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The Impact of U.S. Railroad Abandonment on Domestic Mineral Industries

By Ronald F. Balazik

UNITED STATES DEPARTMENT OF THE INTERIOR
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THE IMPACT OF U.S. RAILROAD ABANDONMENT ON DOMESTIC MINERAL INDUSTRIES

by

Ronald F. Balazik[1]

ABSTRACT

This Bureau of Mines study is intended to identify and evaluate potential effects of impending large-scale U.S. rail line closings (abandonment) on domestic nonfuel mineral industries. This is the first nationwide study of rail abandonment impacts focused on nonfuel minerals. The analysis presented is based principally on a survey of 200 rail freight records and on statistical tests that correlated 2,000 points in the Bureau's Mineral Industry Location System (MILS) with 700 prospective abandonments throughout the United States. The conclusions derived from the analysis can be useful in evaluating proposed national rail abandonment policy and legislation regarding nonfuel mineral shipping. Among these conclusions are the following: (1) Certain mineral materials (especially fertilizers) are likely to account for a large percentage of the rail traffic affected by abandonment in the next few years, but the total tonnage involved will be small; (2) abandonment will adversely affect some mineral shippers, particularly local short haulers; and (3 abandonment could significantly reduce the opportunity to develop new resources or reopen defunct mining facilities. Despite these problems, however, the data examined in this study do not indicate that current abandonment trends will cause widespread disruption of domestic nonfuel mineral shipping.

INTRODUCTION

Problem Background

Considerable interdependence exists between rail transport and mineral shipping in the United States. Raw and processed nonfuel mineral materials account for approximately one-third of U.S. rail freight tonnage and almost one-fifth of rail company gross freight revenues. Railroads, in turn, are significant to the U.S. minerals industry. For example, when measured in ton-miles, domestic railroads account for the transport of about 25 percent of ferrous ores, 90 percent of nonferrous ores, 40 percent of nonmetallic

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minerals, 50 percent of iron and steel, 75 percent of primary nonferrous metal products, and 65 percent of stone, clay, and glass products (25).[2]

In recent years, U.S. rail shipments including mineral freight have been subjected to increased rail line closings throughout the country. This termination of service (hereafter referred to as "abandonment") is becoming a more frequent means of reducing revenue losses by domestic railroad companies. In 1976, the Railroad Revitalization and Regulatory Reform Act authorized procedures whereby abandonment would be expedited by the Interstate Commerce Commission (ICC).[3] In 1979, legislative proposals that include provisions to further expedite abandonment were submitted to Congress. Apropos of these developments, the Chicago, Milwaukee, St. Paul, and Pacific Railroad applied in 1979 for the abandonment of 2,500 miles of track, the largest single abandonment in railroad history.

In September 1977, the ICC announced the prospective abandonment of 907 rail lines totaling over 20,000 miles of track. Subsequently, in March 1978, these abandonments were reduced to 688 lines totaling 16,516 miles of track, or over 8 percent of all U.S. rail trackage. At the current pace of ICC abandonment proceedings, all of these lines are certain to be abandoned by 1985. The Association of American Railroads predicted that as much as 40,000 miles of track, equivalent to 20 percent of U.S. trackage, eventually would be abandoned (24).

The prospective abandonments announced by ICC in 1978 range in length from less than 1 mile to nearly 300 miles, but have an average length of about 25 miles (table 1). These abandonments are located in 45 States and the District of Columbia. More than 30 railroad companies own and operate these lines. A few States have only one abandonment, while several others have more than 40. One State (Iowa) has as many as 53 lines slated for abandonment. The highest incidence of these abandonments occurs in the Midwest and several States bordering the Great Lakes.

In view of the close relationship between rail transport and domestic mineral shipping, there is a clear need for a minerals impact evaluation of the abandonment situation just detailed. Therefore, this study has been prepared to identify and evaluate projected impacts of potential large-scale rail line abandonments on U.S. nonfuel mineral industies.

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[2] Underlined numbers in parentheses refer to items in the bibliography.

[3] The ICC was given control over railroad abandonment by the Transportation Act of 1920.

TABLE 1. - Characteristics of prospective rail line abandonments as of 1978

State	Number of lines	Mileage	Percent of State trackage	State	Number of lines	Mileage	Percent of State trackage
Alabama	8	87	0.2	Montana	11	340	7.0
Arizona	1	64	3.2	North Carolina	15	192	4.7
Arkansas	6	79	2.2	North Dakota	10	331	6.5
California	17	252	3.5	Nebraska	12	320	6.0
Colorado	3	67	2.0	Nevada	5	136	8.7
Connecticut	2	24	3.8	New Hampshire	13	234	31.2
Delaware	1	1	0.3	New Jersey	6	41	2.5
Florida	27	327	8.3	New York	17	271	5.2
Georgia	6	104	1.9	Ohio	30	471	6.3
Idaho	12	307	11.7	Oklahoma	11	433	8.4
Illinois	47	935	8.9	Oregon	5	83	2.7
Indiana	21	568	8.9	Pennsylvania	30	213	2.7
Iowa	53	1,511	20.0	South Carolina	12	186	3.8
Kansas	8	177	2.3	South Dakota	28	1,453	43.4
Kentucky	13	179	5.1	Tennessee	7	145	4.6
Louisiana	11	317	8.5	Texas	19	760	5.7
Massachusetts	29	244	17.4	Utah	1	2	0.1
Maryland	6	75	7.1	Vermont	2	101	13.2
Maine	12	185	11.1	Virginia	5	53	1.4
Michigan	29	1,047	17.7	Washington	22	564	11.9
Minnesota	40	1,127	15.5	West Virginia	3	199	5.8
Mississippi	14	288	8.4	Wisconsin	35	1,274	22.2
Missouri	21	737	12.3	U.S. total[1]	686	16,504	8.4

[1] Includes two abandonments slated for the District of Columbia.

Source: Interstate Commerce Commission report, Mar. 9, 1978.

Related Studies

Previous abandonment impact studies primarily have been concerned with economic effects on communities in the vicinity of abandonment or with the effects on agricultural shippers, particularly those in farming regions that have experienced numerous abandonments in recent years. Additionally, these studies, unlike this study, focused on relatively few rail lines or on presumably uneconomic lines with abandonment potential, rather than analyzing on a national scale all lines actually slated for abandonment. A bibliography of rail abandonment impact studies is presented in this report.

Attention has been given to some mineral industries in a few abandonment impact studies. These studies suggest that adverse effects can occur from abandonment.[4] In 1975, for example, part of a University of Illinois study (9) indicated that the abandonment of two rail lines in Nevada had resulted in higher mining costs and apparently deterred the revival of some mining operations. Also, a study for the U.S. Department of Transportation in 1977 indicated potential increases in mineral transport costs if apparently uneconomic rail lines were abandoned (24). A study for the Bureau of Mines alluded to instances of abandonment of rail lines that served mines in various parts of the United States (25).

STUDY METHODOLOGY

In this study, four principal sources of information were analyzed to determine the impact of rail abandonment:

1. The Bureau of Mines Mineral Industry Location System (MILS) was utilized to identify and locate mines, mineral deposits, and mineral processing facilities in the vicinity of the 688 prospective rail line abandonments discussed earlier.

2. Freight commodity data for over 100 rail line abandonment application cases pending before the ICC were examined to determine current mineral tonnages hauled on the lines. Approximately 100 additional abandonment applications to the ICC were surveyed to determine the pace of abandonment and its predominant regional pattern.

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[4]An excellent example of rail abandonment and its effect on mineral developement involved the Bureau of Mines and the recent closure of a 16-mile span of the Maine Central Railroad in Franklin County, Maine. In this case, the Bureau provided supporting evidence to the State of Maine for its petition before the U.S. Court of Appeals to reverse an ICC abandonment authorization. The Bureau's State Liaison Office indicated that the subject rail line could play a key role in several anticipated local mining operations (garnet, limestone, and sand production). However, the Court declined to review the case and abandonment ensued in late 1978.

3. The Bureau's State Mineral Profile publications were used to supplement MILS data.

4. Previous studies of rail abandonment effects on commerce and industry were examined for indicators of possible impacts on mineral industries.

Analysis of these sources proceeded primarily in two ways: First, commodity tonnage and origin-destination data in the abandonment application records held by the ICC were used to identify the impact of immenent applications. (Decisions on most abandonment applications are made within 60 days and rarely take longer than 1 year.) The details and results of this analysis are shown in the following section. Second, the MILS data base was statistically correlated with the location of the 688 prospective abandonments announced by the ICC in an attempt to identify the impact of the abandonments in the absence of freight data for these lines. This approach also tends to show longer range impacts because, at the present rate of abandonment, the 688 abandonments probably would not be completed until well after 1981. A more detailed explanation of the methodology used in this approach follows.

All of the 688 prospective abandonments were plotted on 1:500,000-scale State maps published by the U.S. Geological Survey. Three types of abandonment were plotted on each State map: (1) more than 130 lines for which abandonment applications were currently pending before the ICC, (2) approximately 350 lines that ICC expected rail companies would seek to abandon by mid-1981, and (3) more than 210 lines under study that the ICC believed would be subject to future abandonment attempts.

The areas that presumably were most likely to be affected by the abandonment were then plotted on the State maps. These "impact areas" were graphically defined by drawing a boundary around each prospective abandonment to enclose all points that were closer to the abandonment line than to any remaining rail lines. Thus, the boundary for each impact area was usually drawn equidistant between the abandoned line and nearest remaining rail lines (see fig. 1). Where it was observed that impassable terrain features (rivers, mountain ranges, etc.) without transport routes intervened between the lines slated for abandonment and other rail lines, the boundary for the impact area was drawn along these features rather than equidistant between the lines. On the other hand, the boundaries were drawn irrespective of roads and waterways because it was determined that the pattern of alternative transport routes did not appreciably affect the overall impact area size or configuration.[5] In some cases, adjacent impact areas for two or more prospective abandonments in close proximity would coalesce into a single larger impact area.

The impact area concept is significant because any potential freight originating within the impact area would require longer movement by alternative transport modes if abandonment occurred. Except for relatively

[5] Statistical testing of a random sample of impact areas indicated that highway routes crossing the impact area boundary did not significantly change the total size of the impact areas.

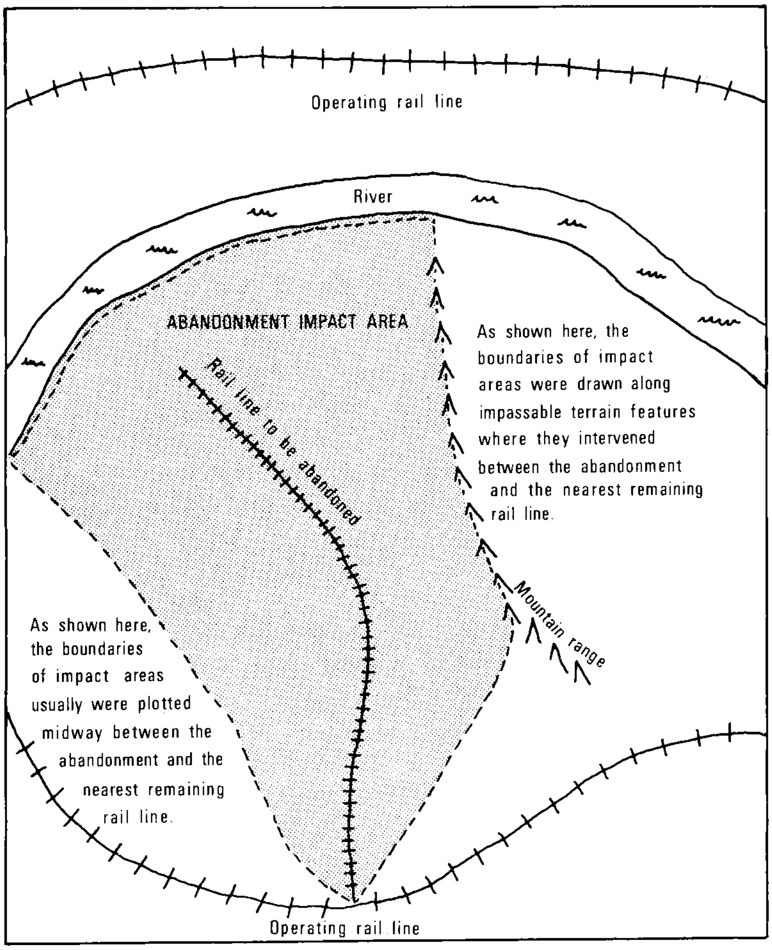

FIGURE 1. - Schematic diagram showing procedure for mapping abandonment impact areas.

few areas where waterways are available, it can be assumed that most of the additional movement would be by truck, which is likely to be more costly and less energy efficient. Thus, the impact area is the most likely place where abandonment would increase the costs of mineral shipping. In addition, heavier truck use would probably lead to more rapid deterioration of roadways in the area.

After the abandonments and their impact areas were plotted, map overlays showing the location of all MILS mineral-related sites were placed over their respective State maps to identify the sites located within each impact area. A total of over 30,000 MILS mineral location points were on the overlays used in this procedure.[6] A tabulation of the number and types of MILS sites in the impact areas was then statistically tested as described in the following section.

Finally, a few caveats concerning this impact area methodology should be noted: First, the methodology is based on the premise that impact is measured solely as an enumeration of MILS sites. Obviously, the number of mineral-related sites alone does not fully measure impact. In terms of employment, production, or other such factors, one site can be more important than several. Thus, a large number of sites in an impact area should be viewed as an indicator, not conclusive evidence, of major impacts. Second, the enumeration of MILS sites was based on the most current listing available as of January 1979. Since that time, the MILS data base has continued to grow with hundreds of new sites being added each month. Analysis

[6] These points are known as "clusters" in the MILS because, for ease of mapping, they represent groups of several closely located mineral properties. In all, these clusters represented more than 85,000 mineral properties at the time this study was done.

of new additions to MILS could, of course, alter the conclusions reached with the 1979 base. In addition, it must be noted that the MILS data base is in different stages of completion for various parts of the country. Thus, interregional variations in the number of listed MILS sites reflects differences in data input as well as actual on-the-ground variations in site density. Nevertheless, despite these qualifying remarks, the impact area methodology outlined above is a viable alternative in lieu of freight tonnage data not available for the prospective abandonments announced by the ICC.

DATA DESCRIPTION AND ANALYSIS

Near-Term Impact Data

A survey was made of more than 200 rail line abandonment applications, including freight records and court proceedings, pending before the ICC between June 1978 and January 1980. The survey was conducted to determine where rail lines were facing imminent abandonment, the pace of abandonment, and what mineral commodities were carried by the lines being abandoned. Approximately half of the surveyed lines were sampled to identify the commodities carried, while the remaining 100 lines were analyzed to identify the rate and locale of abandonment.

Table 2 shows the type of quantity of nonfuel mineral materials carried by rail lines pending ICC abandonment approval (or disapproval) as of June 1978. The data were drawn from a 50-percent random sample of the 104 abandonment applications pending at that time. The applications from which the sample was drawn represented the lines of 39 railroad companies in 30 States, mostly in the Midwest and along the Great Lakes.

TABLE 2. - Raw and processed mineral materials carried by 52 rail lines pending abandonment as of 1978[1]

Category of mineral materials carried	Percent of total tonnage carried[2]
Fertilizers (lime, limestone, phosphate rock, potash, etc.)	11.8
Nonmetallics (cement, clay, glass, gravel, ores, salt, sand, and stone)	6.9
Primary and fabricated metals	1.6
Other (metallic ores, scrap, brick, etc.)	.3
Total	20.6

[1]Based on a 50- percent random sample of 104 rail lines.
[2]All freight carried by the 52 rail lines totaled approximately 4.5 million short tons annually during 1975-77.

Source: Rail abandonment application records; Documents Library, Interstate Commerce Commission.

As shown in table 2, raw and processed mineral materials comprised slightly over 20 percent of the tonnage moved on lines proposed for abandonment. However, it should be noted that all of the mineral-related tonnage equates to an average of less than 18,000 short tons for each line, or only about 200 rail cars per line each year. Most of the mineral tonnage was accounted for by fertilizer shipments. This is not surprising because most of the surveyed lines facing abandonment are in the agriculturally-oriented regions of the country.

Other nonmetallic minerals formed the second largest category of mineral freight moved over the lines slated for abandonment. The traffic consisted primarily of raw mineral commoditites such as sand, gravel, clay, and stone, which were hauled relatively short distances.

By January 1980, over 90 percent of the sampled abandonment cases had been resolved by ICC; almost all were decided in favor of abandonment. However, approximately 100 new applications were pending. These applications were studied to further identify the pace and locale of abandonment. Again, a large portion of the new applications were for rail lines in the Midwest and other agricultural areas nearby. Interviews with ICC personnel[7] concerning the rate and geographic pattern of abandonment confirmed that the emphasis on these farming areas probably would continue through the early 1980's. Thus, mineral fertilizers are expected to continue as a prominent part of the shipping that will be disrupted by abandonment over the next few years.

In addition to fertilizer materials, our review of abandonment records found scattered, localized instances of hardships for mineral shippers. Periodically, testimony in abandonment proceedings claimed that small, local mineral-related facilities such as a brick refractory or clay products plant would be forced to close if abandonment took place. However, there was nothing in the records that revealed recurring instances of problems for shippers of a particular category of minerals other than fertilizers. In the case of fertilizers, total tonnage involved was relatively small and distributed over many rail lines.

In summary, the survey of ICC data and abandonment records indicate that abandonments are not likely to require a major shift in transport modes for nonfuel minerals in the near future. This observation assumes that abandonment proceedings will not be accelerated beyond their present pace and that there will not be a major shift in the current regional pattern of abandonment.

Long-Range Impact Data and Statistical Tests

Long-Range Impact Data

Estimates of longer range abandonment impacts are derived primarily from data shown in tables 1 and 3, and the list of impact-area facilities and/or properties. Statistical analysis correlating this data is described in the following subsection.

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[7] Office of Proceedings, January 1980.

TABLE 3. - MILS mineral sites within abandonment impact areas, by State[1]

State	MILS points in impact areas	State	MILS points in impact areas
Alabama............	12	Montana..............	76
Arizona............	0	North Carolina.......	63
Arkansas...........	2	North Dakota.........	7
California.........	126	Nebraska.............	3
Colorado...........	9	Nevada...............	57
Connecticut........	13	New Hampshire........	42
Delaware...........	0	New Jersey...........	7
Florida............	17	New York.............	22
Georgia............	6	Ohio.................	46
Idaho..............	125	Oklahoma.............	6
Illinois...........	63	Oregon...............	17
Indiana............	33	Pennsylvania.........	18
Iowa...............	12	South Carolina.......	20
Kansas.............	3	South Dakota.........	197
Kentucky...........	10	Tennessee............	35
Louisiana..........	6	Texas................	8
Massachusetts......	53	Utah.................	0
Maryland...........	19	Vermont..............	12
Maine..............	32	Virginia.............	19
Michigan...........	114	Washington...........	254
Minnesota..........	9	West Virgina.........	37
Mississippi........	7	Wisconsin............	246
Missouri...........	110	Total[2]..........	1,973

[1] The definition and derivation of abandonment impact areas are discussed under Study Methodology.

[2] Total accounts for 6 percent of all MILS points in these States.

Table 3 shows the number of MILS minerals-related point locations falling within the impact areas (as previously described under Study Methodology) of each State. As shown in the table, nearly 2,000 MILS points were identified in the impact areas of the 688 abandonment-prone rail lines announced by the ICC. These points represented an estimated 5,800 mineral properties, equal to 7 percent of the total MILS data base. Well over half of the points (1,123) represented inactive sites composed of undeveloped prospects and closed mines and plants, 615 represented active sites of producing mines and operating plants, and the remaining 235 points represented both active and inactive sites. The predominance of inactive sites may portend greatly reduced opportunities to develop new prospects or reopen closed facilities.

The following list shows the varieties of minerals as well as mining and processing activities that are located at the MILS points in the impact areas:[1]

Mineral materials[2]		Mineral facilities and/or properties[2]
Antimony	Magnetite	Abrasives
Asbestos	Manganese	Brick production plants
Barite	Marble	Brine production plants
Bauxite	Molybdenum	Clay products plants
Bentonite	Mica schist	Crushing mills
Beryllium	Nickel	Fiberglass plants
Calcium	Pegmatite	Forgings plants
Cement	Perlite	Glass-producing plants
Clay	Phosphate rock	Grinding mills
Columbium	Phosphorus	Metal works
Copper	Platimum	Milling plants
Corundum	Pyrite	Mines
Diatomite	Osmium	Mineral deposits
Feldspar	Quartz	Mineral pits
Fluorine	Rare-earth minerals	Mineral placers
Gem stones	Salt	Mineral prospects
Germanium	Sand	Pelletizing plants
Glass	Shale	Quarries
Gold	Silica	Refractory plants
Granite	Silver	
Gravel	Slate	
Gypsum	Sodium	
Iridium	Sulfur	
Iron ore	Taconite	
Kaolin	Talc	
Kyanite	Thorium	
Lead ore	Titanium	
Lime	Tungsten	
Limestone	Vermiculite	
Magnesium	Zinc	
	Zirconium	

[1] The definition and derivation of abandonment impact areas are discussed under Study Methodology.
[2] As identified in MILS data base.

Sixty-one mineral materials and 19 types of facilities, operations, or properties have been identified at these points.

In the impact areas, nonmetallic mineral sites greatly outnumbered metallic mineral sites. By far the most frequently encountered nonmetallic site types were sand, gravel, and limestone quarries with the usual auxiliary preparation mills and plants. These quarries were about evenly divided between active and inactive statuses. Numerous prospects, both metallic and nonmetallic, were found in impact areas throughout 18 States, primarily in the East. Iron, lead, and zinc prospects (both developed and undeveloped) and abandoned mines were among the most frequently encountered metallic mineral sites contained in the impact areas.

Statistical Tests

In view of the great number and variety of MILS sites located in the abandonment impact areas, the data presented in tables 1 and 3 were submitted to various statistical tests to determine what correlation, if any, existed between the location of prospective rail abandonments and the occurrence of MILS sites throughout the United States. A strong correlation would indicate that the occurrence of MILS sites in the impact areas was not due to chance but was the result of an unusually high frequency of abandonment in mining and mineral-processing areas. Details of the statistical tests are presented in the appendix.

Testing began with simple regression analysis. In the initial three simple regression analyses, the dependent variable was the total number of MILS points in each State, and the independent variables were those of abandonment mileage, number of abandonment lines, and percent of track network to be abandoned in each State. These tests each yielded a coefficient of determination (R^2) of less then 0.002, indicating virtually no correlation. However, these initial tests did not consider a key factor--the geographic distribution of abandonment lines and MLS location points within each State. The intrastate distribution of abandonment-prone rail lines and MILS points determines whether or not they will coincide geographically, regardless of their total numbers in each States.

The relationship between abandonment lines and MILS points within each State was examined by measuring the correlation between MILS points in the impact areas of each State and various rail line abandonment parameters. Three simple regression analyses were performed using the total number of MILS points in the impact areas of each State as the dependent variable and the following parameters as the independent variables: (1) number of rail lines to be abandoned in each State, (2) track mileage to be abandoned in each State, and (3) percent of total State track network to be abandoned. The R^2 values for the regression analyses of these variables were as follows:

Independent variable	R^2 value
1............................	0.15
2............................	.28
3............................	.18

Another possible hypothesis is that the number of MILS points within impact areas also could be a function of the total number of MILS points in each State. Therefore, the number of points in the impact areas was tested for correlation with the total number of MILS points in each State. The test yielded an R^2 of 0.32, which is higher than the R^2 values achieved with the three rail abandonment variables noted above.

After completing the tests just described, the independent variables that yielded the highest R^2 values were combined in multiple regression analysis to examine further the coincidence of MILS points and impact areas. (Combinations were used only if the degree of association between the independent variables was an R^2 of less than 0.01.) Thus, the number of impact area points for each State was used as the dependent variable and correlated to the following combinations of independent variables: (1) abandonment mileage in each respective State plus total number of MILS points in the State, and (2) percent of State track network to be abandoned plus total number of MILS points in the State. The coefficient of multiple determination (R^2) between the dependent variable and these two sets of independent variables was shown to be 0.59 and 0.65, respectively.[8] Although these were the two highest values attained in regression analysis, they do not indicate a particularly high degree of correlation between MILS points and abandonment impact areas. Furthermore, a substantial part of the R^2 values are due to the correlation between total MILS points and impact area points rather that between MILS points and the track abandonment parameters.

In summary, the R^2 values of all statistical tests utilized in this study were not high enough to indicate a significant correlation between the prospective rail abandonments and the location of mineral properties and facilities. Based on these tests, there is little reason to believe that any geographic coincidence of these variables is more than a random occurrence. Thus, the tests do not provide sufficient evidence to contend that the abandonments unduly impact on mining and mineral-processing areas.

CONCLUSIONS

Concurrent with the trend toward large-scale abandonment of U.S. rail lines, this study analyzed the potential impacts of abandonment on domestic mineral industries. The conclusions reached in this study are derived principally from the analysis of 200 rail line freight records, over 2,000 mineral sites, and 700 prospective abandonments in 45 States. These conclusions are as follows:

1. Raw and processed nonfuel minerals probably will comprise a large percentage of the traffic disrupted by the abandonment of rail lines in the next few years. However, the actual mineral tonnage involved will be small compared with total domestic mineral traffic and will be distributed over many lines. Most of the this mineral freight will be accounted for by fertilizer materials carried within agricultural regions and by relatively low-value minerals (rock, sand, gravel, etc.), which are normally moved short distances. Thus, local short-haul producers and/or shippers will be affected.

2. Instances of hardship on some small mineral shippers already have resulted from abandonment. Moreover, adverse impacts on mineral producers that were important to their local economies were observed frequently enough to suggest a need for safeguards that would mitigate the effects of abandonment disruption.

3. Although a great number and variety of mineral sites were identified in the abandonment impact areas, statistical analysis did not indicate a

[8] Computed T-values between the dependent variable and the independent variables ranged from 5.1 to 6.1.

strong coincidence of MILS mineral sites and prospective rail line abandonments. Thus, the occurrence of MILS sites in the impact areas does not appear to be the result of abandonments focused on mining and mineral-processing areas. However, it should be noted that this conclusion is subject to the caveats described in the Study Methodology section.

4. The predominance of inactive mineral prospects and closed mining facilities in many abandonment impact areas, principally in Western States, suggests that abandonment could significantly reduce the opportunity to develop new resources or reopen defunct mining operations in those areas.

5. Despite the problems noted above, this study did not discern any long-term abandonment trends with national or broad regional dimensions that would require major shifts in transport modes for nonfuel minerals. This conclusion assumes no acceleration in the pace of abandonment proceedings and no major alteration in the current geographic pattern of abandonment.

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APPENDIX.--DETAILS OF STATISTICAL TESTS

Simple Linear Regressions[1]

When Y = number of MILS cluster points in the impact areas of each State,
and X = percent of railroad track abandoned in each State (45 States),

then the regression equation is Y = 17 + 2.77 X,
R^2 (coefficent of determination) is 0.18,
and computed T-value is 3.14.

When Y = number of MILS cluster points in the impact areas of each State,
and X = track mileage to be abandoned in each State (45 States),

then the regression equation is Y = 13 +8.27 X,
R^2 (coefficient of determination) is 0.28,
and computed T-value is 4.13.

When Y = number of MILS cluster points in the impact areas of each State,
and X = number of rail lines to be abandoned in each State (45 States),

then the regression equation is Y = 15 + 1.87 X,
R^2 (coefficient of determination) is 0.15,
and computed T-value is 2.77

When Y = number of MILS cluster points in the impact areas of each State,
and X = total number of MILS sites in each State (42 States),

then the regression equation is Y = 12 + 4.76 X,
R^2 (coefficient of determination) is 0.32,
and computed T-value is 4.42.

When Y = total number of MILS cluster points in each State,
and X = track mileage to be abandoned in each State (42 States),

then the regression equation is Y = 403 - 0.02 X,
R^2 (coefficient of determination) is 0.0009,
and computed T-value = -0.19.

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[1]With Y as the dependent variable and X as the independent variable.

When Y = total number of MILS cluster points in each State,
and X = percent of railroad track to be abandoned in each State (42 States),

then the regression equation in $Y = 695 + 3.95\ X$,
R^2 (coefficient of determination) is 0.002,
and computed T-value is 0.26.

When Y = total number of MILS cluster points in each State,
and X = number of rail lines to be abandoned in each State (42 States),

then the regression equation is $Y = 757 - 1.81\ X$,
R^2 (coefficient of determination) is 0.0008,
and computed T-value is 0.18.

Multiple Regression Analysis[2]

When Y = number of MILS cluster points in the impact areas of each State,
X_1 = total number of MILS cluster points in each State,
and X_2 = percent of railroad track to be abandoned in each State (42 States),

then the regression equation is $Y = -25 + 0.05\ X_1 + 4.6\ X_2$,
R^2 (coefficient of multiple determination) is 0.65,
computed T-value for X_1 is 5.7,
and computed T-value for X_2 is 6.1.

When Y = number of MILS cluster points in the impact areas of each State,
X_1 = total number of MILS cluster points in each State,
and X_2 = track mileage to be abandoned in each State (42 States),

then the regression equation is $Y = 21.5 + 0.05\ X_1 + 0.08\ X_2$,
R^2 (coefficient of multiple determination) is 0.59,
computed T-value for X_1 is 5.6,
and computed T-value for X_2 is 5.1.

[2] With Y as the dependent variable and X_1 and X_2 as the independent variables.