PB81-211765

REPORT NO. FRA/ORD-81/43

ENERGY AUDIT OF THE BOSTON AND MAINE RAILROAD

John Hitz
Robert Dorer
Stephen Cultrera
Arthur Bohnwagner

U.S. Department of Transportation
Research and Special Programs Administration
Transportation Systems Center
Cambridge MA 02142

Boston and Maine Corporation
Iron Horse Park
North Billerica MA 01862

APRIL 1981

INTERIM REPORT

Prepared for

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION
Office of Research and Development
Washington DC 20590

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FRA/ORD-81/43		PB81 211765

4. Title and Subtitle	5. Report Date
ENERGY AUDIT OF THE BOSTON AND MAINE RAILROAD	April 1981
	6. Performing Organization Code: DTS-732
7. Author(s): John Hitz, Robert Dorer, Stephen Cultrera, Arthur Bohnwagner*	8. Performing Organization Report No.: DOT-TSC-FRA-81-11
9. Performing Organization Name and Address: U.S. Department of Transportation, Research and Special Programs Administration, Transportation Systems Center, Cambridge MA 02142	10. Work Unit No. (TRAIS): RR152/R1308
	11. Contract or Grant No.
12. Sponsoring Agency Name and Address: U.S. Department of Transportation, Federal Railroad Administration, Office of Research and Development, Washington DC 20590	13. Type of Report and Period Covered: Interim Report, January 1980-February 1981
	14. Sponsoring Agency Code: RRD-12

15. Supplementary Notes

*Mr. Bohnwagner works for the Boston and Maine Corporation.

16. Abstract

This report documents an energy audit of the Boston and Maine Railroad performed in support of a joint Government/industry program to determine means of conserving energy on railroads without reducing safety or service quality. The audit was performed by DOT's Transportation Systems Center and the B&M Railroad under the sponsorship of the Federal Railroad Administration.

Phase I of the energy audit involved acquisition and analysis of energy-related data for the month of December 1979 to determine energy supply and use patterns on the B&M and identify major areas of energy use for conservation emphasis. Phase II involved more detailed analysis of additional diesel fuel data for the months of December 1979 through August 1980 to assist in identifying and evaluating conservation options for freight train operations.

The energy audit showed that railroads should focus energy conservation efforts on freight train operations where 78% of the total energy used by the B&M was consumed. Accurate metering of diesel fuel supply, use and inventories is a necessary first step in managing conservation of this resource. A strong relationship was found between diesel fuel consumed and ton-miles of work performed indicating that actions taken to increase the gross-to-tare weight ratio of trains (e.g., reduced empty car movement) will reduce overall fuel consumption. A trend towards greater fuel use efficiency (ton-miles per gallon) with warmer weather was explained, in part, by the effectiveness of the B&M policy of restricted locomotive idling during warmer months.

17. Key Words	18. Distribution Statement
Energy conservation Energy audit Railroad energy use Locomotive fuel use Transportation energy use	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	98	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

PREFACE

This report documents interim results of an energy audit of the Boston and Maine Railroad in support of the Federal Railroad Administration (FRA)/Boston and Maine (B&M) Railroad Energy Use Study. The energy audit currently involves acquisition and analysis of energy-related data to determine energy supply and use patterns, identify major areas of energy use for project emphasis and assist in identifying and evaluating energy conservation options. This effort is being performed jointly by the Transportation Systems Center (TSC) and the B&M Railroad to produce information which will be useful to all railroads in determining effective means of conserving energy.

The TSC project manager is Robert Coulombre, and the principal investigator is John Hitz. B&M participation in the project is managed by Sidney Culliford, Vice president of Transportation, and George Gallagher, General Superintendent - Transportation. Acquisition of energy audit data is being coordinated by Arthur Bohnwagner of the B&M. Analysis of the data is performed by Robert Dorer of TSC. A data base management system for the energy audit data was developed and is maintained by Stephen Cultrera of TSC.

The authors are indebted to all TSC and B&M participants for their assistance and cooperation in supporting the energy audit.

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
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		AREA		
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°F	Fahrenheit temperature	[illegible]	Celsius temperature	°C

Approximate Conversions from Metric Measures

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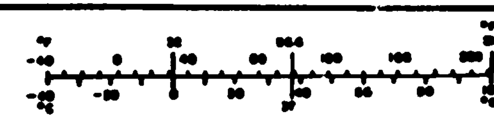
°C	Celsius temperature	[illegible]	Fahrenheit temperature	°F



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SUMMARY

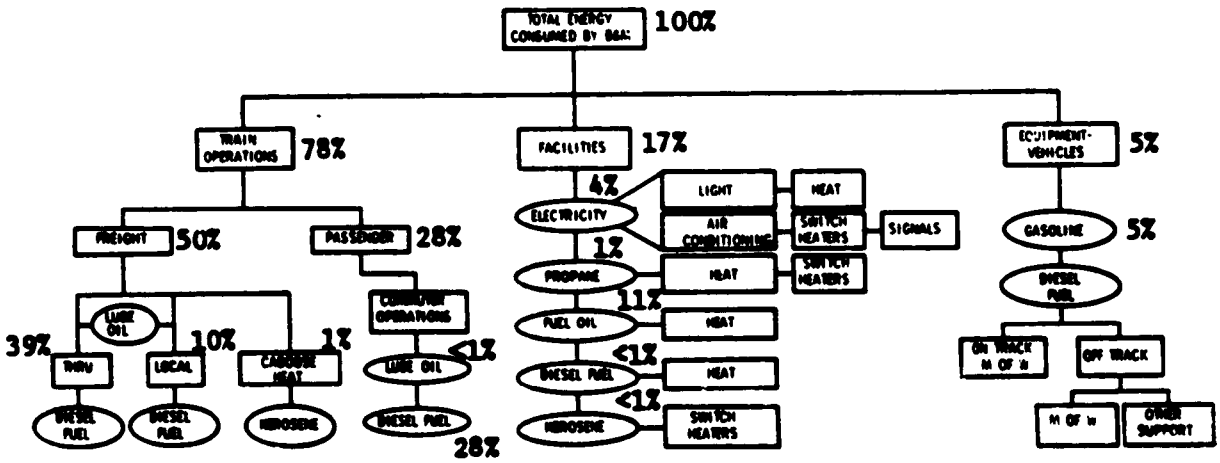
This report documents interim results of an energy audit of the Boston and Maine (B&M) Railroad in support of a joint DOT/B&M Railroad energy conservation study. The energy audit is being performed in two phases. Phase I involved acquisition and analysis of energy-related data for the month of December 1979 to determine energy supply and use patterns on the B&M system and identify major areas of energy use for conservation emphasis. Phase II currently involves more detailed analysis of additional diesel fuel use data for the months of December 1979 through August 1980 to assist in identifying and evaluating conservation options for thru freight train operations. The energy audit is being performed jointly by the B&M Railroad and the DOT's Transportation Systems Center under sponsorship of the Federal Railroad Administration.

The energy audit has resulted in the following conclusions:

- Railroads should focus energy conservation efforts on thru freight train operations
- Accurate metering of diesel fuel supply, use and storage is a necessary first step in managing conservation of this resource
- The audit data supports actions to increase the gross to tare weight ratio of trains and reduce locomotive idling as effective conservation measures.

The results of the Phase I energy audit are summarized in the following energy flow chart of the B&M system. The figure shows that train operations consume 78% of the total energy on the B&M system, while facilities and equipment consume the remaining 17% and 5%, respectively. Within train operations, thru

freight train operations constitute the largest single energy consumption area on the B&M, 39% of the total, and for that reason was selected as the area for project conservation emphasis. Conservation options identified and currently being evaluated for effectiveness include: guidelines for improved matching of locomotive horsepower to train tonnage, locomotive isolation and fuel saver devices, reduced speed profiles and idling times, locomotive mates for line haul service,* and reclaiming and recycling of spilled fuel.



*The mate concept being investigated is a 4-axle locomotive with traction motors but without a diesel engine for power. The mate would be coupled with and driven by two GP-40 locomotives. Because the power available from the two GP-40's would be spread over six traction motors per unit, the same tractive effort can be obtained at low speeds with a mate consist as with a three GP-40 consist. The mate consist can, therefore, achieve fuel savings by permitting the use of one less locomotive for certain train applications. In this configuration, the mate consist has similar fuel consumption characteristics as two SD-40 locomotives.

A data base management system was developed for the continuing Phase II audit of diesel fuel to assist in organization and analysis of the data. The Phase II audit has shown that one major fuel supplier has provided about 56% of the total B&M fuel. The leading three suppliers provided about 78% of the total. The average price of diesel fuel increased from 75¢ to 85¢ per gallon during the audit period from December, 1979, to June, 1980. A comparison of fuel supplied to fuel consumed indicates a net surplus of over 600,000 gallons of fuel over the same period. A detailed examination of fuel use data from newly installed fuel pump meters on the B&M system and inventories of fuel storage tanks should be performed to provide an accurate accounting of this discrepancy between supply and use. This effort would also assist in identifying any areas of spillage or unauthorized use.

Analysis of Phase II diesel fuel data has established a strong relationship between fuel consumed and ton-miles of work performed which is in agreement with results of fuel consumption tests performed on B&M freight trains.* Actions taken to increase the gross-to-tare-weight ratio of trains (e.g., reduced empty car movement) will therefore reduce overall fuel consumption. Phase II data also indicated a trend towards greater fuel use efficiency, measured by ton-miles per gallon, with warmer weather. In part, this improvement may be due to the effectiveness of the B&M policy of reduced locomotive idling during warmer months.

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*Hitz, J., and R. Dorer, "Baseline Fuel Consumption Tests on the B&M Railroad - Interim Results," Project Memorandum, RR152, Transportation Systems Center, December 15, 1980.

Several added tasks should be performed before completion of the audit. The Phase I audit should be expanded to include additional months. As a minimum, several months in the winter and summer should be included. The expanded Phase I audit will permit analysis of the effects of seasonality on the rank of major energy use areas and will reduce potential errors due to time lags between actual and recorded supply/use of energy. The Phase II audit should be extended to a complete year to permit a more thorough analysis and verification of seasonal and other trends in fuel consumption and fuel use efficiency.

1. INTRODUCTION

1.1 PURPOSE

This report documents interim results of an energy audit of the Boston and Maine (B&M) Railroad in support of the Federal Railroad Administration (FRA)/B&M Railroad Energy Use Study. The energy audit involves acquisition and analysis of energy data from the B&M with the objectives of: (1) characterizing energy supply and use patterns, (2) identifying major areas of energy use for project emphasis, and (3) assisting in the selection and evaluation of energy conservation options. This effort is being performed jointly by DOT's Transportation Systems Center (TSC) and the B&M Railroad for the overall purpose of providing information which will be useful to all railroads in determining effective means of conserving energy.

1.2 BACKGROUND

The increasing cost and occasional scarcity of energy, in general, and locomotive diesel fuel, in particular, has created a strong need on the part of all railroads and the FRA to identify and evaluate options for conserving energy. In response to this need, the FRA/B&M Railroad Energy Use Study was initiated in January 1980. Under this project, the FRA is sponsoring a joint effort between TSC and the B&M Railroad with the purpose of determining means of conserving energy on railroads without reducing safety or service quality.

The first task under the FRA/B&M study, reported here, is to perform an energy audit of the B&M Railroad. Results of the energy audit have shown that thru freight train operations are the largest single user of energy on the B&M system and thus the area to receive project emphasis for conservation efforts.

The second task uses information from the audit to identify and evaluate options for conserving energy required for freight train operations. Conservation options identified and currently being evaluated include: better matching of locomotive horsepower to train tonnage, locomotive isolation, fuel saver devices, locomotive mates for line haul service* and changes in speed profiles. Conservation options which the analyses show to be effective will be evaluated in the field under controlled test conditions as part of the third project task. These tests will validate the energy savings of the conservation options and provide a means of evaluating their overall feasibility for implementation. Task four of the project will involve dissemination of useful results to the railroad industry through an FRA-sponsored Energy Management Workshop to be held at TSC in October, 1981.

1.3 APPROACH

The energy audit task was initiated by the development of data requirements for the Phase I effort. These requirements were then coordinated with the B&M Railroad and the necessary data was obtained for the month of December 1979, as described in Section 2. This data was then analyzed to characterize energy supply and use patterns on the B&M and to identify leading energy users for project emphasis on conservation efforts. The results of this task led to

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*The mate concept being investigated is a 4-axle locomotive with traction motors but without a diesel engine for power. The mate would be coupled with and driven by two GP-40 locomotives. Because the power available from the two GP-40's would be spread over six traction motors per unit, the same tractive effort can be obtained at low speeds with a mate consist as with a three GP-40 consist. The mate consist can, therefore, achieve fuel savings by permitting the use of one less locomotive for certain train applications. In this configuration, the mate consist has similar fuel consumption characteristics as two SD-40 locomotives.

identification of thru freight train operations as the leading energy user on the B&M system, as described in Section 3. Phase II of the energy audit, discussed in Section 4, is currently in progress and involves the continued acquisition and analysis of locomotive diesel fuel use data in support of conservation efforts on thru freight train operations. Section 5 of the report discusses remaining work to be performed on the energy audit.

2. ACQUISITION OF ENERGY AUDIT DATA

2.1 DATA REQUIREMENTS

Prior to performing the Phase I energy audit, requirements for data were established. The need to identify the different types and amounts of energy used on the B&M system and the suppliers of this energy resulted in the development of the supplier data form shown in Figure 2-1. Similarly, the data form shown in Figure 2-2 was developed to identify users of the different types of energy. Anticipating that diesel fuel for train operations would be a major use of energy, a more detailed data form was developed for this energy type to describe its various uses at the different fueling points as shown in Figure 2-3.

2.2 DATA ACQUISITION

Working with the B&M, December 1979 was selected as the month for the Phase I audit. At that time, December was the most recent month for which locomotive diesel fuel use data was available. In addition, it was believed that one month's data would be sufficient to provide initial guidance to the project and would limit the extensive amount of labor required for acquisition of data.

Information required on the different types of energy supplied to the B&M (Figure 2-1), other than diesel fuel, was obtained by the B&M accounting and purchasing departments located in Boston. The fuel officer of the transportation department provided the data required on diesel fuel use as specified in Figures 2-1, 2-2, and 2-3.

ENERGY SUPPLIER

TYPE OF ENERGY	#1 $	#1 UNITS	#2 $	#2 UNITS	#3 $	#3 UNITS	#4 $	#4 UNITS
DIESEL FUEL								
HEATING OIL								
ELECTRICITY								
LUB. OIL								
GASOLINE								
NATURAL GAS								
PROPANE GAS								
COAL								
STEAM								
OTHER								

FIGURE 2-1. AMOUNT VERSUS TYPE OF ENERGY SUPPLIED TO B&M BY SUPPLIER

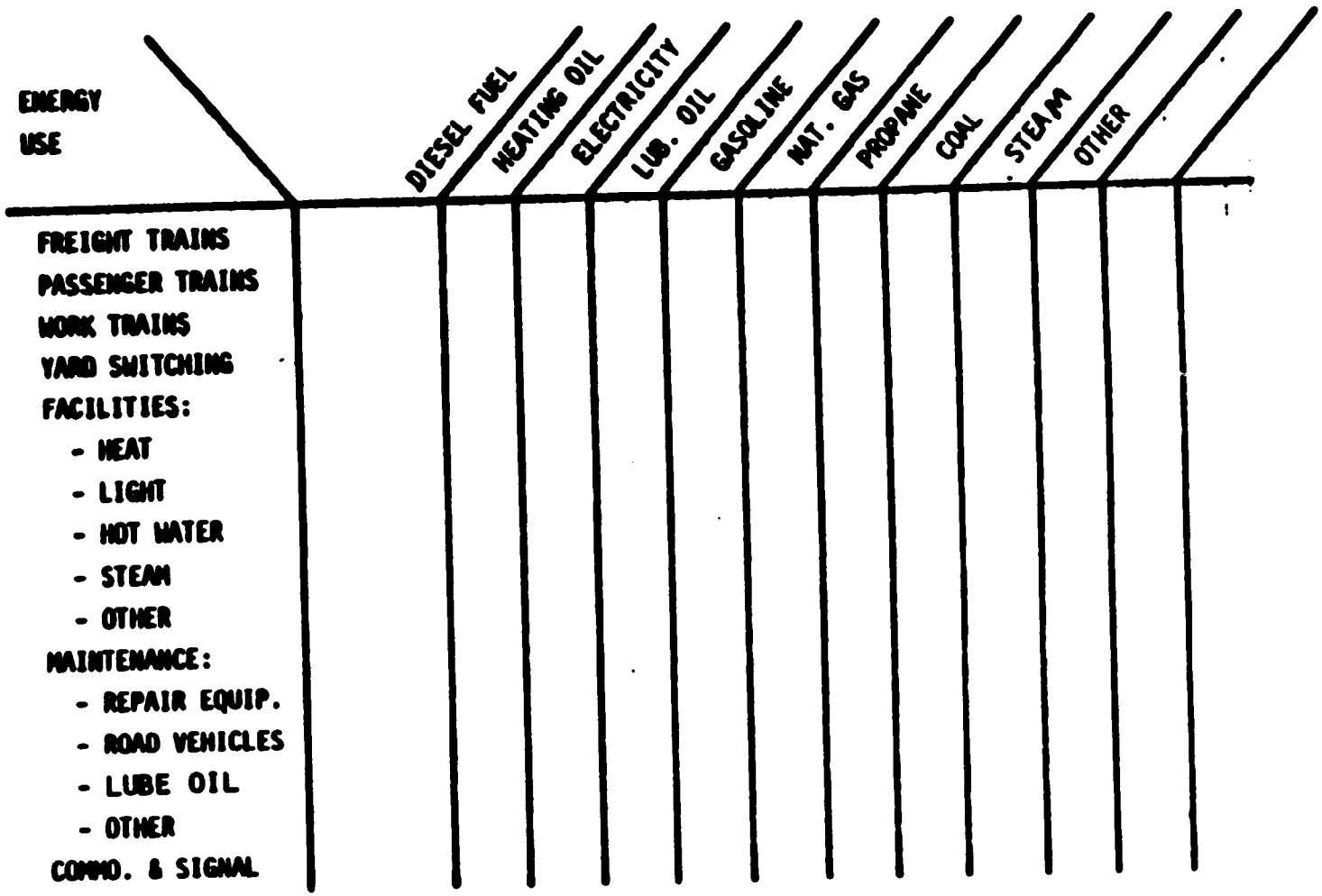

FIGURE 2-2. ENERGY USE VERSUS ENERGY TYPE ON B&M SYSTEM

FUELING STATION	STATION OUTPUT $	GALLONS
ROTTERDAM JCT.		
MECHANICVILLE		
E. DEERFIELD		
GARDNER		
FITCHBURG		
AYER		
LOWELL		
LAWRENCE		
BRADFORD		
DOVER		
PORTLAND		
PORTSMOUTH		
GLOUCESTER		
SALEM		
BOSTON		
WORCESTER		
SPRINGFIELD		
HOLYOKE		
BRATTLEBORO		
WHITE RIVER JCT.		
WELLS RIVER		
WHITEFIELD		
GROVETON		
NASHUA		
MANCHESTER		
CONCORD		

FIGURE 2-3. FUEL CONSUMED AT EACH FUELING STATION

After initiating the data acquisition process, it became apparent that some of the data requirements could not be fully met. For example, manual accounting techniques did not permit identifying all the different suppliers of each energy type as originally specified in Figure 2-1. The exception to this is in the diesel fuel area where it was possible to identify specific suppliers and amounts supplied. For nondiesel fuel energy, therefore, the resulting data reduced to gross totals of the different types of energy supplied to the B&M. Similarly, amounts of different energy types consumed for specific uses, as specified in Figure 2-1, was aggregated to the level of major use areas; e.g., facilities and equipment vehicles. Working with B&M personnel, however, it was possible to identify the specific use subcategories for the different energy types, as shown in Table 2-1.

TABLE 2-1. USE SUBCATEGORIES FOR DIFFERENT ENERGY TYPES

ENERGY TYPE	USE CATEGORIES
Diesel Fuel	Thru Freight Train Operations Local and Switching Train Operations Passenger Train Operations Facility Heating Equipment-Vehicles
Kerosene	Caboose Heating Switch Heaters
Electricity	Facility Lighting Facility Heating Facility Air Conditioning Switch Heaters Signals
Propane	Facility Heating Switch Heaters
Fuel Oil	Facility Heating
Gasoline	Equipment-Vehicles
Lubrication Oil	Freight Train Operations Passenger Train Operations

For the nondiesel fuel energy types, records of energy supplied were assumed to be equal to energy used during the month of December. For electricity, a major energy use category, this assumption is not considered to introduce any error since this form of energy is not stored. For other nondiesel stored-types of energy, some error in use estimates may be introduced. A longer term audit, presently being considered, would tend to eliminate this type of error.

3. ANALYSIS OF B&M ENERGY USE DATA, PHASE I

3.1 ENERGY SUPPLY AND USE PATTERNS

A summary of the energy data obtained for the December 1979 audit is presented in Figures 3-1 and 3-2. These figures express the energy used on the B&M system in common units of dollars (Figure 3-1) and BTU's (Figure 3-2). The average cost rates and equivalent BTU contents of the different types of energy used to convert the basic data are listed in Appendices A and B, respectively. As Figures 3-1 and 3-2 show, the resulting combinations of energy types and uses is greatly simplified from the possible combinations originally proposed. Several energy types, such as coal and steam, were not used at all by the B&M and others were not used for certain applications; e.g., electricity was not used for train operations.

Overall use of energy on the B&M system, in units of dollars, is described by the diagram in Figure 3-3. Of the three major use categories identified; train operations, facilities, and equipment-vehicles, train operations consumed the most energy. The dominant energy type for train operations is diesel fuel with relatively small amounts of lube oil and kerosene also being used. Facilities also consumed a significant amount of energy with the largest portion (65%) being fuel oil for heating. It is expected that this level of fuel oil use would diminish in warmer weather. As described by the diagram, the amounts of certain energy types used for specific purposes could not be established by the available data. For example, the amounts of electrical energy used specifically for lighting and air conditioning could not be determined, although the total amount of electricity used was known. Equipment-vehicles used a relatively small amount of energy consisting

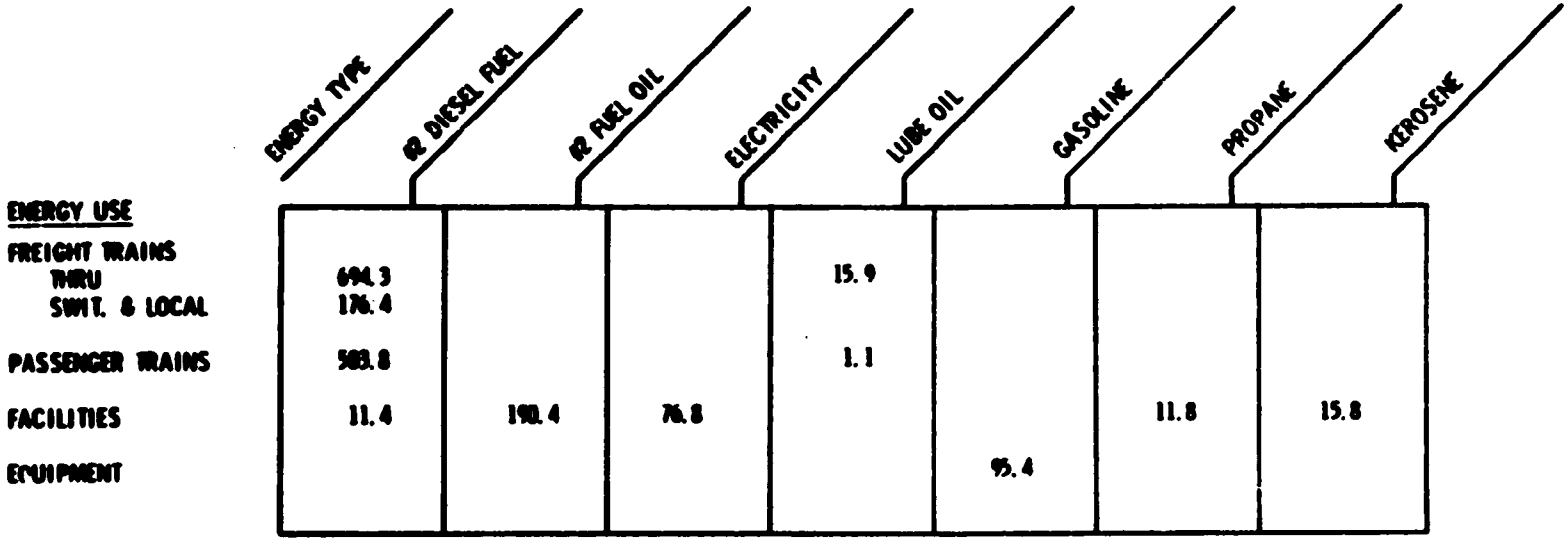

FIGURE 3-1. ENERGY USE BY ENERGY TYPE, $ THOUSANDS - DECEMBER, 1979

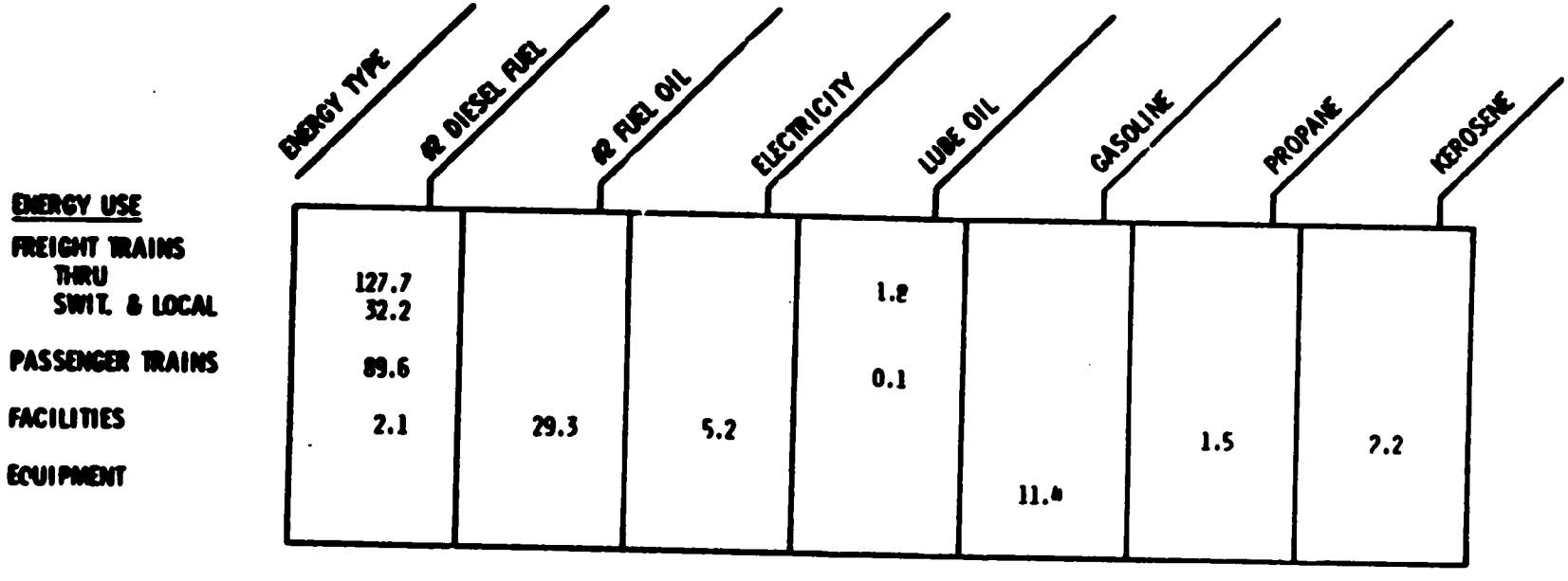

FIGURE 3-2, ENERGY USE BY ENERGY TYPE, BTU's x 10^9 - DECEMBER, 1979

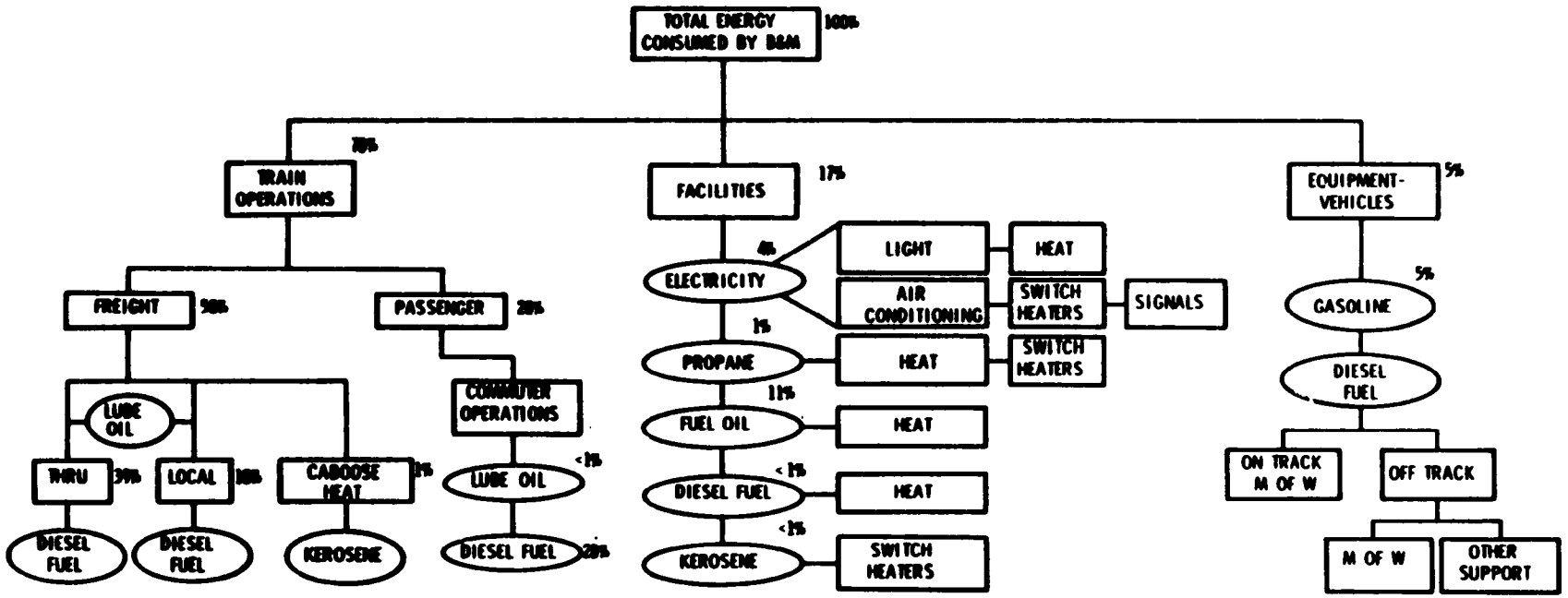

FIGURE 3-3. B&M SYSTEM ENERGY USE BY PERCENT OF TOTAL ENERGY COST - DECEMBER, 1979

primarily of gasoline. Again, the amounts of this energy type used for specific purposes could not be determined.

Table 3-1 provides a ranking of the major energy uses on the B&M system on the basis of cost. The table also shows the percent by cost of total energy consumed by each use category and its equivalent BTU's. Train operations, as a separate major category, consumes 78% of the total energy used by the B&M Railroad. Within this category, thru freight train operations is the single largest consumer of energy, 39% of the total. Passenger train operations also consume a significant portion of the total energy, 28%. This comparison of freight and passenger operations does not consider their relative fuel efficiencies; e.g., in terms of gallons per ton-mile. Facilities heating with fuel oil, ranked third, is the leading nontrain operations energy user consuming a significant 11% of the total energy. Two other energy uses, caboose heating and lube oil, while consuming less than 1% of the total, appear excessive when considered separately. The amount of kerosene used for caboose heating was estimated on the basis of a six-gallon per day burn rate. The total kerosene and lube oil amounts were estimated on the basis of supply records for the month of December and could change significantly if averaged over a longer period.

Because of the anticipated large use of diesel fuel for train operations, additional information was obtained on its supply and use. Table 3-2 shows the amount of diesel fuel used by the B&M for thru freight, switch and local freight, and passenger service for all the fueling points on the B&M for the month of December 1979. The fueling points are ranked by the amount of fuel used. Since most of the passenger trains are fueled in Boston, it ranked the

TABLE 3-1. RANKING OF MAJOR ENERGY USES BY COST - DECEMBER, 1979

ENERGY USE	AMOUNT & TYPE	COST (X$1000)	BTU'S (X 10^9)
THRU FREIGHT OPERATION	913,563 GAL. #2 DIESEL FUEL	694.3	127.7
PASSENGER TRAIN OPERATION	645,892 GAL. #2 DIESEL FUEL	503.8	89.6
FACILITIES HEATING (FRT.)	211,611 GAL. #2 FUE L OIL	190.4	29.3
SWITCH AND LOCAL TRAIN OPERATION	232,046 GAL. #2 DIESEL FUEL	176.4	32.2
EQUIPMENT (ON & OFF TRACK VEHICLES)	90,830 GAL. (REG. & UN-LEADED) GASOLINE	95.4	11.4
FACILITIES (HEAT, LIGHT, SWITCH HEATERS, ETC.)	1,536,000 KWH ELECTRICITY	76.8	5.2
LOCOMOTIVE LUBE OIL (FRT.)	12,709 GAL. LUBE OIL	15.9	1.8
CABOOSE HEATING	14,460 GAL. KEROSENE	13.7	1.7
FACILITIES (HEAT & SWITCH HEATING)	16,900 GAL. PROPANE	11.8	1.5
FACILITIES (TAP OFF FOR BET BOILER)	15,000 GAL. #2 DIESEL FUEL	11.0	2.1
FACILITIES (SWITCH HEATERS, "POTS", DIESEL FUEL SUB-STITUTE)	2,606 GAL. KEROSENE	2.1	.5
LOCOMOTIVE LUBE OIL (PASS.)	880 GAL. LUBE OIL	1.1	.1
	TOTALS	$1,792,000	303.1

TABLE 3-2. DIESEL FUEL USE BY TYPE OF TRAIN AND FUELING STATION, GALLONS - DECEMBER, 1979*

FUELING STATION	THRU FRT	SWITCH & LOCAL	PASSENGER	TOTAL
BOSTON, MA	78,632	41,401	321,071	441,104
PORTLAND, ME	280,961	-	-	280,961
EAST DEERFIELD, MA	223,096	37,728	-	260,824
MECHANICVILLE, NY	209,815	13,374	-	223,189
SOUTH STATION	-	-	121,633	121,633
PROVIDENCE, RI	-	-	71,797	71,797
SPRINGFIELD, MA	57,000	4,481	-	61,481
CONCORD, NH	32,915	13,871	12,576	59,362
FRANKLIN, MA	-	-	55,036	55,036
WHITE RIVER JCT, VT	31,144	3,876	-	35,020
FITCHBURG, MA	-	12,613	14,381	26.994
HAVERHILL, MA	-	-	21,508	21,508
AYER, MA	-	21,085	-	21,085
GARDNER, MA	-	1,395	14,837	16,232
LOWELL, MA	-	3,773	11,089	14,862
LAWRENCE, MA	-	14,645	-	14,645
MANCHESTER, NH	-	13,852	-	13,852
WORCHESTER, MA	-	10,525	-	10,525
DOVER, NH	-	10,292	-	10,292
NASHUA, NH	-	6,004	-	6,004
GROVETON, NH	-	4,826	-	4,826
SALEM, MA	-	4,760	-	4,760
PORTSMOUTH, NH	-	4,236	-	4,236
WHITEFIELD, NH	-	3,644	-	3,644
BRATTLEBORO, VT	-	3,472	-	3,472
HOLYOKE, MA	-	2,193	-	2,193
ROCKPORT, MA	-	-	1,964	1,964
	913,563	252,046	645,892	1,791,501

*All figures presented here were revised slightly to their final values presented in Appendix F.

highest. The three major thru freight fueling points, Portland, East Deerfield and Mechanicville, were the next largest issuers of fuel. Since the December audit, fueling at Portland was discontinued and transferred primarily to East Deerfield.

Table 3-3 shows a listing of diesel fuel suppliers to the B&M ranked by the amounts of fuel supplied to the B&M fueling points for the month of December. The suppliers' names have been coded because of their proprietary nature. The leading supplier to the B&M provided about 56% of the total fuel used. About 78% of the fuel supplied was provided by three suppliers.

A comparison of the fuel supplied and used at each fueling point, as shown in Tables 3-2 and 3-3, indicates several discrepancies. In some cases, these discrepancies are caused by time lags between actual and recorded supply. Amounts of fuel supplied to the system are taken from billing records received in December which may have included fuel actually supplied in earlier months. Fuel use records, however, are determined from actual use for that month. In addition, several fueling points have storage tanks, the inventories of which have not been accounted for. Discrepancies can also result from spillage, unauthorized uses and other unaccounted for uses of fuel. Since the December energy audit, the B&M has installed fuel meters on all fueling facilities. Monitoring of these meters, tank inventories and actual times of fuel supplied will permit a considerably more accurate audit of fuel use and should help in identifying any areas of waste and unauthorized use. This monitoring effort is particularly important during periods of rapid price increases and spot shortages since monthly supplies can vary significantly depending on corporate purchasing policies and fuel availability.

TABLE 3-3. B&M DIESEL FUEL SUPPLIERS BY FUELING LOCATION (DECEMBER, 1979)*

SUPPLIER	FUELING LOCATION		GALLONS OF FUEL	% OF TOTAL
DES UK INC.	BOSTON & SYSTEM	MA	1,097,326.	56.25
NOEA ERLEUM CO	E. DEERFIELD	MA	228,050.	11.69
F.RORSCMPANY	E. DEERFIELD	MA	205,503.	10.53
POANTRIAL CO.	PORTLAND	ME	135,625.	6.95
FOILOPN	SPRINGFIELD	MA	81,552.	4.18
DE'SI OPANY	FRANKLIN	MA	50,549.	2.59
SHEYULOL CO.	FITCHBURG	MA	33,923.	1.74
SPDI I OMPANY	WHITE RIVER JCT	VT	32,843.	1.68
GEE ARN CO.	MECHANICVILLE	NY	30,002.	1.54
C.SPGECMPANY	CONCORD	NH	30,001.	1.54
GOINI OPANY	PORTSMOUTH	NH	5,511.	.28
RYS E EVICE	GROVETON	NH	4,478.	.23

*See Appendix C for complete listing of December, 1979 suppliers.

3.2 IDENTIFICATION OF AREAS FOR PROJECT EMPHASIS

The results of the Phase I energy audit for December were reviewed with the B&M to establish areas of emphasis for the remainder of the project. Since thru freight train operations was the largest user of energy on the B&M system, 39% of the total, it was selected as the area of project concentration for determining means of conserving energy. Thru freight train operations held the greatest potential for significant fuel savings and many of the useful results applicable to thru freight could possibly be directly transferrable to local/switching and passenger t· in operations. All three areas of train operations, taken together, comprised 78% of the total energy use on the B&M.

The emphasis on conservation of energy in train operations led to subsequent selection of various options for accomplishing this objective.* These options, currently being evaluated through analysis and test prior to possible implementation, are listed below:

- guidelines for improved matching of locomotive horsepower to train tonnage to minimize fuel consumption,
- modified speed profiles,
- isolation of locomotives,
- locomotive mates for line haul service,
- reduced idling,
- fuel saver devices,
- modified braking strategies (e.g., drifting versus power braking),and
- locomotive engineer "flight plans" for fuel efficient train operation.

*Hitz, J.S., "The Selection and Prioritization of Energy Conservation Options for Field Tests on the Boston & Maine Railroad," Project Memorandum, RR052, Transportation Systems Center, June 2, 1980.

Other areas identified of possible future interest, either jointly with the B&M or as an independent B&M effort, were the following:

- heating of facilities,
- caboose heating,
- recycling of lubrication oil or its use as a fuel stretcher, and
- recycling or reclaiming spilled fuel.

Next to train operations, the heating of facilities appeared to have the greatest potential for significant energy savings. An inspection of the B&M terminal in Boston, for example, identified a number of opportunities for conservation through weatherproofing, insulation and upgrading of heating equipment. The extent of fuel spillage on the B&M could not be precisely determined; however, it was apparent from inspections that it does occur and efforts are being made by the B&M to minimize the problem. The B&M has installed fuel meters, improved fueling nozzles, catch basins, and other facilities for reclaiming and recycling spilled fuel. On a national basis, it was estimated in 1975 that spillage amounted to 3% of total fuel use.[8]

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[8]Cetinich, J.H., "Fuel Efficiency Improvements in Rail Freight Transportation," Final Report, FRA-OR&D-76-136/DOT-TSC-FRA-75-26, NTIS #PB-250673, 1975.

4. ANALYSIS OF B&M DIESEL FUEL USE DATA, PHASE II

4.1 ENERGY AUDIT DATA BASE MANAGEMENT SYSTEM

With emphasis of the project directed to train operations, the energy audit concentrated on continued acquisition of diesel fuel data. This effort constituted the second phase of the energy audit. To assist in the organization and analysis of the diesel fuel data, a data base management system (DBMS) was developed. The DBMS permits convenient storage, retrieval and manipulation of the data for sorting, tabulating and plotting of various data combinations. Each month, data on diesel fuel use provided by the B&M is placed in the DBMS. The data consists of amounts of fuel supplied by each supplier to each fueling point and the amounts of fuel used at each fueling point by type of train operation. In addition, train operations data on ton-miles, train-miles, cars handled and trains operated is provided for use in normalizing fuel use statistics by activity levels.

Two types of standard reports are currently being generated by the DBMS, tables and bar charts. The tables provide monthly summaries of fuel supply and use and cumulative statistics for the year to date. The bar charts provide a display of the trend in fuel use by month for the year to date. A listing of the reports produced by the DBMS, together with the appendix locations of the actual reports, is provided below.

Tables:

- Fueling Location Suppliers by Month	Appendix C
- Fueling Location Suppliers, Cumulative Summary to Date	Appendix D
- Fuel Supplied, Cumulative Summary by Month	Appendix E
- Fuel consumption Statistics by Location and Type of Service by Month	Appendix F
- Fuel Consumption Statistics by Location and Type of Service, Cumulative Summary to Date	Appendix G

- Operating Statistics by Month — Appendix H
- Operating Statistics, Cumulative Average to Date — Appendix I
- Fuel Use Statistics by Month — Appendix J
- Fuel Use Statistics, Cumulative Average to Date — Appendix K

Bar Charts:

- Diesel Fuel Consumed by Month and Type of Service — Appendix L
- Thru Freight Diesel Fuel Consumed by Month — Appendix M
- Gross Thru Freight Ton-miles Handled by Month — Appendix N
- Gross Ton-miles per Thru Freight Gallon by Month — Appendix O

4.2 ANALYSIS OF DIESEL FUEL SUPPLY AND USE PATTERNS

Information on the supply of diesel fuel to the different fueling points by supplier for the period from December, 1979, through June, 1980, is provided in Appendices C, D, and E. One supplier consistenly provided more fuel to the B&M than any other supplier, the average being 56% over the audit period. The most fuel provided by any other supplier was 38.8% in April. The leading supply location is Boston. Portland, which initially ranked fourth as a supply location, was discontinued as a fueling point in December and did not appear on any reports after February. The average diesel fuel price increased from 75¢ in December to 84¢ in June, a period of relative price stability compared with the previous year. The average monthly amount of fuel supplied during the same period was 1,868,564 gallons per month.

Appendixes F and G provide statistics on the amounts of fuel consumed, by train type, for the different fueling points from December, 1979, through August, 1980. The amounts shown consumed for the months of December and January were adjusted to account for three days of December fuel consumption data originally assigned to January. The December figures in Appendix F, therefore, differ slightly from the earlier data presented in Section 3 for the Phase I audit. The leading fueling points, in terms of fuel pumped into locomotives, were Boston in December, East Deerfield until April, and then

Mechanicville for the remainder of the audit. This shift from Boston appears to reflect the discontinuance of Portland as a fueling point and the transfer of its fueling operations to the western portions of the system. The average monthly amount of fuel consumed by all train operations for the nine-month period through August was 1,757,370 gallons.

A comparison of the average amounts of fuel supplied and consumed monthly indicates a net surplus of fuel over the audit period. Through June, just over 600,000 gallons more fuel was shown supplied than consumed. There are several explanations for this difference. Since the surplus is only 37% of the total tank storage capacity of the system, the difference could be accounted for by increased inventories in the storage tanks. Time lags between delivery and billing records could account for some of the difference, particularly on a month-to-month basis, however, it is expected that this effect would have tended to cancel out over the audit period. The lower consumption figures may also be due, in part, to spillage, unauthorized uses and other unaccounted for uses of fuel. A more detailed examination of the data from the recently installed fuel pump meters and the storage tank inventories should provide a reasonably accurate accounting of the supply-consumption differences and would assist in identifying any areas of spillage or unauthorized use.

The trend in fuel consumption, as shown by the bar chart in Appendix L, indicates small monthly variations. The minimum consumption month was July (1,564,094 gallons) and the peak month was December (1,985,312 gallons), a 24% difference from the average consumption. The month-to-month variations in fuel consumption seem to closely follow changes in ton-miles of traffic.

December was the third highest freight traffic month while July had the lowest freight ton-miles.

A comparison of thru freight fuel consumption trends, Appendix M, with trends in thru freight ton-miles indicates a close correlation. A plot of the monthly data points for thru freight fuel consumption versus ton-miles is shown in Figure 4-1. The linear regression line drawn through the data points has a correlation coefficient squared value, r^2, of 0.77 indicating that a significant amount of the variation in fuel consumption is explained by the linear relatonship with ton-miles. These results agree well with the results of the baseline fuel consumption tests performed on B&M trains which show a similar strong relationship between fuel consumed and ton-miles of work performed.* The data therefore supports, as effective energy conservation measures, any actions, such as improved freight car utilization, which will increase the overall gross to tare weight ratio of trains.

Fuel use efficiency, measured in ton-miles per gallon, tended to improve over the period of the audit from December to July, as shown by the bar chart in Appendix O. The average ton-miles per gallon for the four-month winter period from December through March is 440, while from april through July it is 456. The apparent explanation for this trend is due to the shift from cooler to warmer weather. As it gets warmer, locomotives are shut down when not in service. The data suggests, therefore, that the B&M policy of restricted idling during the warm months may be effective in reducing fuel consumption.

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*Hitz, J., and R. Dorer, "Baseline Fuel Consumption Tests on the B&M Railroad - Interim Results," Project Memorandum, RR152, Transportation Systems Center, December 15, 1980.

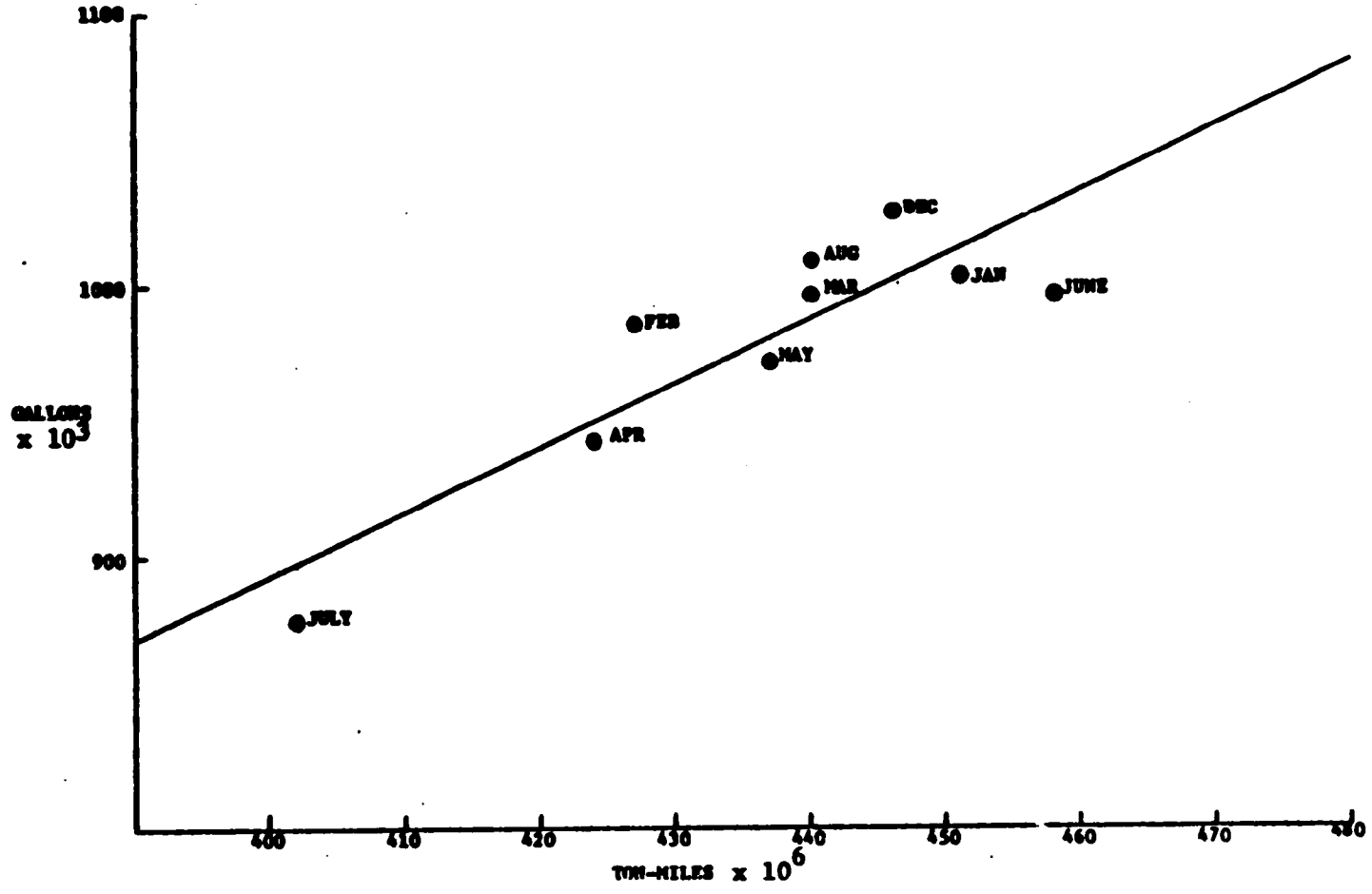


FIGURE 4-1. MONTHLY THRU-FREIGHT FUEL CONSUMPTION VERSUS TON-MILES

5. FUTURE ENERGY AUDIT EFFORTS

Several additional tasks should be accomplished before completion of the energy audit. The Phase I audit which considered all energy types and uses on the B&M system was only performed for the month of December. While this was sufficient to identify the major energy users for project emphasis, additional data will permit analysis of any shifts in energy use areas occurring with changes in season, thus affecting future project priorities; e.g., the relative roles of heating oil versus electricity. Also, any possible audit errors due to time lags between actual supply or use and that indicated by accounting records would tend to be eliminated with additional months of data. As a minimum, the audit should include several winter months (December through February) and summer months (June through August).

The Phase II audit of diesel fuel is reasonably complete. A full year of data, however, would permit additional verification of seasonal and other trends already observed; e.g., differences in supply and consumption, correlations between fuel consumed and ton-miles of work, and improvements in fuel use efficiency with warmer weather.

APPENDIX A

AVERAGE UNIT ENERGY COST CONVERSION FACTORS

Appendix A contains the average energy unit costs used to convert the December, 1979 energy use data into common units of dollars.

AVERAGE UNIT ENERGY COSTS FOR DECEMBER, 1979

Diesel Fuel, Freight Trains	$.76 per gallon
Diesel Fuel, Passenger Trains	$.78 per gallon
Fuel Oil	$.90 per gallon
Propane	$.70 per gallon
Lube Oil	$1.25 per gallon
Electricity	$.05 per kilowatt-hour
Kerosene	$.95 per gallon
Gasoline	$1.05 per gallon

APPENDIX B

AVERAGE BTU ENERGY EQUIVALENT FACTORS

Appendix B contains the average BTU energy equivalent factors used to convert the December, 1979 energy use data into common units of BTU's. Actual energy content of diesel fuel can vary significantly from these averages. Fuel supplies should be tested for energy content if more precise information is required for specific supplies.

AVERAGE BTU ENERGY EQUIVALENT FACTORS FOR DECEMBER, 1979

Diesel Fuel, Freight Trains	5,825,000 Btu/barrel
Diesel Fuel, Passenger Trains	5,825,000 Btu/barrel
Fuel Oil	5,825,000 Btu/barrel
Propane	3,836,000 Btu/barrel
Lube Oil	6,065,000 Btu/barrel
Electricity	3,412 Btu/kWh
Kerosene	5,670,000 Btu/barrel
Gasoline	5,253,000 Btu/barrel

APPENDIX C

FUELING LOCATION SUPPLIERS BY MONTH

Each of the following tables in Appendix C provides fuel supplier data for a separate month for the period from December, 1979 through August, 1980. Data for the month of July, 1980 is not included as it is not available at this time. Each fuel supplier that supplied fuel to the B&M system is listed along with the following information:

- place where the fuel was supplied, city and state
- gallons of fuel supplied
- percent of total gallons supplied
- average price per gallon
- estimated total cost of fuel based on average price
- percent of total cost for fuel

The supplier names have been coded because of the proprietary nature of this information to the B&M Railroad. The codes are consistent from month to month to permit analysis of monthly trends.

D & N ENERGY USE STUDY

FUELING LOCATION SUPPLIERS

FOR DECEMBER, 1979

SUPPLIER	FUELING LOCATION		GALLONS OF FUEL	% OF TOT.GAL.	PRICE PER GAL.	ESTIMATED $ AMOUNT	% OF TOTAL $
DES UK INC.	BOSTON & SYSTEM	MA	1,077,326.	54.25	$0.7541	$ 829,688.	54.31
MIKA ERLEUN CO	E. DEERFIELD	MA	220,050.	11.09	$0.7077	$ 161,391.	10.95
F.RRRSCHPANY	E. DEERFIELD	MA	205,503.	10.53	$0.7667	$ 157,559.	10.69
PRANTRIAL CO.	PORTLAND	ME	135,625.	6.95	$0.7185	$ 97,447.	6.61
PBILSPN	SPRINGFIELD	MA	81,552.	4.18	$0.7995	$ 65,201.	4.43
DE'SI SPANY	FRANKLIN	MA	50,549.	2.59	$0.8610	$ 43,523.	2.95
SNEYULSL CO.	FITCHBURG	MA	33,923.	1.74	$0.7677	$ 26,043.	1.77
SPSI I SNPANY	WHITE RIVER JCT	VT	32,843.	1.68	$0.7394	$ 24,284.	1.65
SEE ARN CO.	MECHANICVILLE	NY	30,092.	1.54	$0.8356	$ 25,070.	1.70
C.SPSECHPANY	CONCORD	NH	30,001.	1.54	$0.7139	$ 21,418.	1.45
SSINI SPANY	PORTSMOUTH	NH	5,511.	.28	$0.8810	$ 4,855.	.33
RYS E EVICE	SROVETON	NH	4,478.	.23	$0.8834	$ 3,956.	.27
CSILSPN	LOWELL	MA	4,047.	.21	$0.8206	$ 3,321.	.23
SAMSI SPANY	BRATTLESSRO	VT	3,790.	.19	$0.8557	$ 3,243.	.22
PRESV I CO.	ROCKPORT	MA	2,577.	.13	$0.8036	$ 2,071.	.14
MAISI EVICE	HOLYOKE	MA	2,226.	.11	$0.8356	$ 1,860.	.13
STS LCHANY	WHITEFIELD	NH	1,438.	.07	$0.8314	$ 1,193.	.08
SAS LSRICE	UNKNOWN LOCATION		723.	.04	$0.8603	$ 622.	.04
CH CYSLCO.	GARDNER	MA	705.	.04	$0.8539	$ 602.	.04
	TOTALS:		1,980,866.	99.99%	(AVE.) $0.7952	$1,473,346.	100.00%

B & M ENERGY USE STUDY

FUELING LOCATION SUPPLIERS

FOR JANUARY, 1980

SUPPLIER	FUELING LOCATION		GALLONS OF FUEL	% OF TOT.GAL.	PRICE PER GAL.	ESTIMATED $ AMOUNT	% OF TOTAL $
BES UK INC.	BOSTON & SYSTEM	MA	1,062,759.	52.41	0.7865	$ 835,860.	53.02
F.ROSSCOMPANY	E. DEERFIELD	MA	388,601.	19.17	0.7091	$ 275,557.	17.48
NSEA ERLEMN CO	E. DEERFIELD	MA	164,307.	8.10	0.7325	$ 120,355.	7.63
FOILSPN	SPRINGFIELD	MA	88,906.	4.38	0.8398	$ 74,663.	4.74
BE'SI SPANY	FRANKLIN	MA	79,562.	3.92	0.9011	$ 71,693.	4.55
SEE ARN CO.	MECHANICVILLE	NY	52,503.	2.59	0.8582	$ 45,058.	2.86
SHEVALSL CO.	FITCHBURG	MA	39,747.	1.96	0.7948	$ 31,193.	1.98
C.SPSECMPANY	CONCORD	NH	37,500.	1.85	0.7339	$ 27,521.	1.75
PSANTRIAL CO.	PORTLAND	ME	31,166.	1.54	0.7801	$ 24,313.	1.54
SPSI I SNPANY	WHITE RIVER JCT	VT	28,535.	1.41	0.7897	$ 22,534.	1.43
SSEATSLCO.	HAVERHILL	MA	24,970.	1.23	0.9031	$ 22,550.	1.43
CSILSPN	LOWELL	MA	6,984.	.34	0.8305	$ 5,800.	.37
CH CYSLCO.	GARDNER	MA	6,172.	.30	0.8992	$ 5,550.	.35
RYS E SVICE	GROVETSN	NH	5,426.	.27	0.8483	$ 4,603.	.29
SSINE SPANY	PORTSMOUTH	NH	4,206.	.21	0.9218	$ 3,877.	.25
NAISI SVICE	HOLYOKE	MA	2,804.	.14	0.8454	$ 2,371.	.15
STS LCNANY	WHITEFIELD	NH	1,904.	.09	0.8529	$ 1,624.	.10
PRESV I CO.	ROCKPORT	MA	1,590.	.08	0.8459	$ 1,345.	.09
	TOTALS:		2,027,642.	100.00%	(AVE.) 0.7774	$1,576,468.	100.00%

B & M ENERGY USE STUDY

FUELING LOCATION SUPPLIERS

FOR FEBRUARY, 1980

SUPPLIER	FUELING LOCATION		GALLONS OF FUEL	% OF TOT.GAL.	PRICE PER GAL.	ESTIMATED $ AMOUNT	% OF TOTAL $
DES UK INC.	BOSTON S SYSTEM	MA	799,381.	49.71	$.8141	$ 650,752.	49.10
MOBA ERLEUN CO	E. DEERFIELD	MA	321,773.	20.01	$.8093	$ 260,411.	19.65
F.RGRSCHPANY	E. DEERFIELD	MA	130,708.	8.13	$.8189	$ 107,037.	8.08
PGANTRIAL CO.	PORTLAND	ME	74,343.	4.62	$.7528	$ 55,965.	4.22
PBILGPN	SPRINGFIELD	MA	53,100.	3.30	$.8320	$ 44,077.	3.54
BE'SI GPANY	FRANKLIN	MA	52,476.	3.26	$.9388	$ 49,264.	3.72
SHEVULGL CO.	FITCHBURG	MA	35,712.	2.22	$.8283	$ 29,580.	2.23
GEE ARN CO.	MECHANICVILLE	NY	30,001.	1.87	$.8751	$ 26,254.	1.98
GREATGLCO.	HAVERHILL	MA	16,758.	1.04	$.9638	$ 16,151.	1.22
CN CYGLCO.	GARDNER	MA	16,222.	1.01	$.9384	$ 15,223.	1.15
JANGEIC	DOVER	NH	15,406.	.96	$.8967	$ 13,815.	1.04
C.GPGECHPANY	CONCORD	NH	15,002.	.93	$.7944	$ 11,918.	.90
K.GGI GPANY	CONCORD	NH	8,413.	.52	$.9105	$ 7,660.	.58
G.DG GPNY	UNKNOWN LOCATION		6,553.	.41	$.8622	$ 5,650.	.43
DANGI GPANY	BRATTLEBORO	VT	5,372.	.33	$.9311	$ 5,002.	.38
RYG E EVICE	BRUNSTON	NH	5,138.	.32	$.8739	$ 4,490.	.34
CBILGPN	LOWELL	MA	4,692.	.29	$.8760	$ 4,110.	.31
GPGI I GNPANY	WHITE RIVER JCT	VT	3,932.	.24	$.8960	$ 3,523.	.27
GGINI GPANY	PORTSMOUTH	NH	3,917.	.24	$.9581	$ 3,753.	.28
PRESV I CO.	ROCKPORT	MA	3,883.	.24	$.8493	$ 3,230.	.24
NAISI EVICE	HOLYOKE	MA	3,274.	.20	$.8874	$ 2,923.	.22
STS LCHANY	WHITEFIELD	NH	1,976.	.12	$.8887	$ 1,756.	.13
	TOTALS:		1,607,942.	100.00%	(AVE.) $.8242	$1,325,343.	100.00%

B & M ENERGY USE STUDY

FUELING LOCATION SUPPLIERS

FOR MARCH, 1980

SUPPLIER	FUELING LOCATION		GALLONS OF FUEL	% OF TOT.GAL.	PRICE PER GAL.	ESTIMATED $ AMOUNT	% OF TOTAL $
DEB UK INC.	BOSTON S SYSTEM	MA	1,710,677.	69.63	$.8081	$1,382,398.	68.51
F.RRRCMPANY	E. DEERFIELD	MA	262,325.	10.68	$.8338	$ 218,727.	10.84
GUY LCMANY	BOSTON S SYSTEM	MA	130,805.	5.32	$.7764	$ 101,557.	5.03
MBEA ERLEMN CO	E. DEERFIELD	MA	78,303.	3.19	$.7744	$ 60,654.	3.01
FBILSPN	SPRINGFIELD	MA	73,369.	2.99	$.9102	$ 66,780.	3.31
BE'SI CPANY	FRANKLIN	MA	57,645.	2.35	$.9777	$ 56,360.	2.79
BEE ANN CO.	MECHANICVILLE	NY	22,501.	.92	$.8752	$ 19,693.	.98
BHEYULBL CO.	FITCHBURG	MA	22,317.	.91	$.8608	$ 19,210.	.95
BBEATBLCO.	HAVERHILL	MA	19,530.	.79	$.9724	$ 18,991.	.94
CH CYBLCO.	GARDNER	MA	17,808.	.72	$.9533	$ 16,976.	.84
K.BBI CPANY	CONCORD	NH	14,490.	.59	$.9321	$ 13,506.	.67
JAMBEIC	DOVER	NH	9,892.	.40	$.9360	$ 9,259.	.46
C.SPBECMPANY	CONCORD	NH	7,500.	.31	$.8045	$ 6,034.	.30
BBINI CPANY	PORTSMOUTH	NH	5,978.	.24	$.9772	$ 5,839.	.29
RYB E EVICE	BROKETON	MA	5,021.	.20	$.8873	$ 4,455.	.22
BAMBI CPANY	BRATTLEBORO	VT	4,304.	.18	$.9900	$ 4,261.	.21
PREBV I CO.	ROCKPORT	MA	3,845.	.16	$.8854	$ 3,423.	.17
CBILSPN	LOWELL	MA	3,268.	.13	$.9223	$ 3,014.	.15
SPBI I CMPANY	WHITE RIVER JCT	VT	3,190.	.13	$.9251	$ 2,951.	.15
MAIBI EVICE	MELVOKE	MA	2,739.	.11	$.9449	$ 2,607.	.13
FRLIBLCMPANY	UNKNOWN LOCATION		500.	.02	$.9600	$ 480.	.02
TEB C	UNKNOWN LOCATION		400.	.02	$.6250	$ 250.	.01
STB LCMANY	WHITEFIELD	NH	398.	.02	$.9548	$ 380.	.02
	TOTALS:		2,454,842.	100.00%	(AVE.) $.8213	$2,017,805.	100.00%

S & N ENERGY USE STUDY

FUELING LOCATION SUPPLIERS

FOR APRIL, 1980

SUPPLIER	FUELING LOCATION		GALLONS OF FUEL	% OF TOT.GAL.	PRICE PER GAL.	ESTIMATED $ AMOUNT	% OF TOTAL $
DES UK INC.	BOSTON S SYSTEM	MA	832,757.	42.68	$.8363	$ 696,435.	43.56
GUY LCHANY	BOSTON S SYSTEM	MA	812,803.	41.66	$.7634	$ 620,494.	38.81
FUELSPN	SPRINGFIELD	MA	73,128.	3.75	$.9210	$ 67,351.	4.21
SE'SI SPANY	FRANKLIN	MA	53,989.	2.77	$.9923	$ 53,573.	3.35
F.RERSCHPANY	E. DEERFIELD	MA	48,001.	2.46	$.8276	$ 39,726.	2.48
SHEVRLEL CO.	FITCHBURG	MA	34,483.	1.78	$.8755	$ 30,345.	1.90
CN CYSLCO.	GARDNER	MA	17,897.	.90	$.9692	$ 17,055.	1.07
K.SSI SPANY	CONCORD	NH	16,406.	.84	$.9394	$ 15,411.	.96
GREATSLCO.	HAVERHILL	MA	14,800.	.76	$.9426	$ 13,950.	.87
JAMSEIC	DOVER	NH	14,442.	.74	$.9519	$ 13,747.	.86
SR S SPNY	LAWRENCE	MA	6,162.	.31	$.9828	$ 5,997.	.38
RYS E EVICE	GROVETON	NH	5,630.	.26	$.9169	$ 4,612.	.29
DAWSI SPANY	BRATTLEBORO	VT	4,642.	.24	$.9717	$ 4,530.	.28
SPSI I SNPANY	WHITE RIVER JCT	VT	4,499.	.23	$.9402	$ 4,230.	.26
PRESV I CO.	ROCKPORT	MA	4,218.	.22	$.9035	$ 3,811.	.24
MAISI EVICE	MELVENE	MA	2,707.	.14	$.9686	$ 2,622.	.16
SSINI SPANY	PORTSMOUTH	NH	2,454.	.14	$.9104	$ 2,418.	.15
CSILSPN	LOWELL	MA	2,575.	.13	$.9592	$ 2,470.	.15
	TOTALS:		1,951,654.	99.99%	(AVE.) $.8194	$1,598,797.	100.00%

B & M ENERGY USE STUDY

FUELING LOCATION SUPPLIERS

FOR MAY, 1980

SUPPLIER	FUELING LOCATION		GALLONS OF FUEL	% OF TOT.GAL.	PRICE PER GAL.	ESTIMATED $ AMOUNT	% OF TOTAL $
BEB UK INC.	BOSTON & SYSTEM	MA	748,010.	49.95	0.8254	$ 631,439.	50.47
GUY LCHANY	BOSTON & SYSTEM	MA	561,373.	36.48	0.7721	$ 433,436.	34.64
FOULSPN	SPRINGFIELD	MA	65,289.	4.24	0.9216	$ 60,143.	4.81
F.RORSCHPANY	E. DEERFIELD	MA	54,001.	3.44	0.8098	$ 45,350.	3.62
BE'SI SPANY	FRANKLIN	MA	42,581.	2.77	0.9924	$ 42,178.	3.37
SHEVULSL CO.	FITCHBURG	MA	15,428.	1.01	0.8813	$ 13,597.	1.09
RYS E EVICE	GROVETON	NH	4,389.	.29	0.9171	$ 4,025.	.32
JANSKIC	DOVER	MA	3,849.	.25	0.9543	$ 3,673.	.29
BANSI SPANY	BRATTLEBORO	VT	3,802.	.25	0.9763	$ 3,419.	.27
COILSPN	LOWELL	MA	3,127.	.20	0.9591	$ 2,999.	.24
SPDI I SNPANY	WHITE RIVER JCT	VT	2,762.	.18	0.9406	$ 2,598.	.21
MAISI EVICE	HOLYOKE	MA	1,923.	.13	0.9891	$ 1,902.	.15
K.OSI SPANY	CONCORD	NH	1,834.	.12	0.9455	$ 1,734.	.14
STS LCHANY	WHITEFIELD	NH	1,428.	.09	0.9888	$ 1,412.	.11
CN CYSLCO.	GARDNER	MA	1,048.	.07	0.9700	$ 1,036.	.08
SSINI SPANY	PORTSMOUTH	NH	1,032.	.07	0.9874	$ 1,019.	.08
MAFF ERLEWN CO	UNKNOWN LOCATION		493.	.03	0.9798	$ 479.	.03
NUNDAWN OIL CO	UNKNOWN LOCATION		500.	.03	0.9500	$ 475.	.04
	TOTALS:		1,531,679.	100.00%	(AVE.) 0.8168	$1,251,114.	100.00%

B & M ENERGY USE STUDY

FUELING LOCATION SUPPLIERS

FOR JUNE, 1980

SUPPLIER	FUELING LOCATION		GALLONS OF FUEL	% OF TOT.GAL.	PRICE PER GAL.	ESTIMATED $ AMOUNT	% OF TOTAL $
BES UX INC.	BOSTON S SYSTEM	MA	1,021,134.	65.71	$.8320	$ 849,583.	65.23
F.RORCOMPANY	E. DEERFIELD	MA	360,014.	23.17	$.8167	$ 294,023.	22.58
FOILSPN	SPRINGFIELD	MA	67,861.	4.37	$.9240	$ 62,839.	4.82
GUY LCHANY	BOSTON S SYSTEM	MA	44,702.	2.88	$.8237	$ 36,821.	2.83
DE'SI SPANY	FRANKLIN	MA	38,958.	2.51	$.9928	$ 38,678.	2.97
RYS E EVICE	GROVETON	NH	4,745.	.31	$.9475	$ 4,496.	.35
DANGI SPANY	BRATTLEBORO	VT	3,769.	.24	$.9886	$ 3,726.	.29
STS LCHANY	WHITEFIELD	NH	3,334.	.21	$.9892	$ 3,300.	.25
SPOI I SNPANY	WHITE RIVER JCT	VT	2,911.	.19	$.9402	$ 2,737.	.21
MAISI EVICE	HOLYOKE	MA	2,650.	.18	$.9449	$ 2,493.	.21
JANDEIC	DOVER	MA	1,987.	.13	$.9542	$ 1,896.	.15
COILSPN	LOWELL	MA	1,459.	.11	$.9620	$ 1,596.	.12
	TOTALS:		1,553,924.	100.00%	(AVE.) $.8381	$1,302,388.	100.00%

B & M ENERGY USE STUDY

FUELING LOCATION SUPPLIERS

FOR AUGUST, 1980

SUPPLIER	FUELING LOCATION		GALLONS OF FUEL	% OF TOT.GAL.	PRICE PER GAL.	ESTIMATED $ AMOUNT	% OF TOTAL $
BES UK INC.	BOSTON & SYSTEM	MA	938,784.	67.13	0.8257	$ 775,129.	66.11
F.REDSCHPANY	E. DEERFIELD	MA	312,010.	22.31	0.8262	$ 257,783.	21.99
FSELSPN	SPRINGFIELD	MA	62,437.	4.46	0.9173	$ 57,457.	4.90
BE'SI SPANY	FRANKLIN	MA	51,767.	3.70	0.9909	$ 51,296.	4.37
SHEVALSL CO.	FITCHBURG	MA	15,776.	1.13	0.9041	$ 14,263.	1.22
SPSI I SHPANY	WHITE RIVER JCT.	VT	8,218.	.59	0.9306	$ 7,645.	.65
BANSI SPANY	BRATTLEBORO	VT	3,857.	.28	0.9691	$ 3,738.	.32
RYS E SVICE	BRUNSWICK	MN	2,922.	.21	0.9764	$ 2,853.	.24
HAISI SVICE	MELVENE	MA	1,636.	.12	0.9444	$ 1,545.	.13
CN CYSLCO.	GARDNER	MA	557.	.04	0.9981	$ 580.	.05
CSILSPN	LOWELL	MA	221.	.02	0.9774	$ 216.	.02
	TOTALS:		1,398,382.	100.00%	(AVE.) 0.8384	$1,172,505.	100.00%

APPENDIX D

FUELING LOCATION SUPPLIERS, CUMULATIVE SUMMARY

The following table provides a cumulative summary of the monthly supplier information contained in Appendix C for the period of December, 1979 through June, 1980.

Each fuel supplier to the B&M system is listed along with the following information:

- Location where fuel was supplied, city and state
- Gallons of fuel supplied
- Percent of total gallons supplied
- Average price per gallon (based on the total number of gallons delivered for the audit period by each supplier)
- Estimated total cost of fuel based on average price of each supplier
- Percent of total cost for fuel for the period covered.

Supplier names have been coded because of the proprietary nature of this information to the B&M Railroad; these coded names are consistent from month to month to permit analysis of monthly trends.

B & M ENERGY USE STUDY

FUELING LOCATION SUPPLIER SUMMARY

FOR PERIOD: DECEMBER, 1979 THRU JUNE, 1980

SUPPLIER	FUELING LOCATION		GALLONS OF FUEL	% OF TOT.GAL.	AVE.COST PER GAL.	ESTIMATED $ AMOUNT	% OF TOTAL $
F.REDCOMPANY	E. DEERFIELD	MA	1,451,153.	11.09	0.7841	$ 1,137,978.	10.79
NDEA ERLEUN CO	E. DEERFIELD	MA	792,433.	6.04	0.7607	$ 602,810.	5.72
GEE ARN CO.	MECHANICVILLE	NY	138,007.	1.03	0.8597	$ 116,074.	1.10
DES UK INC.	BOSTON & SYSTEN	MA	7,289,014.	55.73	0.8041	$ 5,876,155.	55.72
GAY LCHANY	BOSTON & SYSTEN	MA	1,549,683.	11.85	0.7693	$ 1,192,308.	11.31
C.SPEECHPANY	CONCORD	NH	90,003.	.69	0.7432	$ 66,890.	.63
K.DEI CPANY	CONCORD	NH	41,142.	.31	0.9311	$ 38,311.	.36
SHEVULOL CO.	FITCHBURG	MA	181,810.	1.39	0.8249	$ 149,969.	1.42
SR O CPNY	LAWRENCE	MA	6,102.	.05	0.9828	$ 5,997.	.06
EDINI CPANY	PORTSMOUTH	NH	23,297.	.18	0.9340	$ 21,761.	.21
JANDEIC	DOVER	MA	45,576.	.35	0.9300	$ 42,390.	.40
CDILCPN	LOWELL	MA	26,352.	.20	0.8845	$ 23,310.	.22
EPDI I CNPANY	WHITE RIVER JCT	VT	78,672.	.60	0.7989	$ 62,857.	.60
FDILCPN	SPRINGFIELD	MA	503,178.	3.85	0.8821	$ 443,854.	4.21
AYS E EVICE	GROVETON	NH	34,227.	.26	0.8951	$ 30,637.	.29
DANSI CPANY	BRATTLEBORO	VT	28,399.	.19	0.9520	$ 24,181.	.23
DE'SI CPANY	FRANKLIN	MA	375,600.	2.87	0.9454	$ 355,269.	3.37
PRESV I CO.	ROCKPORT	MA	14,063.	.12	0.8646	$ 13,800.	.13
GDEATELCO.	HAVERHILL	MA	76,000.	.58	0.9419	$ 71,643.	.68
CH CYELCO.	GARDNER	MA	59,872.	.46	0.9474	$ 56,442.	.54
NAISI EVICE	HOLYOKE	MA	18,563.	.14	0.9146	$ 16,978.	.16

D & N ENERGY USE STUDY

FUELING LOCATION SUPPLIER SUMMARY

FOR PERIOD: DECEMBER, 1979 THRU JUNE, 1980

SUPPLIER	FUELING LOCATION		GALLONS OF FUEL	% OF TOT.GAL.	AVE.COST PER GAL.	ESTIMATED $ AMOUNT	% OF TOTAL $
STB LCHANY	WHITEFIELD	NH	10,477.	.08	$.9225	$ 9,665.	.09
PEANTRIAL CO.	PORTLAND	ME	241,134.	1.84	$.7370	$ 177,725.	1.69
BAB LBRICE	UNKNOWN LOCATION		723.	.01	$.8603	$ 622.	.01
FELIGLCHPANY	UNKNOWN LOCATION		500.	.00	$.9600	$ 480.	.00
S.BO BPNY	UNKNOWN LOCATION		6,953.	.05	$.8622	$ 5,650.	.05
HAFF ERLEHN CO	UNKNOWN LOCATION		693.	.01	$.7798	$ 679.	.01
HOUBAHN OIL CO	UNKNOWN LOCATION		500.	.00	$.9500	$ 475.	.00
TEB C	UNKNOWN LOCATION		400.	.00	$.6250	$ 250.	.00
	TOTALS:		13,079,951.	100.00 %	(AVE.) $.8062	$10,545,261.	100.00 %

APPENDIX E

FUEL SUPPLIED, CUMULATIVE SUMMARY BY MONTH

The following table summarizes by month the total diesel fuel supplied to the B&M Railroad by all suppliers during the period from December, 1979 through August, 1980. This information corresponds with the totals contained in each of the tables in Appendix C. Entries are by month and year; gallons of fuel supplied; the percentage of the gallons supplied that month against the total gallons supplied for all months in the period; the average price of fuel per gallon for each month; the estimated cost of fuel per month based on the gallons of fuel supplied and its associated percentage. Note that data from July, 1980 was not available.

B & H ENERGY USE STUDY

TOTAL FUEL SUPPLIED

CUMULATIVE SUMMARY BY MONTH

MONTH	YEAR	GALLONS OF FUEL	% OF TOT.GAL.	AVE.PRICE PER GAL.	ESTIMATED $ AMOUNT	% OF TOTAL $
DECEMBER	1979	1,950,866.	13.47	$.7582	$ 1,473,346.	12.57
JANUARY	1980	2,027,642.	14.00	$.7774	$ 1,576,468.	13.45
FEBRUARY	1980	1,607,942.	11.11	$.8242	$ 1,325,343.	11.31
MARCH	1980	2,486,842.	16.97	$.8213	$ 2,017,804.	17.22
APRIL	1980	1,981,084.	13.48	$.8194	$ 1,598,797.	13.64
MAY	1980	1,531,679.	10.58	$.8168	$ 1,251,114.	10.68
JUNE	1980	1,583,926.	10.73	$.8381	$ 1,302,388.	11.11
AUGUST	1980	1,398,382.	9.66	$.8384	$ 1,172,505.	10.01
	TOTALS:	14,478,333.	100.00 %	$.8093	$11,717,765.	100.00 %

APPENDIX F

FUEL CONSUMPTION STATISTICS BY LOCATION AND TYPE OF SERVICE BY MONTH

Each of the following tables in Appendix F provides monthly statistics on fuel consumption for each of the thirty fueling locations in the Boston and Maine Railroad system in three train categories: Thru Freight, Switch and Local Freight, and Passenger. All categories are totaled for each location, and percentages for each location in each category are calculated. Also listed is the storage tank capacity in gallons for each location. The period this information covers is from December, 1979 through August, 1980.

B & M ENERGY USE STUDY

FUEL CONSUMPTION STATISTICS BY LOCATION

PERIOD: DECEMBER, 1979

FUELING LOCATION		TANK CAPACITY (GALLONS)	THRU FREIGHT (GAL.)	% OF THRU FREIGHT	SWITCH & LOCAL FREIGHT	% OF S & L FREIGHT	PASSNGR (GAL.)	% OF PASS. (GAL.)	LOCATION TOTAL (GAL.)	% OF TOTAL GALLONS
E. DEERFIELD	MA	101000	250758	24.4	39802	16.3	0	.0	290560	14.6
MECHANICVILLE	NY	550000	235831	23.0	14107	5.8	0	.0	249938	12.6
BOSTON	MA	960000	88381	8.6	43677	17.8	354782	49.7	486840	24.5
CONCORD	NH	20000	36995	3.6	14633	6.0	13895	1.9	65523	3.3
FITCHBURG	MA	20000	0	.0	13305	5.4	15890	2.2	29195	1.5
WORCESTER	MA	20000	0	.0	11102	4.5	0	.0	11102	.6
MANCHESTER	NH	20000	0	.0	14613	6.0	0	.0	14613	.7
LAWRENCE	MA	20000	0	.0	15449	6.3	0	.0	15449	.8
SALEM	MA	20000	0	.0	5021	2.1	0	.0	5021	.3
PORTSMOUTH	NH	20000	0	.0	4468	1.8	0	.0	4468	.2
DOVER	NH	20000	0	.0	10857	4.4	0	.0	10857	.5
NASHUA	NH	10000	0	.0	6333	2.6	0	.0	6333	.3
LOWELL	MA	10000	0	.0	3979	1.6	12252	1.7	16231	.8
WHITE RIVER JCT.	VT	0	35004	3.4	4089	1.7	0	.0	39093	2.0
SPRINGFIELD	MA	0	64067	6.2	4726	1.9	0	.0	68793	3.5
AYER	MA	0	0	.0	22243	9.1	0	.0	22243	1.1
GROVETON	NH	0	0	.0	5090	2.1	0	.0	5090	.3
BRATTLEBORO	VT	0	0	.0	3661	1.5	0	.0	3661	.2
FRANKLIN	MA	0	0	.0	0	.0	60813	8.5	60813	3.1
SOUTH STATION	MA	0	0	.0	0	.0	134403	18.8	134403	6.8
ROCKPORT	MA	0	0	.0	0	.0	2169	.3	2169	.1
HAVERHILL	MA	0	0	.0	0	.0	23765	3.3	23765	1.2
YARD 7-BOSTON	MA	0	0	.0	0	.0	0	.0	0	.0
GARDNER	MA	0	0	.0	1471	.6	16393	2.3	17864	.9
ST. ALBANS	VT	0	0	.0	0	.0	0	.0	0	.0
NEWPORT	VT	0	0	.0	0	.0	0	.0	0	.0
HOLYOKE	MA	0	0	.0	2312	.9	0	.0	2312	.1
WHITEFIELD	NH	0	0	.0	3843	1.6	0	.0	3843	.2
PROVIDENCE	RI	0	0	.0	0	.0	79334	11.1	79334	4.0
PORTLAND	ME	0	315799	30.8	0	.0	0	.0	315799	15.9
		TOTALS:	1026835		244781		713696		1985312	

B & M ENERGY USE STUDY

FUEL CONSUMPTION STATISTICS BY LOCATION

PERIOD: JANUARY, 1980

FUELING LOCATION		TANK CAPACITY (GALLONS)	THRU FREIGHT (GAL.)	% OF THRU FREIGHT	SWITCH & LOCAL FREIGHT	% OF S & L FREIGHT	PASSNGR (GAL.)	% OF PASS. (GAL.)	LOCATION TOTAL (GAL.)	% OF TOTAL GALLONS
E. DEERFIELD	MA	101000	401672	40.0	34021	18.8	0	.0	435693	25.6
MECHANICVILLE	NY	550000	281642	28.0	11793	6.5	0	.0	293435	17.2
BOSTON	MA	960000	27510	2.7	0	.0	269641	52.0	297151	17.4
CONCORD	NH	20000	53048	5.3	2183	1.2	0	.0	55231	3.2
FITCHBURG	MA	20000	0	.0	12072	6.7	5498	1.1	17570	1.0
WORCESTER	MA	20000	0	.0	11328	6.3	0	.0	11328	.7
MANCHESTER	NH	20000	8318	.8	3568	2.0	0	.0	11886	.7
LAWRENCE	MA	20000	0	.0	12463	6.9	0	.0	12463	.7
SALEM	MA	20000	0	.0	8437	4.7	0	.0	8437	.5
PORTSMOUTH	NH	20000	0	.0	3507	1.9	0	.0	3507	.2
DOVER	NH	20000	0	.0	13781	7.6	0	.0	13781	.8
NASHUA	NH	10000	0	.0	5730	3.2	0	.0	5730	.3
LOWELL	MA	10000	0	.0	4710	2.6	2716	.5	7426	.4
WHITE RIVER JCT.	VT	0	13804	1.4	4263	2.4	0	.0	18067	1.1
SPRINGFIELD	MA	0	71032	7.1	2230	1.2	0	.0	73262	4.3
AYER	MA	0	0	.0	11289	6.2	0	.0	11289	.7
GROVETON	NH	0	0	.0	5125	2.8	0	.0	5125	.3
BRATTLEBORO	VT	0	0	.0	3368	1.9	0	.0	3368	.2
FRANKLIN	MA	0	0	.0	0	.0	60088	11.6	60088	3.5
SOUTH STATION	MA	0	0	.0	0	.0	95504	18.4	95504	5.6
ROCKPORT	MA	0	0	.0	0	.0	1868	.4	1868	.1
HAVERHILL	MA	0	0	.0	0	.0	16567	3.2	16567	1.0
YARD 7-BOSTON	MA	0	0	.0	26603	14.7	0	.0	26603	1.6
GARDNER	MA	0	0	.0	1657	.9	4966	1.0	6623	.4
ST. ALBANS	VT	0	31756	3.2	0	.0	0	.0	31756	1.9
NEWPORT	VT	0	0	.0	0	.0	0	.0	0	.0
HOLYOKE	MA	0	0	.0	2820	1.6	0	.0	2820	.2
WHITEFIELD	NH	0	1776	.2	0	.0	0	.0	1776	.1
PROVIDENCE	RI	0	0	.0	0	.0	61430	11.9	61430	3.6
PORTLAND	ME	0	113585	11.3	0	.0	0	.0	113585	6.7
		TOTALS:	1004143		180948		518278		1703369	

B & M ENERGY USE STUDY

FUEL CONSUMPTION STATISTICS BY LOCATION

PERIOD: FEBRUARY, 1980

FUELING LOCATION		TANK CAPACITY (GALLONS)	THRU FREIGHT (GAL.)	% OF THRU FREIGHT	SWITCH & LOCAL FREIGHT	% OF S & L FREIGHT	PASSNGR (GAL.)	% OF PASS. (GAL.)	LOCATION TOTAL (GAL.)	% OF TOTAL GALLONS
E. DEERFIELD	MA	101000	477806	48.5	46434	21.0	0	.0	524242	28.8
MECHANICVILLE	NY	550000	372191	37.8	14932	6.8	0	.0	387123	21.2
BOSTON	MA	960000	0	.0	3708	1.7	319575	51.8	323283	17.7
CONCORD	NH	20000	54895	5.6	4120	1.9	11536	1.9	70551	3.9
FITCHBURG	MA	20000	0	.0	9957	4.5	14110	2.3	24067	1.3
WORCESTER	MA	2000	0	.0	11344	5.1	0	.0	11344	.6
MANCHESTER	NH	2000	0	.0	9464	4.3	0	.0	9464	.5
LAWRENCE	MA	20000	0	.0	11580	5.2	0	.0	11580	.6
SALEM	MA	20000	0	.0	7566	3.4	0	.0	7566	.4
PORTSMOUTH	NH	20000	0	.0	4009	1.8	0	.0	4009	.2
DOVER	NH	20000	0	.0	13048	5.9	0	.0	13048	.7
NASHUA	NH	10000	0	.0	5737	2.6	0	.0	737	.3
LOWELL	MA	10000	0	.0	3925	1.8	1442	.2	5367	.3
WHITE RIVER JCT.	VT	0	0	.0	4259	1.9	0	.0	4259	.2
SPRINGFIELD	MA	0	53169	5.4	2420	1.1	0	.0	55589	3.1
AYER	MA	0	0	.0	8374	3.8	0	.0	8374	.5
GROVETON	NH	0	0	.0	4730	2.1	0	.0	4730	.3
BRATTLEBORO	VT	0	0	.0	3602	1.6	0	.0	3602	.2
FRANKLIN	MA	0	0	.0	0	.0	63926	10.4	63926	3.5
SOUTH STATION	MA	0	0	.0	0	.0	95739	15.5	95739	5.3
ROCKPORT	MA	0	0	.0	0	.0	3636	.6	3636	.2
HAVERHILL	MA	0	0	.0	0	.0	16092	2.6	16092	.9
YARD 7-BOSTON	MA	0	0	.0	47690	21.6	0	.0	47690	2.6
GARDNER	MA	0	0	.0	1407	.6	14862	2.4	16269	.9
ST. ALBANS	VT	0	26225	2.7	0	.0	0	.0	26225	1.4
NEWPORT	VT	0	0	.0	0	.0	0	.0	0	.0
HOLYOKE	MA	0	0	.0	2301	1.0	0	.0	2301	.1
WHITEFIELD	NH	0	398	.0	0	.0	0	.0	398	.0
PROVIDENCE	RI	0	0	.0	0	.0	75971	12.3	75971	4.2
PORTLAND	ME	0	0	.0	0	.0	0	.0	0	.0
		TOTALS:	984684		220609		616889		1822182	

B & M ENERGY USE STUDY

FUEL CONSUMPTION STATISTICS BY LOCATION

PERIOD: MARCH, 1980

FUELING LOCATION		TANK CAPACITY (GALLONS)	THRU FREIGHT (GAL.)	% OF THRU FREIGHT	SWITCH & LOCAL FREIGHT	% OF S & L FREIGHT	PASSNGR (GAL.)	% OF PASS. (GAL.)	LOCATION TOTAL (GAL.)	% OF TOTAL GALLONS
E. DEERFIELD	MA	101000	451323	45.2	45463	26.1	0	.0	496786	27.1
MECHANICVILLE	NY	550000	420910	42.1	17015	9.8	0	.0	437925	23.9
BOSTON	MA	960000	0	.0	3977	2.3	345887	52.4	349864	19.1
CONCORD	NH	20000	46195	4.6	4150	2.4	17727	2.7	68072	3.7
FITCHBURG	MA	20000	0	.0	9967	5.7	0	.0	9967	.5
WORCESTER	MA	20000	0	.0	12598	7.2	0	.0	12598	.7
MANCHESTER	NH	20000	0	.0	0	.0	0	.0	0	.0
LAWRENCE	MA	20000	0	.0	11209	6.4	0	.0	11209	.6
SALEM	MA	20000	0	.0	8215	4.7	0	.0	8215	.4
PORTSMOUTH	NH	20000	0	.0	5010	2.9	0	.0	5010	.3
DOVER	NH	20000	0	.0	13124	7.5	0	.0	13124	.7
NASHUA	NH	10000	0	.0	6496	3.7	0	.0	6496	.4
LOWELL	MA	10000	0	.0	4459	2.6	0	.0	4459	.2
WHITE RIVER JCT.	VT	0	0	.0	2919	1.7	0	.0	2919	.2
SPRINGFIELD	MA	0	61117	6.1	965	.6	0	.0	62082	3.4
AYER	MA	0	0	.0	11826	6.8	0	.0	11826	.6
GROVETON	NH	0	0	.0	4777	2.7	0	.0	4777	.3
BRATTLEBORO	VT	0	0	.0	3425	2.0	0	.0	3425	.2
FRANKLIN	MA	0	0	.0	0	.0	56274	8.5	56274	3.1
SOUTH STATION	MA	0	0	.0	0	.0	130689	19.8	130689	7.1
ROCKPORT	MA	0	0	.0	0	.0	2927	.4	2927	.2
HAVERHILL	MA	0	0	.0	0	.0	19317	2.9	19317	1.1
YARD 7-BOSTON	MA	0	0	.0	5411	3.1	0	.0	5411	.3
GARDNER	MA	0	0	.0	847	.5	19273	2.9	20120	1.1
ST. ALBANS	VT	0	19466	1.9	0	.0	0	.0	19466	1.1
NEWPORT	VT	0	0	.0	0	.0	0	.0	0	.0
HOLYOKE	MA	0	0	.0	2110	1.2	0	.0	2110	.1
WHITEFIELD	NH	0	0	.0	0	.0	0	.0	0	.0
PROVIDENCE	RI	0	0	.0	0	.0	68594	10.4	68594	3.7
PORTLAND	ME	0	0	.0	0	.0	0	.0	0	.0
		TOTALS:	999011		173963		660688		1833662	

B & M ENERGY USE STUDY

FUEL CONSUMPTION STATISTICS BY LOCATION

PERIOD: APRIL, 1980

FUELING LOCATION		TANK CAPACITY (GALLONS)	THRU FREIGHT (GAL.)	% OF THRU FREIGHT	SWITCH & LOCAL FREIGHT	% OF S & L FREIGHT	PASSNGR (GAL.)	% OF PASS. (GAL.)	LOCATION TOTAL (GAL.)	% OF TOTAL GALLONS
E. DEERFIELD	MA	101000	319492	33.9	41811	19.4	0	.0	361303	21.1
MECHANICVILLE	NY	550000	443941	49.3	20051	9.3	0	.0	464012	28.2
BOSTON	MA	960000	0	.0	5255	2.4	318834	57.1	324089	18.9
CONCORD	NH	20000	47365	5.0	3470	1.6	10001	1.8	60836	3.5
FITCHBURG	MA	20000	0	.0	8134	3.8	9465	1.7	17599	1.0
WORCESTER	MA	20000	0	.0	8063	3.7	0	.0	8063	.5
MANCHESTER	NH	20000	5067	.5	5990	2.8	0	.0	11057	.6
LAWRENCE	MA	20000	0	.0	8420	3.9	0	.0	8420	.5
SALEM	MA	20000	0	.0	8237	3.8	0	.0	8237	.5
PORTSMOUTH	NH	20000	0	.0	4416	2.0	0	.0	4416	.3
DOVER	NH	20000	0	.0	17765	8.2	0	.0	17765	1.0
NASHUA	NH	10000	0	.0	5746	2.7	0	.0	5746	.3
LOWELL	MA	10000	0	.0	8250	3.8	0	.0	8250	.5
WHITE RIVER JCT.	VT	0	0	.0	3216	1.5	0	.0	3216	.2
SPRINGFIELD	MA	0	61533	6.5	2953	1.4	0	.0	64486	3.8
AYER	MA	0	0	.0	16458	7.6	0	.0	16458	1.0
GROVETON	NH	0	0	.0	4053	1.9	0	.0	4053	.2
BRATTLEBORO	VT	0	0	.0	3207	1.5	0	.0	3207	.2
FRANKLIN	MA	0	0	.0	0	.0	43912	7.9	43912	2.6
SOUTH STATION	MA	0	0	.0	0	.0	95063	17.0	95063	5.5
ROCKPORT	MA	0	0	.0	0	.0	1379	.2	1379	.1
HAVERHILL	MA	0	0	.0	0	.0	11476	2.1	11476	.7
YARD 7-BOSTON	MA	0	0	.0	37035	17.2	0	.0	37035	2.2
GARDNER	MA	0	0	.0	1068	.5	13134	2.4	14202	.8
ST. ALBANS	VT	0	22583	2.4	0	.0	0	.0	22583	1.3
NEWPORT	VT	0	19669	2.1	0	.0	0	.0	19669	1.1
HOLYOKE	MA	0	0	.0	2148	1.0	0	.0	2148	.1
WHITEFIELD	NH	0	1428	.2	0	.0	0	.0	1428	.1
PROVIDENCE	RI	0	0	.0	0	.0	54752	9.8	54752	3.2
PORTLAND	ME	0	0	.0	0	.0	0	.0	0	.0
		TOTALS:	941098		215746		558016		1714860	

B & M ENERGY USE STUDY

FUEL CONSUMPTION STATISTICS BY LOCATION

PERIOD: MAY, 1980

FUELING LOCATION		TANK CAPACITY (GALLONS)	THRU FREIGHT (GAL.)	% OF THRU FREIGHT	SWITCH & LOCAL FREIGHT	% OF S & L FREIGHT	PASSNGR (GAL.)	% OF PASS. (GAL.)	LOCATION TOTAL (GAL.)	% OF TOTAL GALLONS
E. DEERFIELD	MA	101000	275320	28.4	46823	22.3	0	.0	324143	19.2
MECHANICVILLE	NY	550000	520620	53.6	24527	11.2	0	.0	545147	32.2
BOSTON	MA	960000	0	.0	0	.0	324340	64.5	324340	19.2
CONCORD	NH	20000	52262	5.4	3982	1.8	0	.0	56244	3.3
FITCHBURG	MA	20000	0	.0	11011	5.0	0	.0	11011	.7
WORCESTER	MA	20000	0	.0	7529	3.4	0	.0	7529	.4
MANCHESTER	NH	20000	8660	.9	5774	2.6	0	.0	14434	.9
LAWRENCE	MA	20000	0	.0	6557	3.0	0	.0	6557	.4
SALEM	MA	20000	0	.0	8445	3.9	0	.0	8445	.5
PORTSMOUTH	NH	20000	0	.0	4440	2.0	0	.0	4440	.3
DOVER	NH	20000	0	.0	27038	12.4	0	.0	27038	1.6
NASHUA	NH	10000	0	.0	3304	1.5	0	.0	3304	.2
LOWELL	MA	10000	0	.0	7196	3.3	0	.0	7196	.4
WHITE RIVER JCT.	VT	0	0	.0	3169	1.4	0	.0	3169	.2
SPRINGFIELD	MA	0	61276	6.3	5042	2.3	0	.0	66318	3.9
AYER	MA	0	0	.0	12125	5.5	0	.0	12125	.7
GROVETON	NH	0	0	.0	4746	2.2	0	.0	4746	.3
BRATTLEBORO	VT	0	0	.0	3504	1.6	42401	8.4	45905	2.7
FRANKLIN	MA	0	0	.0	0	.0	90459	18.0	90459	5.3
SOUTH STATION	MA	0	0	.0	0	.0	0	.0	0	.0
ROCKPORT	MA	0	0	.0	0	.0	0	.0	0	.0
HAVERHILL	MA	0	0	.0	0	.0	0	.0	0	.0
YARD 7-BOSTON	MA	0	0	.0	28537	13.1	0	.0	28537	1.7
GARDNER	MA	0	0	.0	0	.0	0	.0	0	.0
ST. ALBANS	VT	0	18156	1.9	0	.0	0	.0	18156	1.1
NEWPORT	VT	0	30795	3.2	0	.0	0	.0	30795	1.8
HOLYOKE	MA	0	0	.0	2851	1.3	0	.0	2851	.2
WHITEFIELD	NH	0	3337	.3	0	.0	0	.0	3337	.2
PROVIDENCE	RI	0	0	.0	0	.0	46000	9.1	46000	2.7
PORTLAND	ME	0	0	.0	0	.0	0	.0	0	.0
		TOTALS:	970426		218600		503200		1692226	

D & H ENERGY USE STUDY

FUEL CONSUMPTION STATISTICS BY LOCATION

PERIOD: JUNE, 1980

FUELING LOCATION		TANK CAPACITY (GALLONS)	THRU FREIGHT (GAL.)	% OF THRU FREIGHT	SWITCH & LOCAL FREIGHT	% OF S & L FREIGHT	PASSNGR (GAL.)	% OF PASS. (GAL.)	LOCATION TOTAL (GAL.)	% OF TOTAL GALLONS
E. DEERFIELD	MA	101000	318361	31.9	44958	19.7	0	.0	363319	21.1
MECHANICVILLE	NY	550000	490195	49.2	16976	7.4	0	.0	507171	29.4
BOSTON	MA	960000	0	.0	2374	1.0	326748	45.7	329122	19.1
CONCORD	NH	20000	71765	7.2	3240	1.4	0	.0	75005	4.4
FITCHBURG	MA	20000	0	.0	10196	4.5	0	.0	10196	.6
WORCESTER	MA	20000	0	.0	7123	3.1	0	.0	7123	.4
MANCHESTER	NH	20000	6872	.7	6475	2.8	0	.0	13347	.8
LAWRENCE	MA	20000	0	.0	5369	2.4	0	.0	5369	.3
SALEM	MA	20000	0	.0	6327	2.8	0	.0	6327	.4
PORTSMOUTH	NH	20000	0	.0	4100	1.8	0	.0	4100	.2
DOVER	NH	20000	0	.0	33429	14.7	0	.0	33429	1.9
NASHUA	NH	10000	0	.0	2890	1.3	0	.0	2890	.2
LOWELL	MA	10000	0	.0	7104	3.1	0	.0	7104	.4
WHITE RIVER JCT.	VT	0	0	.0	3860	1.7	0	.0	3860	.2
SPRINGFIELD	MA	0	67836	6.8	5279	2.3	0	.0	73115	4.2
AYER	MA	0	4600	.5	17805	7.8	0	.0	22405	1.3
GROVETON	NH	0	0	.0	2518	1.1	0	.0	2518	.1
BRATTLEBORO	VT	0	0	.0	4066	1.8	0	.0	4066	.2
FRANKLIN	MA	0	0	.0	0	.0	44643	9.0	44643	2.6
SOUTH STATION	MA	0	0	.0	0	.0	84805	17.1	84805	4.9
ROCKPORT	MA	0	0	.0	0	.0	0	.0	0	.0
HAVERHILL	MA	0	0	.0	0	.0	0	.0	0	.0
YARD 7-BOSTON	MA	0	0	.0	41420	18.2	0	.0	41420	2.4
GARDNER	MA	0	0	.0	0	.0	0	.0	0	.0
ST. ALBANS	VT	0	13609	1.4	0	.0	0	.0	13609	.8
NEWPORT	VT	0	23494	2.4	0	.0	0	.0	23494	1.4
HOLYOKE	MA	0	0	.0	2520	1.1	0	.0	2520	.1
WHITEFIELD	NH	0	423	.0	0	.0	0	.0	423	.0
PROVIDENCE	RI	0	0	.0	0	.0	41080	8.3	41080	2.4
PORTLAND	ME	0	0	.0	0	.0	0	.0	0	.0
		TOTALS:	997155		228029		497276		1722460	

B & M ENERGY USE STUDY

FUEL CONSUMPTION STATISTICS BY LOCATION

PERIOD: JULY, 1980

FUELING LOCATION		TANK CAPACITY (GALLONS)	THRU FREIGHT (GAL.)	% OF THRU FREIGHT	SWITCH & LOCAL FREIGHT	% OF S & L FREIGHT	PASSNGR (GAL.)	% OF PASS. (GAL.)	LOCATION TOTAL (GAL.)	% OF TOTAL GALLONS
E. DEERFIELD	MA	101000	291180	33.2	42008	18.1	0	.0	333188	21.3
MECHANICVILLE	NY	550000	491230	56.0	19402	8.4	0	.0	510632	32.7
BOSTON	MA	960000	0	.0	0	.0	293762	64.9	293762	18.8
CONCORD	NH	20000	39387	4.5	5594	2.4	0	.0	44981	2.9
FITCHBURG	MA	20000	0	.0	8360	3.6	0	.0	8360	.5
WORCESTER	MA	20000	0	.0	11041	4.8	0	.0	11041	.7
MANCHESTER	NH	20000	7721	.9	3873	1.7	0	.0	11594	.7
LAWRENCE	MA	20000	0	.0	6067	2.6	0	.0	6067	.4
SALEM	MA	20000	0	.0	9120	3.9	0	.0	9120	.6
PORTSMOUTH	NH	20000	0	.0	4875	2.1	0	.0	4875	.3
DOVER	NH	20000	0	.0	37191	16.0	0	.0	37191	2.4
NASHUA	NH	10000	0	.0	3278	1.4	0	.0	3278	.2
LOWELL	MA	10000	0	.0	8622	3.7	0	.0	8622	.6
WHITE RIVER JCT.	VT	0	0	.0	6123	2.6	0	.0	6123	.4
SPRINGFIELD	MA	0	0	.0	0	.0	0	.0	0	.0
AYER	MA	0	0	.0	13945	6.0	0	.0	13945	.9
GROVETON	NH	0	0	.0	2922	1.3	0	.0	2922	.2
BRATTLEBORO	VT	0	0	.0	3857	1.7	0	.0	3857	.2
FRANKLIN	MA	0	0	.0	0	.0	47194	10.4	47194	3.0
SOUTH STATION	MA	0	0	.0	0	.0	72249	16.0	72249	4.6
ROCKPORT	MA	0	0	.0	0	.0	0	.0	0	.0
HAVERHILL	MA	0	0	.0	0	.0	0	.0	0	.0
YARD 7-BOSTON	MA	0	0	.0	43355	18.7	0	.0	43355	2.8
GARDNER	MA	0	0	.0	587	.3	0	.0	587	.0
ST. ALBANS	VT	0	23244	2.7	0	.0	0	.0	23244	1.5
NEWPORT	VT	0	23494	2.7	0	.0	0	.0	23494	1.5
HOLYOKE	MA	0	0	.0	1636	.7	0	.0	1636	.1
WHITEFIELD	NH	0	345	.0	0	.0	0	.0	345	.0
PROVIDENCE	RI	0	0	.0	0	.0	39432	8.7	39432	2.5
PORTLAND	ME	0	0	.0	0	.0	0	.0	0	.0
		TOTALS:	876401		231856		452637		1561094	

B & M ENERGY USE STUDY

FUEL CONSUMPTION STATISTICS BY LOCATION

PERIOD: AUGUST, 1980

FUELING LOCATION		TANK CAPACITY (GALLONS)	THRU FREIGHT (GAL.)	% OF THRU FREIGHT	SWITCH & LOCAL FREIGHT	% OF S & L FREIGHT	PASSNGR (GAL.)	% OF PASS. (GAL.)	LOCATION TOTAL (GAL.)	% OF TOTAL GALLONS
E. DEERFIELD	MA	101000	321818	31.9	47611	20.1	0	.0	369429	20.7
MECHANICVILLE	NY	550000	546894	54.2	13131	5.5	0	.0	560025	31.4
BOSTON	MA	960000	0	.0	0	.0	334503	62.4	334503	18.8
CONCORD	NH	20000	58955	5.8	8415	3.6	0	.0	67370	3.8
FITCHBURG	MA	20000	0	.0	9160	3.9	0	.0	9160	.5
WORCESTER	MA	20000	0	.0	13220	5.6	0	.0	13220	.7
MANCHESTER	NH	20000	0	.0	9824	4.2	0	.0	9824	.6
LAWRENCE	MA	20000	0	.0	5259	2.2	0	.0	5259	.3
SALEM	MA	20000	0	.0	3636	1.5	0	.0	3636	.2
PORTSMOUTH	NH	20000	0	.0	3798	1.6	0	.0	3798	.2
DOVER	NH	20000	0	.0	30400	12.8	0	.0	30400	1.7
NASHUA	NH	10000	0	.0	3798	1.6	0	.0	3798	.2
LOWELL	MA	10000	0	.0	6995	3.0	0	.0	6995	.4
WHITE RIVER JCT.	VT	0	0	.0	6207	2.6	0	.0	6207	.3
SPRINGFIELD	MA	0	61861	6.1	4931	2.1	0	.0	66792	3.7
AYER	MA	0	0	.0	20225	8.5	0	.0	20225	1.1
GROVETON	NH	0	0	.0	2675	1.2	0	.0	2875	.2
BRATTLEBORO	VT	0	0	.0	4394	1.9	0	.0	4394	.2
FRANKLIN	MA	0	0	.0	0	.0	63393	11.8	63393	3.6
SOUTH STATION	MA	0	0	.0	0	.0	93471	15.6	83471	4.7
ROCKPORT	MA	0	0	.0	0	.0	0	.0	0	.0
HAVERHILL	MA	0	0	.0	0	.0	0	.0	0	.0
YARD 7-BOSTON	MA	0	0	.0	41369	17.5	0	.0	41369	2.3
GARDNER	MA	0	0	.0	0	.0	0	.0	0	.0
ST. ALBANS	VT	0	14727	1.5	0	.0	0	.0	14727	.8
NEWPORT	VT	0	3968	.4	0	.0	0	.0	3968	.2
HOLYOKE	MA	0	0	.0	1472	.6	0	.0	1472	.1
WHITEFIELD	NH	0	0	.0	0	.0	0	.0	0	.0
PROVIDENCE	RI	0	0	.0	0	.0	54852	10.2	54852	3.1
PORTLAND	ME	0	0	.0	0	.0	0	.0	0	.0
		TOTALS:	1008223		236720		536219		1781162	

APPENDIX G

FUEL CONSUMPTION STATISTICS BY LOCATION AND TYPE OF SERVICE, CUMULATIVE SUMMARY

The following table provides a cumulative summary of the monthly tables that appear in Appendix F. This information includes data for the period of December, 1979 through August, 1980, divided into three train categories: Thru Freight, Switch and Local Freight, and Passenger. All categories are totaled for each location, and percentages for each location in each category are calculated. Also listed is the storage tank capacity in gallons for each location.

B & M ENERGY USE STUDY

FUEL CONSUMPTION STATISTICS BY LOCATION & TYPE OF SERVICE

CUMULATIVE SUMMARY (DECEMBER, 1979 THRU AUGUST, 1980)

FUELING LOCATION		TANK CAPACITY (GALLONS)	THRU FREIGHT (GAL.)	% OF THRU FREIGHT	SWITCH & LOCAL FREIGHT	% OF S & L FREIGHT	PASSNGR (GAL.)	% OF PASS. (GAL.)	LOCATION TOTAL (GAL.)	% OF TOTAL GALLONS
E. DEERFIELD	MA	101000	3107730	35.3	390933	20.0	0	.0	3498663	22.1
MECHANICVILLE	NY	550000	3823474	43.4	151934	7.8	0	.0	3975408	25.1
BOSTON	MA	960000	115891	1.3	58991	3.0	2888072	57.1	3062954	19.4
CONCORD	NH	20000	440847	5.2	49787	2.6	53159	1.1	563813	3.6
FITCHBURG	MA	20000	0	.0	92162	4.7	44963	.9	137125	.9
WORCESTER	MA	20000	0	.0	93348	4.8	0	.0	93348	.6
MANCHESTER	NH	20000	36438	.4	59581	3.1	0	.0	96219	.6
LAWRENCE	MA	20000	0	.0	82373	4.2	0	.0	82373	.5
SALEM	MA	20000	0	.0	65004	3.3	0	.0	65004	.4
PORTSMOUTH	NH	20000	0	.0	38623	2.0	0	.0	38623	.2
DOVER	NH	20000	0	.0	196633	10.1	0	.0	196633	1.2
NASHUA	NH	10000	0	.0	43312	2.2	0	.0	43312	.3
LOWELL	MA	10000	0	.0	55240	2.8	16410	.3	71650	.5
WHITE RIVER JCT.	VT	0	48808	.6	38105	2.0	0	.0	86913	.5
SPRINGFIELD	MA	0	501891	5.7	28546	1.5	0	.0	530437	3.4
AYER	MA	0	4600	.1	134290	6.9	0	.0	138890	.9
GROVETON	NH	0	0	.0	36836	1.9	0	.0	36836	.2
BRATTLEBORO	VT	0	0	.0	33084	1.7	42401	.8	75485	.5
FRANKLIN	MA	0	0	.0	0	.0	530702	10.5	530702	3.4
SOUTH STATION	MA	0	0	.0	0	.0	791923	15.7	791923	5.0
ROCKPORT	MA	0	0	.0	0	.0	11979	.2	11979	.1
HAVERHILL	MA	0	0	.0	0	.0	87217	1.7	87217	.6
YARD 7-BOSTON	MA	0	0	.0	271420	13.9	0	.0	271420	1.7
GARDNER	MA	0	0	.0	7037	.4	68628	1.4	75665	.5
ST. ALBANS	VT	0	169766	1.9	0	.0	0	.0	169766	1.1
NEWPORT	VT	0	101420	1.2	0	.0	0	.0	101420	.6
HOLYOKE	MA	0	0	.0	20170	1.0	0	.0	20170	.1
WHITEFIELD	NH	0	7707	.1	3843	.2	0	.0	11550	.1
PROVIDENCE	RI	0	0	.0	0	.0	521445	10.3	521445	3.3
PORTLAND	ME	0	429384	4.9	0	.0	0	.0	429384	2.7
			TOTALS: 8808176		1951252		5056899		15816327	

APPENDIX H

OPERATING STATISTICS BY MONTH

The tables in Appendix H contain train operating statistics for each month over the period from December, 1979 through August, 1980. The information is used to normalize fuel consumption data for Thru Freight Trains. The operating statistics for Thru Freight Trains includes the following:

- Gross ton miles handled
- The numbers of total cars, loaded cars, and empty cars handled
- The number of trains operated
- The total miles of track operated
- Total freight train miles
- Locomotive unit-miles.

The tables also list the number of Local trains operated, Switch trains operated, Passenger trains operated, and Coal trains operated by month, as well as total miles of Branch track operated and total Passenger train miles.

B & M ENERGY USE STUDY

OPERATING STATISTICS

FOR DECEMBER, 1979

Gross Ton Miles Handled (Thru):	445831050
Number of Total Cars Handled (Thru):	72582
Number of Loaded Cars Handled (Thru):	37068
Number of Empty Cars Handled (Thru):	35514
Number of Trains Operated (Thru):	668
Number of Trains Operated (Local):	516
Number of Trains Operated (Switch):	1378
Number of Trains Operated (Passenger):	7480
Number of Trains Operated (Coal):	8
Total Miles of Track Operated (Thru):	1018
Total Miles of Track Operated (Branch):	397
Total Freight Train Miles (Thru):	128558
Total Passenger Train Miles:	190140
Locomotive Unit-Miles (Thru):	345958

B & M ENERGY USE STUDY

OPERATING STATISTICS

FOR JANUARY, 1980

Gross Ton Miles Handled (Thru):	452276879
Number of Total Cars Handled (Thru):	78595
Number of Loaded Cars Handled (Thru):	38806
Number of Empty Cars Handled (Thru):	39789
Number of Trains Operated (Thru):	672
Number of Trains Operated (Local):	564
Number of Trains Operated (Switch):	1410
Number of Trains Operated (Passenger):	7972
Number of Trains Operated (Coal):	10
Total Miles of Track Operated (Thru):	1018
Total Miles of Track Operated (Branch):	397
Total Freight Train Miles (Thru):	130410
Total Passenger Train Miles:	178781
Locomotive Unit-Miles (Thru):	351054

B & M ENERGY USE STUDY

OPERATING STATISTICS

FOR FEBRUARY, 1980

Gross Ton Miles Handled (Thru):	427295926
Number of Total Cars Handled (Thru):	74302
Number of Loaded Cars Handled (Thru):	37849
Number of Empty Cars Handled (Thru):	36453
Number of Trains Operated (Thru):	646
Number of Trains Operated (Local):	300
Number of Trains Operated (Switch):	1410
Number of Trains Operated (Passenger):	7614
Number of Trains Operated (Coal):	10
Total Miles of Track Operated (Thru):	1018
Total Miles of Track Operated (Branch):	397
Total Freight Train Miles (Thru):	120690
Total Passenger Train Miles:	172334
Locomotive Unit-Miles (Thru):	331086

B & M ENERGY USE STUDY

OPERATING STATISTICS

FOR MARCH, 1980

Gross Ton Miles Handled (Thru):	440277384
Number of Total Cars Handled (Thru):	78230
Number of Loaded Cars Handled (Thru):	40107
Number of Empty Cars Handled (Thru):	38123
Number of Trains Operated (Thru):	684
Number of Trains Operated (Local):	564
Number of Trains Operated (Switch):	1376
Number of Trains Operated (Passenger):	7655
Number of Trains Operated (Coal):	6
Total Miles of Track Operated (Thru):	1018
Total Miles of Track Operated (Branch):	397
Total Freight Train Miles (Thru):	129798
Total Passenger Train Miles:	185860
Locomotive Unit-Miles (Thru):	364998

B & M ENERGY USE STUDY

OPERATING STATISTICS

FOR APRIL, 1980

Gross Ton Miles Handled (Thru):	424687179
Number of Total Cars Handled (Thru):	73891
Number of Loaded Cars Handled (Thru):	36198
Number of Empty Cars Handled (Thru):	37693
Number of Trains Operated (Thru):	654
Number of Trains Operated (Local):	564
Number of Trains Operated (Switch):	1402
Number of Trains Operated (Passenger):	7622
Number of Trains Operated (Coal):	8
Total Miles of Track Operated (Thru):	1018
Total Miles of Track Operated (Branch):	397
Total Freight Train Miles (Thru):	126575
Total Passenger Train Miles:	185575
Locomotive Unit-Miles (Thru):	333554

B & M ENERGY USE STUDY

OPERATING STATISTICS

FOR MAY, 1980

Gross Ton Miles Handled (Thru):	436907602
Number of Total Cars Handled (Thru):	76294
Number of Loaded Cars Handled (Thru):	37408
Number of Empty Cars Handled (Thru):	38886
Number of Trains Operated (Thru):	695
Number of Trains Operated (Local):	510
Number of Trains Operated (Switch):	1405
Number of Trains Operated (Passenger):	7584
Number of Trains Operated (Coal):	9
Total Miles of Track Operated (Thru):	1018
Total Miles of Track Operated (Branch):	397
Total Freight Train Miles (Thru):	125398
Total Passenger Train Miles:	186189
Locomotive Unit-Miles (Thru):	328155

B & M ENERGY USE STUDY

OPERATING STATISTICS

FOR JUNE, 1980

Gross Ton Miles Handled (Thru):	458470425
Number of Total Cars Handled (Thru):	80244
Number of Loaded Cars Handled (Thru):	39592
Number of Empty Cars Handled (Thru):	40652
Number of Trains Operated (Thru):	635
Number of Trains Operated (Local):	522
Number of Trains Operated (Switch):	1395
Number of Trains Operated (Passenger):	7421
Number of Trains Operated (Coal):	12
Total Miles of Track Operated (Thru):	1018
Total Miles of Track Operated (Branch):	397
Total Freight Train Miles (Thru):	119981
Total Passenger Train Miles:	182177
Locomotive Unit-Miles (Thru):	326958

B & M ENERGY USE STUDY

OPERATING STATISTICS

FOR JULY, 1980

Gross Ton Miles Handled (Thru):	404595865
Number of Total Cars Handled (Thru):	77339
Number of Loaded Cars Handled (Thru):	36653
Number of Empty Cars Handled (Thru):	40686
Number of Trains Operated (Thru):	624
Number of Trains Operated (Local):	502
Number of Trains Operated (Switch):	1375
Number of Trains Operated (Passenger):	7720
Number of Trains Operated (Coal):	6
Total Miles of Track Operated (Thru):	1018
Total Miles of Track Operated (Branch):	397
Total Freight Train Miles (Thru):	116646
Total Passenger Train Miles:	187216
Locomotive Unit-Miles (Thru):	313508

B & M ENERGY USE STUDY

OPERATING STATISTICS

FOR AUGUST, 1980

Gross Ton Miles Handled (Thru):	440262597
Number of Total Cars Handled (Thru):	79208
Number of Loaded Cars Handled (Thru):	39017
Number of Empty Cars Handled (Thru):	40191
Number of Trains Operated (Thru):	628
Number of Trains Operated (Local):	515
Number of Trains Operated (Switch):	1385
Number of Trains Operated (Passenger):	7584
Number of Trains Operated (Coal):	12
Total Miles of Track Operated (Thru):	1018
Total Miles of Track Operated (Branch):	397
Total Freight Train Miles (Thru):	122730
Total Passenger Train Miles:	183182
Locomotive Unit-Miles (Thru):	326560

APPENDIX I

OPERATING STATISTICS, CUMULATIVE AVERAGE TO DATE

The table in Appendix I contains summary cumulative train operating statistics for the period from December, 1979 to August, 1980. The information is used to normalize fuel consumption data for Thru Freight Trains. The operating statistics for Thru Freight Trains includes the following:

- Gross ton miles handled
- The numbers of total cars, loaded cars, and empty cars handled
- The number of trains operated
- The total miles of track operated
- Total freight train miles
- Locomotive unit-miles.

The table also lists the number of Local trains operated, Switch trains operated, Passenger trains operated, and Coal trains operated by month, as well as total miles of Branch track operated and total Passenger train miles.

B & M ENERGY USE STUDY

OPERATING STATISTICS AVERAGES

FROM DECEMBER, 1979 THRU AUGUST, 1980

Average Gross Ton Miles Handled (Thru):	436733884
Average Number of Total Cars Handled (Thru):	76742
Average Number of Loaded Cars Handled (Thru):	38077
Average Number of Empty Cars Handled (Thru):	38665
Average Number of Trains Operated (Thru):	456
Average Number of Trains Operated (Local):	506
Average Number of Trains Operated (Switch):	1392
Average Number of Trains Operated (Passenger):	7628
Average Number of Trains Operated (Coal):	9
Average Total Miles of Track Operated (Thru):	1018
Average Total Miles of Track Operated (Branch):	397
Average Total Freight Train Miles (Thru):	124534
Average Total Passenger Train Miles:	183494
Average Locomotive Unit-Miles (Thru):	335759

APPENDIX J

FUEL USE STATISTICS BY MONTH

The tables in Appendix J contain train fuel use statistics for each month over the period from December, 1979 to August, 1980. The statistics are developed by combining fuel consumption data from Appendix F with train operations data from Appendix H for the purpose of analyzing trends in Thru Freight Train performance. The fuel use statistics for Thru Freight train operations include the following:

- Gross ton-miles per gallon
- Percent of cars handled empty
- Gallons per train
- Gallons per locomotive unit mile
- Locomotives per gross ton
- Locomotives per train

The tables also provide gallon per train statistics for Switch and Local trains and Passenger trains.

B & M ENERGY USE STUDY

FUEL USE STATISTICS FOR DECEMBER, 1979

Gross Ton Miles Per Gallon (Thru):	434.18
Percent of Cars Handled Empty (Thru):	48.93
Gallons Per Train (Thru):	1518.99
Gallons Per Train (Switch & Local):	129.24
Gallons Per Train (Passenger):	95.41
Gallons Per Locomotive Unit Mile (Thru):	2.97
Locomotives Per Gross Ton (Thru):	.00078
Locomotives Per Train (Thru):	2.69

B & M ENERGY USE STUDY

FUEL USE STATISTICS FOR JANUARY, 1980

Gross Ton Miles Per Gallon (Thru):	450.41
Percent of Cars Handled Empty (Thru):	50.63
Gallons Per Train (Thru):	1472.35
Gallons Per Train (Switch & Local):	91.67
Gallons Per Train (Passenger):	65.01
Gallons Per Locomotive Unit Mile (Thru):	2.86
Locomotives Per Gross Ton (Thru):	.00078
Locomotives Per Train (Thru):	2.69

B & M ENERGY USE STUDY

FUEL USE STATISTICS FOR FEBRUARY, 1980

Gross Ton Miles Per Gallon (Thru):	433.94
Percent of Cars Handled Empty (Thru):	49.06
Gallons Per Train (Thru):	1501.04
Gallons Per Train (Switch & Local):	129.01
Gallons Per Train (Passenger):	81.02
Gallons Per Locomotive Unit Mile (Thru):	2.97
Locomotives Per Gross Ton (Thru):	.00077
Locomotives Per Train (Thru):	2.74

B & M ENERGY USE STUDY

FUEL USE STATISTICS FOR MARCH, 1980

Gross Ton Miles Per Gallon (Thru):	440.71
Percent of Cars Handled Empty (Thru):	48.73
Gallons Per Train (Thru):	1447.84
Gallons Per Train (Switch & Local):	89.67
Gallons Per Train (Passenger):	86.31
Gallons Per Locomotive Unit Mile (Thru):	2.74
Locomotives Per Gross Ton (Thru):	.00083
Locomotives Per Train (Thru):	2.81

B & M ENERGY USE STUDY

FUEL USE STATISTICS FOR APRIL, 1980

Gross Ton Miles Per Gallon (Thru):	451.27
Percent of Cars Handled Empty (Thru):	51.01
Gallons Per Train (Thru):	1421.60
Gallons Per Train (Switch & Local):	109.74
Gallons Per Train (Passenger):	73.21
Gallons Per Locomotive Unit Mile (Thru):	2.82
Locomotives Per Gross Ton (Thru):	.00079
Locomotives Per Train (Thru):	2.64

B & M ENERGY USE STUDY

FUEL USE STATISTICS FOR MAY, 1980

Gross Ton Miles Per Gallon (Thru):	450.22
Percent of Cars Handled Empty (Thru):	50.97
Gallons Per Train (Thru):	1378.45
Gallons Per Train (Switch & Local):	114.15
Gallons Per Train (Passenger):	66.35
Gallons Per Locomotive Unit Mile (Thru):	2.96
Locomotives Per Gross Ton (Thru):	.00075
Locomotives Per Train (Thru):	2.61

B & M ENERGY USE STUDY

FUEL USE STATISTICS FOR JUNE, 1980

Gross Ton Miles Per Gallon (Thru):	459.78
Percent of Cars Handled Empty (Thru):	50.66
Gallons Per Train (Thru):	1541.20
Gallons Per Train (Switch & Local):	118.95
Gallons Per Train (Passenger):	67.01
Gallons Per Locomotive Unit Mile (Thru):	3.05
Locomotives Per Gross Ton (Thru):	.00071
Locomotives Per Train (Thru):	2.73

B & M ENERGY USE STUDY

FUEL USE STATISTICS FOR JULY, 1980

Gross Ton Miles Per Gallon (Thru):	461.55
Percent of Cars Handled Empty (Thru):	52.61
Gallons Per Train (Thru):	1391.43
Gallons Per Train (Switch & Local):	123.52
Gallons Per Train (Passenger):	58.63
Gallons Per Locomotive Unit Mile (Thru):	2.80
Locomotives Per Gross Ton (Thru):	.00077
Locomotives Per Train (Thru):	2.69

B & M ENERGY USE STUDY

FUEL USE STATISTICS FOR AUGUST, 1980

Gross Ton Miles Per Gallon (Thru):	436.67
Percent of Cars Handled Empty (Thru):	50.74
Gallons Per Train (Thru):	1575.35
Gallons Per Train (Switch & Local):	124.59
Gallons Per Train (Passenger):	70.70
Gallons Per Locomotive Unit Mile (Thru):	3.09
Locomotives Per Gross Ton (Thru):	.00074
Locomotives Per Train (Thru):	2.66

APPENDIX K

FUEL USE STATISTICS, CUMULATIVE AVERAGE TO DATE

The table in K contains cumulative train fuel use statistics for each month over the period from December, 1979 to August, 1980. The statistics are developed by combining fuel consumption data from Appendix G with train operations data from Appendix I for the purpose of analyzing trends in Thru Freight Train performance. The fuel use statistics for Thru Freight Train operations include the following:

- Gross ton-miles per gallon
- Percent of cars handled empty
- Gallons per train
- Gallons per locomotive unit mile
- Locomotives per gross ton
- Locomotives per train

The table also provides gallon per train statistics for Switch and Local trains and Passenger trains.

B & M ENERGY USE STUDY

AVERAGE FUEL USE STATISTICS

FOR PERIOD: DECEMBER, 1979 THRU AUGUST, 1980

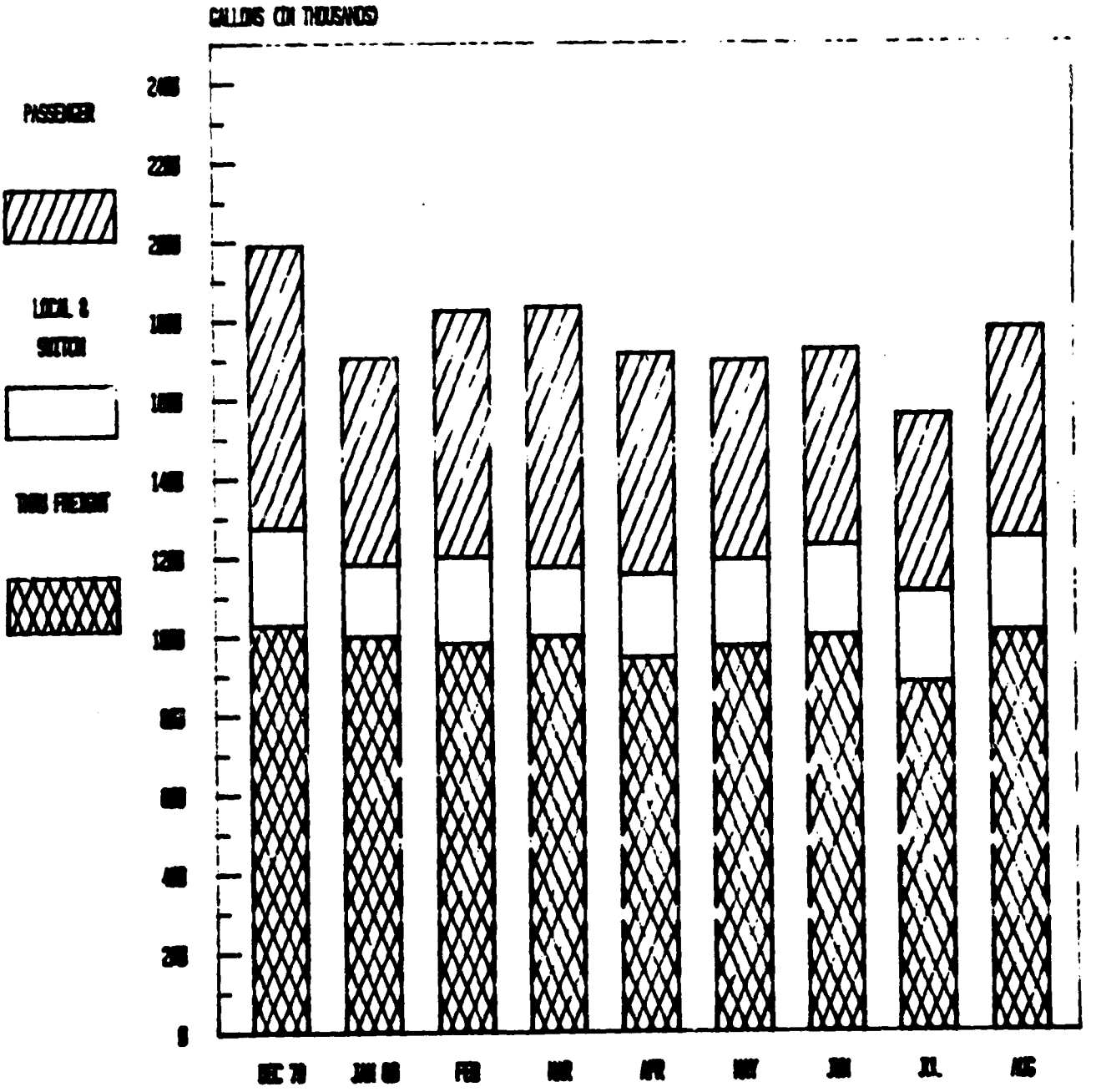
Gross Ton Miles Per Gallon (Thru):	446.25
Percent of Cars Handled Empty (Thru):	50.38
Gallons Per Train (Thru):	1471.22
Gallons Per Train (Switch & Local):	114.16
Gallons Per Train (Passenger):	73.66
Gallons Per Locomotive Unit Mile (Thru):	2.91
Locomotives Per Gross Ton (Thru):	.00077
Locomotives Per Train (Thru):	2.70

APPENDIX L

DIESEL FUEL CONSUMED BY MONTH AND TYPE OF SERVICE

The bar chart in Appendix L shows the nthly trend in total diesel fuel consumption over the pericd from December, 1979 to August, 1980. The bar for each month is divided intc three components showing the amount of fuel consumed by Thru Freight, Local and Switch, and Passenger train operations.

FRA/B&M ENERGY USE STUDY
DIESEL FUEL CONSUMED

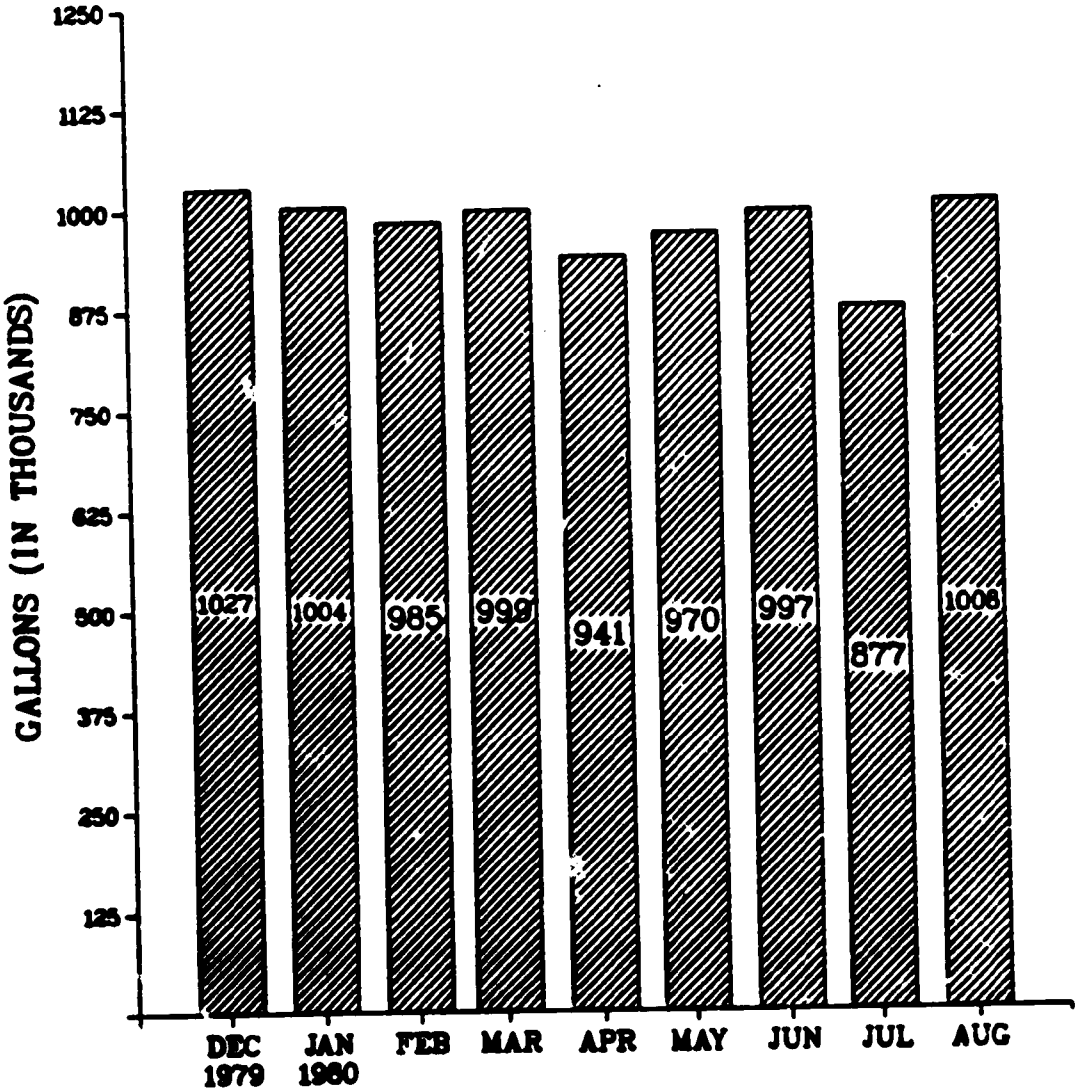


APPENDIX M

THRU FREIGHT DIESEL FUEL CONSUMED BY MONTH

The bar chart in Appendix M shows the monthly trend in total Thru Freight diesel fuel consumption over the period from December, 1979 to August, 1980.

THRU FREIGHT DIESEL FUEL CONSUMED

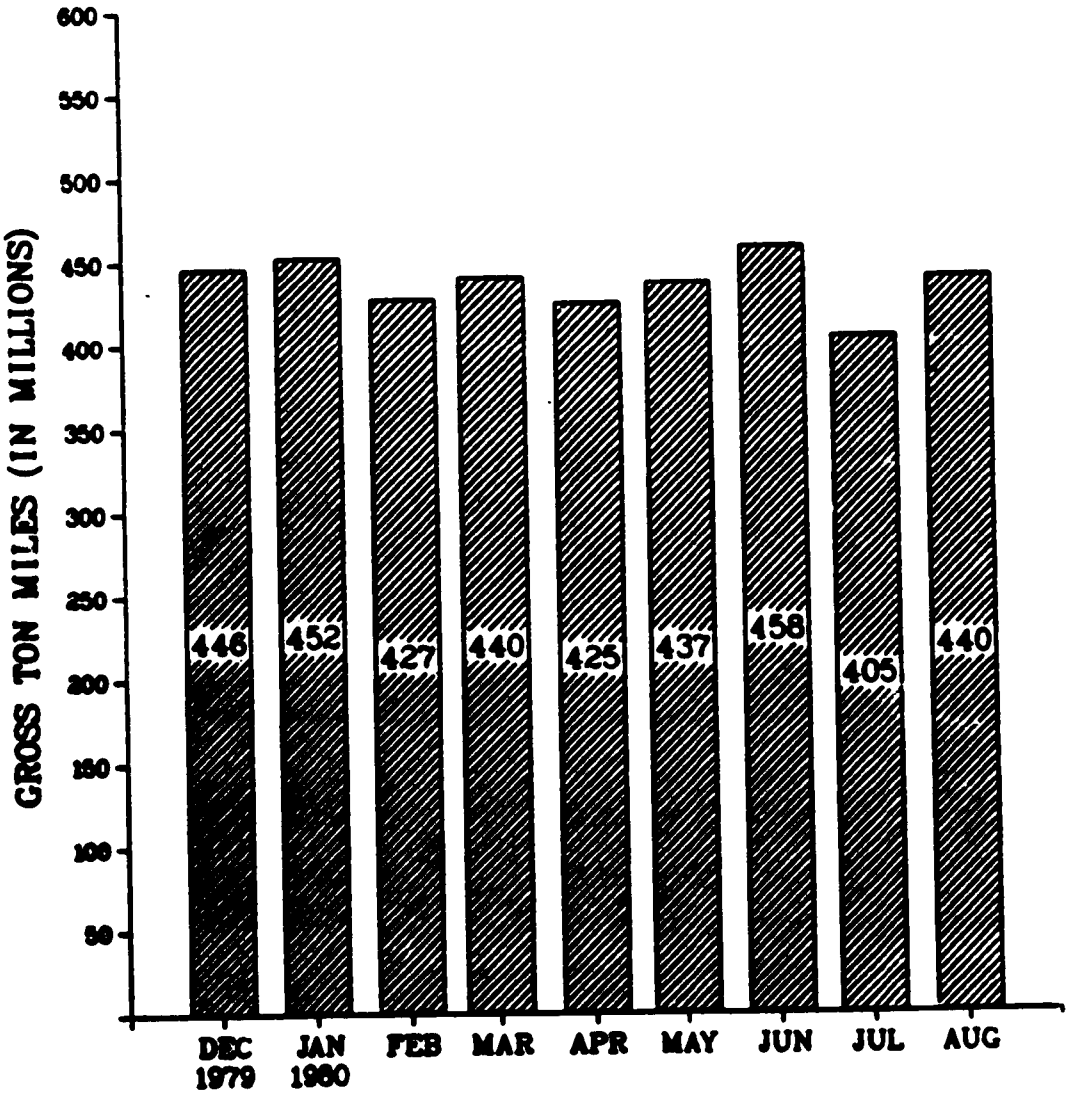


APPENDIX N

THRU FREIGHT TON MILES HANDLED BY MONTH

The bar chart in Appendix N shows the monthly trend in total Thru Freight ton miles over the period from December, 1979 to August, 1980.

GROSS THRU FREIGHT TON MILES HANDLED



APPENDIX O

GROSS TON MILES PER THRU FREIGHT GALLON BY MONTH

The bar chart in Appendix O shows the monthly trend in gross ton-miles per gallon for Thru Freight Train operations over the period from December, 1979 to August, 1980. The information was developed by normalizing the monthly Thru Freight fuel consumption data in Appendix M by the monthly Thru Freight ton-miles data in Appendix N.

GROSS TON MILES PER THRU FREIGHT GALLON