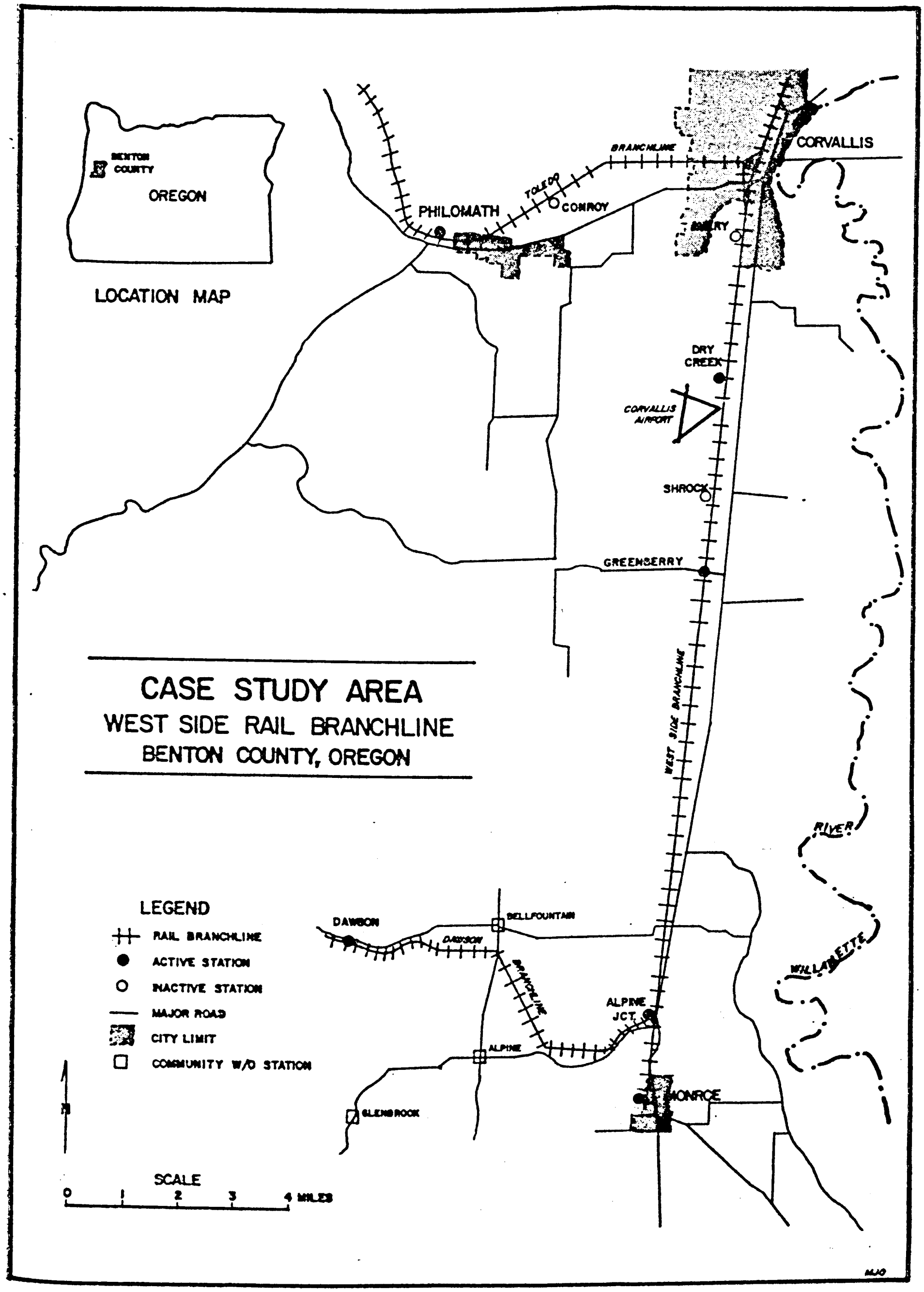
BENTON COUNTY
OREGON
LOCATION MAP
CORVALLIS
BRANCHLINE
TOLEDO
CONROY
PHILOMATH
DRY CREEK
CORVALLIS AIRPORT
SHROCK
GREENBERRY
CASE STUDY AREA
WEST SIDE RAIL BRANCHLINE
BENTON COUNTY, OREGON
WEST SIDE BRANCHLINE
RIVER
WILLAMETTE
LEGEND
RAIL BRANCHLINE
ACTIVE STATION
INACTIVE STATION
MAJOR ROAD
CITY LIMIT
COMMUNITY W/O STATION
DAWSON
BELLFOUNTAIN
DAWSON
BRANCHLINE
ALPINE JCT.
ALPINE
MONROE
GLENBROOK
N
SCALE
0 1 2 3 4 MILES
MJO

FIGURE 1

Dry Creek, Greenberry, Alpine Junction, Monroe, and Dawson. There is an active station in Corvallis at the junction of the case study branchline and the Toledo Branchline, but this study is concerned only with rural rail service and will therefore focus on stations south of this branchline junction Branchline spurs had once served other rural stations in the area but service to these stations has been abandoned.

There are nine major shippers on the case study branchline, which represent an estimated 95% of the total traffic generated from the case study branchline. The major shippers are: one pulp product manufacturer, one plywood manufacturer, one grain farmer, one fertilizer distributor, two lumber mill operators, and three Christmas tree farmers. The modal split of these businesses and other comparative statistics of these shippers are displayed in Table 1.

Modal Choice Variables In Transportation

A number of models have been developed that attempt to predict choice of one mode over another. The three variables that are usually compared are cost difference, convenience difference, and time difference.

No doubt that cost differences influence the patterns of freight and passenger movement by different modes of transport between points of origin and destinations. Practically all goods and services have built into their final value the outlays required to have them available when and where they are required.[11] However, the quality of transport service is not judged by freight rates alone. Depending on the nature of the commodity being transported and the individual shipper's perception of need, other important variables such as time and convenience may play important if not deciding roles in modal choice.

Much of the freight in the United States that formally moved by rail is now being transported by motor carriers. Initial highway systems were irrationally developed and used mainly for ensuring local movements "get out of the mud." However, since that time active federal involvement in road construction and improved technology in vehicles have made motor carriers become increasingly more competitive for the freight transport needs previously served by rail.

Modal Choice of Branchline Shippers

In an attempt to determine the factors

TABLE 1

COMPARATIVE SHIPPER STATISTICS

Establishment	Station	Commodities	Principle Rail Market Regions	Rail Modal Split	Rail Car Generation*	Service Revenue*
Shipper "A"	Dry Creek	pulp product	Rocky Mtn. States, South Plains States	20%	22	$ 13,780
Shipper "B"	Dry Creek	plywood	Eastern US States, Great Lakes States	67%	559	$507,067
Shipper "C"	Greenberry/ Dry Creek	grass seed wheat	Florida, Carolinas[1.]	90%	117	$219,143
Shipper "D"	Greenberry	Christmas trees	Texas, California, New York	20%	40 (estimate)	$ 53,300 (estimate)
Shipper "E"	Alpine Junction	fertilizers	local consumers[2.]	100%	27	$ 12,158
Shipper "F"	Alpine Junction	Christmas trees	Southwest States, California	20%	44	$ 58,645
Shipper "G"	Monroe	Christmas trees	Texas, California	15%	32	$ 42,650 (estimate)
Shipper "H"	Dawson	lumber, chips	Southwest States, California[3.]	90%	244	$237,000 (estimate)
Shipper "I"	Dawson	lumber, logs	California, South Plains States	75%	936	$910,489

1. All wheat is shipped to Portland for export.
2. All rail freight is inbound from British Columbia, Eastern Washington and Idaho.
3. Nearly all chips are shipped to Port of Toledo for export.
* 1978 data

involved in modal choice decisions of rural shippers, a list of transport service attributes was presented to the shippers on the case study branchline. Each was requested to identify service attributes that may be associated with truck and/or rail transportation. The results are presented in Table 2.

Of the shippers on the case study rail branchline, truck was favored to rail service in terms of fast service, frequency of service, links to many markets, and relations with transport firms. Rail service was favored by the same shippers in terms of ability to handle perishables, minimization of theft or damage, traceability of consignments and low cost. Rail and truck service are rated equal by the shippers in terms of regularity of service and ability to handle bulk items.

Many of the shippers responded to the service attributes in a predictable manner. For example, fast service was viewed by all nine shippers to be characteristic of trucking. One shipper (lumber mill), however, also identified rail to offer fast service. Another predictable response was that the shippers as a whole felt that rail provided a lower cost service than trucks. The three shippers that identified trucks as having low cost service were the Christmas tree shippers.

Unlike lumber, grain and fertilizer, Christmas trees are relatively high-value per unit weight, and therefore do not capitalize on the competitive advantage of rail transportation. Furthermore, rail cars have a rate structure that includes a minimum weight charge, the trees are light-weight and often do not meet the minimum weight but are nonetheless charged for such. One lumber shipper claims exceptionally low rail rates can be established with long-standing, reliable customers by a milling-in-transit rate which is a special lower rate for certain point-to-point shipments.

Trucks were viewed as providing "high frequency of service" and "good links to many markets" by the shippers. These were also predictable responses in that trucks exhibit much greater route and schedule flexibility than railroads. Trucks operate on most public roads and are therefore free to travel between nearly any two points, whereas railroads of course can serve only those points with rail service. Trucks also have generally more flexible schedules than railroads and can thus often offer more frequent service.

Some of the results from this survey were contrary to the literature and other surveys. Surprisingly, the shippers favored rail to offer "ready traceability of consignments." One previous survey by the Oregon Public Utilities Commission (PUC) identified poor tracing to be a major complaint of rail shippers.[12] The literature also suggests that rail offers a better ability to handle bulk items, whereas the shippers on the case study branchline rated rail and trucks equal on this attribute. One Christmas tree shipper commented that the trucks were easier to load than rail cars. Irregular service is another frequent complaint of rail transportation. Hcwever, the five of nine responding shippers characterized rail to have "good regularity of service."

As a whole, the shippers on the case study branchline felt that the business relationships with the trucking industry and the railroads were equally good.

TABLE 2

TRANSPORT SERVICE ATTRIBUTES

Attribute	Rail	Truck
a. fast service	1/9*	9/9*
b. high frequency of service	4/9	7/9
c. good regularity of service	5/9	5/9
d. good ability to handle bulk items	7/9	7/9
e. good ability to handle perishables	3/3	0/3
f. good links to many markets	4/8	7/8
g. good relations with transport firms	6/9	8/9
h. minimization of theft or damage	6/8	4/8
i. ready traceability of consignments	6/9	2/9
j. relatively low cost	6/9	3/9

*Numerator represents the number of shippers that had an affirmative response to the attribute. Denominator represents the total number of shippers that responded to the attribute.

However, two shippers did specifically claim to have poor relationships with the railroad.

Rail service was considered to have a "good ability to handle perishables." Only the three Christmas tree shippers responded to this attribute as that the other commodities on the branchline are not perishable. The tree shippers unanimously considered the refrigerated rail cars ("refers") to be better design to handle Christmas trees — although at a higher cost than trucks. The Christmas tree shippers also felt that rails offered "minimization of theft or damage" whereas trucks did not.

Rail Service Deficiencies

In an effort to determine the needs of rail shippers, the Oregon PUC conducted a railroad service survey of 450 shippers.[13] The variables of highest concern of the shippers were insufficient communications, transit time, car availability and switching problems.

Insufficient communications is a major complaint of rail service for many shippers. Often shippers are uninformed about the status of their shipments after leaving points of origin. Their customers may be anxious for car arrivals, especially if late, and with inadequate communications from the railroad the shippers are unable to respond to customer concerns. Important communications include notice of arrival, notice of delay, constructive placement notice, and general information such as tracing, and rate quotes.

Car availability, or more specific car unavailability, is also a frequent concern of shippers. Freight car shortages is a national problem, but one that seems to be more of a critical problem in Oregon than elsewhere in the nation. In addition to the actual shortage of cars and costs associated with delay of shipments to customers, demurrage (charges placed for detaining or reserving cars) also affect car supply and contributes another financial burden for shippers.

Transit time problems are not only related to the actual through-put time required of shipments to destinations. Erratic and therefore unreliable quotes on transit time also make it difficult for shippers and receivers to adequately plan inventory requirements. The same movement can have drastically different transit times in addition to the extra time associated with adverse weather or the time required to repair a bad order.

Switching problems are actually another form of time delay. Transit time is considered to be the time required from origin terminal to destination terminal without switching operations. However, in nearly all movements, switching operations occur during the haul and at the terminals which may add time delay. Frequently, bunching of cars is reported at destination terminals, thus although the cars may arrive "on time," switching problems prevent the timely unloading of the consignments.

Desired Rail Service Improvements

One objective of the case study is to determine the desired service improvements from the shipper's perspective. To a certain extent, this can be derived from summaries regarding service attributes (as presented earlier). Those attributes that were rated low identify service deficiencies. But this does not specify which service characteristics need more improvement than others. To meet this task, the shippers were provided with a list of characteristics which describe ways in which rail service could be improved, and were asked to rank these from most important (1st) to least important (6th). The choices for ranking and the responses of the shippers are presented in Table 3.

The results of the rank order test indicate that reducing total transit time is the aspect of service that needs the most improvement in rail transportation according to the branchline shippers. Reducing rates also carries a high priority overall, but this opinion is much more variable as indicated by standard deviation measure. All Christmas tree shippers were most concerned with rates, and second delivery time to market. Christmas trees are obviously a "time - constrained" commodity. The functional cycle between product procurement and delivery to the consumer must occur in a very short time interval, much like fresh produce. However, unlike produce which exhibit a fairly steady year-round demand, Christmas trees likewise have leptokurtic seasonal peak demand in late November-early December. Reducing rates is also a critical concern of this industry because trees have a relatively high-value per unit weight unlike most commodities moved by rail and cannot benefit from natural rail economies. Whereas grain and fertilizers do benefit from rail economies due to their low value per unit weight nature, and the shippers indicate relative satisfaction in rail rates. The plywood manufacturer was also concconcerned with rail transit. A seasonal peaking is also witnessed by this industry with housing construction (major commodity use) primarily occurring

TABLE 3

DESIRED RAIL SERVICE IMPROVEMENTS

	Rank Score By Establishments									Results		
Improvements	Firm "A"	Firm "B"	Firm "C"	Firm "D"	Firm "E"	Firm "F"	Firm "G"	Firm "H"	Firm "I"	Average Rank Score	Standard Deviation	Overall Value
a. Rates	3	2	5	1	5	1	1	1	3	2.44	3.52	2
b. Loss/Damage	5	4	6	6	3	6	6	5	6	5.22	3.16	6
c. Total Time	4	1	3	2	1	2	2	3	1	2.11	2.71	1
d. Availability	2	3	1	3	6	4	5	2	2	3.11	3.37	3
e. Frequency	6	6	4	4	4	5	4	6	5	4.88	2.67	5
f. Consistency	1	5	2	5	2	3	3	4	4	3.22	3.19	4

Type of Establishment	
Establishment "A"	pulp product
Establishment "B"	plywood
Establishment "C"	grass seed, wheat
Establishment "D"	Christmas trees
Establishment "E"	fertilizers
Establishment "F"	Christmas Trees
Establishment "G"	Christmas Trees
Establishment "H"	lumber, chips, fuel, sawdust
Establishment "I"	lumber, logs

Desired Improvements

a. Reduce rates, while maintaining present service conditions.

b. Reduce loss or damages.

c. Reduce total transit time.

d. Provide greater availability of cars for outbound loading.

e. Increase frequency of service.

f. Improve consistency of transit times.

within a few months. The shippers from the lumber mills are also tied into the construction season and therefore, have the same needs. However, the product at this early stage of transformation is not as susceptible to value reduction due to damage as is plywood, therefore the lumber shippers ranked "loss/damage" lower than the plywood shipper as a desired service improvement. The fertilizer shipper was highly concerned with time and less so with rates which is a response that does not support the literature.

The grain shipper was highly concerned with car availability. This response supports the literature. The Oregon grain industry is very sensitive to this problem. There is a widespread shortage of railcars for grain shipments nationally and the overall demand for cars is greater in the "wheat belt" of the Midwest United States than Oregon. However, much of Oregon's grain industry is dependent upon international demand and pricing, which are very unpredictable therefore, a responsive and reliable transportation mode is essential. The shippers of lumber and chips are faced with similar situations in their industries and therefore responded to car availability in the same manner. Overall, car availability exhibited a wide variety of ranked responses.

As discussed earlier, one of the critical variables in modal choice is convenience. This may be expressed in many ways in freight transport. In the PUC survey "switching problems" and "insufficient communications" were two of the four most frequently cited problems of rail transportation. Both of these problems may be considered as convenience problems — they create an element of uncertainty in the transaction between shipper and consignee, usually expressed in unforeseen delivery time delays without notice. In the questionnaire used in the case study, inconsistency in transit time is a category that may also fall into this category of convenience problems — inconsistency is an inconvenience. Although "improved consistency of transit times" was ranked only fourth overall in the desired rail service improvements selection, three shippers ranked it first or second, the pulp product manufacturer, the grain farmer, and the fertilizer distributor. The fertilizer distributor, unlike all the other shippers on the branchline, is solely in business for inbound shipments, and is therefore on the very noticeable "waiting-end" of a shipment delay. The manufacturer also receives substantial amounts of inbound freight.

Loss and damage and frequency of service were not viewed as significant current problems in rail transportation service by the shippers.

The results of the rank order test indicate that reducing total transit time is the aspect of service that needs the most improvement in rail transportation according to the branchline shippers.

"Trade-off" Analysis

As indicated by the results of the rank order test, individual firms have individual preferences regarding desired rail improvements. This exercise is useful in identifying the comparative importance of various needed service improvements as perceived by individual shippers. However, the rank order test does not quantify the incremental difference between choices, i.e. "how much" more important is rates (1st choice) than transit time (2nd choice), for example.

Another limitation in the rank order test is that it compares transportation characeristics in an isolated manner, i.e. rates vs. transit time, for example. Whereas in reality, "good service" is a combination of many attributes — rates, transit time, frequent service, etc. One attribute may be "more important" than another, and most shippers are willing to accept a lower level of service of a "less-important" attribute if a higher level of service can be obtained for "more-important" attributes. Consumers of products and services must make judgements about the relative values of multi-attribute alternatives, and a choice is made based on complex personal trade-offs. This trade-off situation may also be applied to evaluating transportation service from the point-of-view of the shipper.

One form of trade-off analysis is conjoint measurement. This technique originated from the fields of mathematical psychology and psychometrics,[14] and later introduced into the marketing literature.[15] More recently various trade-off analysis techniques (conjoint measurement,[16] utility theory,[17] nonmetric scaling,[18] and conjoint scaling[19]) have attracted much attention in marketing literature. The techniques begin with the consumer's overall judgements about a set of complex alternatives. The alternatives are then ranked in order of preference by the consumer. Then the original evaluations are transformed into compatible utility scales by which the original judgements can be reconstituted. Thus, ordinal data is transformed into ratio scaled utility values. With the aid of various multi-dimensional scaling computer programs the output is expressed in decimal units, thus enabling a quantitative assessment of the perceived utility to be interpreted.

The objective of the trade-off analysis performed in this study was to gain insight on how shippers of various commodities, and therefore various transport needs, differ in terms of alternative combinations of service characteristics and service levels.

The rank order test identified that the four characteristics of highest concern are: rates, total transit time, variability of transit time and car availability. All shippers were presented with a common scenario as a basis for their trade-off decisions regarding the above selected transportation characteristics (see Table 4). For each of the four transportation characteristics, two alternative service levels were identified, one offering a high level of service, the other offering a low level of service. Therefore, the shippers were presented with sixteen possible alternative combinations of service characteristics and service levels, and were asked to rank them. The results were quantitatively assessed by applying a monotone analysis of variance which is a mathematical procedure for transforming data from a factorial experiment into the highest possible percentage of variance accounted for by combining various factors.[20] Or more simply, each service characteristic is assigned a utility estimate that expresses its quantitative value among the field of all service characteristics based on the trade-off choices of individual shippers.

Service Level Utilities

The results of the trade-off analysis were quantified by a computer algorithm entitled MONANOVA.[21] This produced a numerical value for each attribute for each shipper, or a service level utility. For example, if comparing the utility levels of 1.735 for rates and .868 for car availability, one could reasonably deduce that to that individual, rates as a service characteristic is twice as important as car availability in measuring service utility. The results are presented in Table 5.

It is interesting to compare the results of the rank-order test with those of the trade-off analysis. In many cases, shippers that ranked a certain attribute as highest priority in terms of rank did not respond consistently in a trade-off situation, i.e. they are only willing to allow a lesser attribute to decrease in service a certain amount before sacri-

TABLE 4

TRADE-OFF SCENARIO

Characteristics of Service	Service Level 1	Service Level 2
A. Shipment rates on commodities	maintain present rates	10% increase in rates
B. Total transit time to prime market	eight days	eleven days
C. Variability expected in quoted transit time	± three days	± six days
D. Availability of cars as requested	usually available	availability unreliable

ficing a high level of service for a more important attribute.

In some cases, rates were viewed as a more important consideration in a trade-off situation than in isolated ranking. For example, Firm "A' (pulp products) ranked time variability first and rates third in rank-order. However, in the trade-off situation, the same shipper considered rates eight-times higher than time variability. However, some shippers (such as Firm "B") responded to both situations identically, still the trade-off analysis established a utility value for each attribute, thus enabling one to note the decimal value of each attribute for each shipper.

Firm "C" (grain) expressed very similar (and modest) utilities for rates, transit time and time variability (.540, .660, .559, respectfully), yet expressed an extremely high utility value for car availability (1.759). To this shipper, without available cars, no other service attribute is of importance. This similar attitude was expressed by Firm "I" (lumber, logs). One Christmas tree shipper (Firm "D") found transit time and time variability to be quite important in a trade-off situation, whereas in isolated ranking, this shipper ranked rates as most important. Whereas another Christmas tree (Firm "F") shipper found all four attributes to be nearly equal in importance.

Case Study Findings

Many of the findings from the case study support the literature on rural rail branchlines. The shippers as a whole found rail transport to provide lower cost service than trucks, whereas trucking was viewed to offer fast delivery of products. The rank order test indicates that reducing transit time is the aspect of service that needs the most improvement in rail transportation.

The grain shipper was highly concerned with car availability. This finding is supported by both the rank-order test and the trade-off analysis. The literature indicates that lack of rail cars is a critical problem nationwide for grain shippers. The shippers of lumber and chips

TABLE 5

SERVICE LEVEL UTILITIES

Establishment*	Rates	Transit Time	Time Variability	Car Availability
Firm "A"	1.735	.434	.217	.868
Firm "B"	1.118	1.464	.506	.591
Firm "C"	.540	.550	.559	1.759
Firm "D"	.541	1.307	1.306	.541
Firm "F"	1.001	1.014	.994	.992
Firm "H"	1.325	.667	.028	1.341
Firm "I"	.715	.987	.534	1.493

*Refer to Table 1 for establishment identification. Firms "E" and "G" did not participate.

also indicated car availability to be a typical rail problem.

The case study also produced findings that do not support the literature on rural rail branchlines. "Regularity of service" and "ready traceability of consignments" are often viewed as rail service problems, and these aspects of service were found to be frequent complaints in one recent Oregon PUC survey. However, the shippers of the case study branchline feel that these aspects of service are not a major problem.

Several findings of the case study could be considered original in that literature has not yet addressed certain interesting aspects of rail service. For example, the unique characteristics of Christmas tree transportation. Certainly this commodity is not of significant national concern, however Christmas trees are of considerable local concern being the leading Benton County agricultural product in terms of cash receipts. Consistently the three Christmas tree shippers responded to the case study survey in similar fashion, and often expressed priorities and concerns quite different from the other branchline shippers. Tree shippers, unlike the other shippers, identified trucks as having lower cost service than rail due to the rate structures offered by each mode, particularly the cost penalty for LCL orders, however the tree shippers prefer rail service because for their product trucks do not handle perishables as well as refrigerated rail cars. Furthermore, Christmas trees exhibit a very high seasonal demand and are very sensitive to fast, on-time delivery and the case study reflected these conditions.

The case study also explored the use of trade-off analysis for identifying rail service needs. The trade-off analysis, principally used in product marketing, also provides a way to quantify the utility of individual service attributes within the complex situations in which service is offered, i.e. a combination of various service attributes at various service levels. Overall, the shippers gave similar responses to both the rank-order test and the trade-off analysis with transit time, rates, and car availability being of highest concern, depending upon the nature of the commodity being transported.

Certainly a more comprehensive study of shippers and branchlines would be necessary in order to make generalizations regarding branchline service optimization. The intention rather of the case study is to demonstrate the value of shipper satisfaction and customer research in rail service marketing. Trade-off analysis proved to be a useful technique for this sort of effort.

FOOTNOTES

1 Francis H. Parker and Gorman Gilbert, "Rail Planning—Crisis and Opportunity," **Journal of American Institute of Planners**, Vol. 43 (January, 1977), p. 14.

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