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FREIGHT TRANSPORTATION ENERGY USE
Volume IV-Analysis of Selected Energy Conservation Options

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FINAL REPORT

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PREFACE

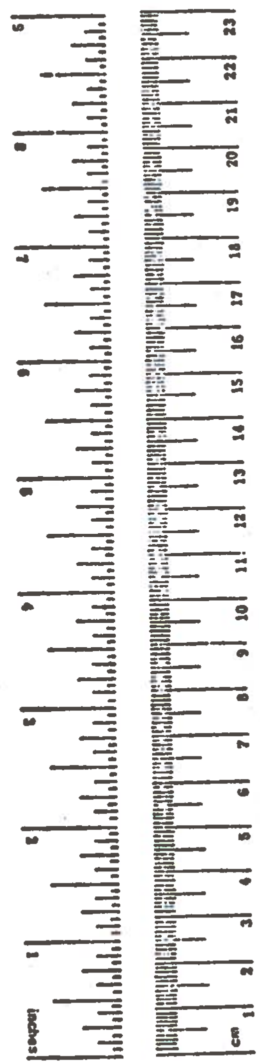
This study is one part of a larger Department of Transportation effort to examine transportation energy efficiency. The study was performed by CACI, Inc. - Federal for the DOT Transportation Systems Center. The TSC technical monitors were Dr. David Anderson and Dr. Russell Cherry. Their support, encouragement, and technical aid are gratefully acknowledged. Valuable guidance and assistance were also received from Paul Hoxie, Domenic Maio, and John Murphy of TSC. CACI participants in the study were Michael Bronzini, Roger Miller, John Sabo, Catherine Schourek, Conrad Strack, and Kenneth Wright. Both TSC and CACI also wish to acknowledge the cooperation of the Army Corps of Engineers, who made available for the study the multimodal network model and data developed under their inland navigation systems analysis program.

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

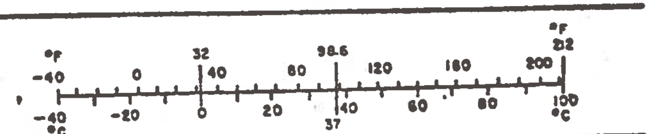
Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in ≡ 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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16. Abstract

The TSC Freight Energy Model is applied to a preliminary analysis of two energy conservation options: (1) increased use of Run-Through TOFC rail service; and (2) use of double 40-foot trailers on all divided highways. These options are examined primarily within the limited context of competition for movement of intercity freight which presently moves in single trailer highway service. Both options are found to produce significant energy savings, but to offer the potential for additional modal or submodal trafffic diversion which would tend to negate the energy savings. Other volumes of this report are:

Vol. I - Summary and Baseline Results, 62p.
Vol. II - Methodology and Program Documentation, 232p.
Vol. III - Freight Network and Operations Database, 140p.

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1. TECHNICAL APPROACH

Introduction

This volume reports on application of the TSC Freight Energy Model to two transportation supply options whose energy conservation features have been widely advertised by their respective proponents. The first option is increased use of run-through TOFC, and it is examined within the context of truck/rail competition for the movement of manufactured and processed commodities. The second option is nationwide legalization of double trailer operations on all divided highways. This option is studied as a submode of the highway mode; that is, competition between double trailers and single trailers for baseline truck traffic is addressed. These two options are hereafter referred to as "Run-Through TOFC" and "Double Trailers", respectively.

Information essential to a complete understanding of this analysis is provided in the other volumes of this report. The TSC Freight Energy Model is described in detail in Volume 2 and the freight network and operations database is presented in Volume 3. Volume 1 summarizes the model and data and presents baseline results for 1972 and 1990.

The remainder of this chapter states the objectives, procedures, and assumptions of this study, and summarizes the baseline results for 1990. Chapter two covers the Run-Through TOFC option, and chapter three presents the Double Trailers case. A summary and conclusions are provided in chapter four. The Appendix to this volume contains copies of the computer output summary reports from all model runs discussed in this report.

Objectives and Procedures

The modeling experiments presented below were undertaken for two reasons:

- to test and demonstrate the ability of the TSC Freight Energy Model to provide useful analyses of energy conservation options;
- to obtain preliminary indications of the energy-use, cost, and service consequences of implementing Run-Through TOFC or Double Trailers.

In that the first objective was the more important of the two, no efforts were made to coax out of the model every bit of accuracy that is obtainable. In particular, no iterations or successive approximations of supply/demand equilibrium were attempted. Hence the quantitative results presented do not reflect complete adjustment to changed transportation circumstances.

Both of the options were tested under 1990 network and transport demand conditions. The procedure used was to simply insert each option separately into the network and operations data, and then run the transportation network model. Shipment inputs for these runs were the same as for the 1990 baseline run. * In all cases, the model was run in an unconstrained fashion, i.e., the model was allowed to make all relevant modal choice decisions. Those shipments not involved in the intermodal competition under study were assigned to the same mode and path as in the 1990 baseline run, primarily to conserve computer resources. The distinction between competitive and fixed-choice shipments is taken up in the discussion of each option in later chapters.

Baseline Results

A complete discussion of the 1990 baseline results obtained with the TSC Freight Energy Model appears in Volume 1 of this report. To provide a point of departure for assessing the energy conservation options, those results are summarized here. Some technical details concerning baseline model inputs for 1990 are also provided.

* The commodity flow input data available for this project represented only about 40% of the total truck tonnage.

- 1990 Network

The 1990 intercity freight network is very similar to the base year (1972) network. Only a few major projects and trends, either already operational or virtually certain to be in effect by 1990, were included in the updated network. The following specific changes were made:

- The Ohio River link/node structure was revised to include new locks and dams at Hannibal, Willow Island, Cannelton, Newburgh, Uniontown, and Smithland. Each location features a main chamber 1200 feet long by 110 feet wide and an auxiliary 600 x 110-foot chamber. The smaller locks which these new projects replaced were removed from the network.

- The Tennessee-Tombigbee Waterway was added to the network. The ten new locks, all 600 x 110-foot structures, were placed in class AK600.110, and the channel links were assigned the same functions as class BW/TOMB/MO.

- The capacities of Locks 26 on the Mississippi River and Gallipolis on the Ohio River were increased by 20,000 kilotons per year, to reflect either structural or lock management improvements. The capacity parameters of the corresponding time, energy, and cost functions were increased by the same amount.

- Coal commodity adjustments for the rail mode were revised to show an increase in the proportion of traffic handled in unit trains from 33% to 50%. Revised factors are given in Table 1-1.

- A $0.22 per gallon increase in the real price of diesel fuel was assumed. This assumption was captured in the model input by using an energy-weighting factor of $0.001586/KBTU in the impedance weighting factor data for each commodity, which was much simpler than revising all of the cost functions. This means, however, that the costs included in the model output reports and files must be increased by the above multiple of the corresponding energy use to arrive at the current figures for 1990.*

No other changes in the freight network and operations data were made for the 1990 baseline; i.e., all data are as reported in Volume 3.

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* This adjustment is already included in the tables appearing in this report.

Table 1-1. Coal Commodity Adjustment Factors for Rail (1990)

Network Element	Impedance Multipliers		
	Time	Energy	Cost
Nodes	.50	.39	.39
Linehaul Links	1.05	.64	.66
Access	.53	.53	.67

- Assumptions

The major assumptions underlying the 1990 baseline results are discussed fully in Volume 1. For convenience, they are also listed below.

- Commodity flow estimates for 1990 assume "business as usual" population and economic growth, and do not take into account energy shortages, western coal, Sun Belt development, and so on. Base year (1972) origin-destination patterns are also preserved.
- There will be no significant changes in modal technology and operations.
- There will be no differential inflation, other than in the price of fuel.
- All model relationships established for 1972 carry through to 1990.

- Results

A summary of the 1990 baseline results is given in Table 1-2. The performance of the options studied will be assessed by comparing the model results, at a finer level of detail, with the baseline results. For comparative purposes, Table 1-2 also shows the overall results of a model run in which all shipments were assigned to energy-minimizing modes and routes. Both of these runs are discussed in detail in Volume 1.

Table 1-2. Summary of 1990 Baseline Freight Operations

Item	Unadjusted Estimate*	
	Baseline	Min Energy
Tons (million)	3,026	3,027
Ton-Miles (billion)	1,626	1,623
Cost ($ million)	33,382	26,452
Energy (trillion BTU)	1,362	943
Service (million ton-days)	16,370	23,906
Disutility ($ million)	49,938	55,874

* Outputs from unconstrained runs of the transportation network model.

The major factors underlying the 1990 baseline results appear to be:

- an increasing proportion of manufactured goods in the traffic stream
- escalated fuel prices
- waterway modernization and expansion
- increasing use of unit trains for coal movements
- operation of existing pipelines at or near economic capacity.

The minimum energy case features massive shifts of truck traffic to rail and waterway, and some diversion of pipeline shipments as well. These modal share realignments reduce energy-use and cost, but that also drastically reduce service quality and increase shippers' perceived economic costs ("disutility" in Table 1-2). The 1990 baseline results do not include the effects of energy saving technological improvements currently under development within each mode, which could reduce the energy-use figures cited here by 10 to 30 percent.

2. RUN-THROUGH TOFC OPTION

Procedure

The Run-Through TOFC option was designed as a test of the ability of improved TOFC service to compete successfully with intercity trucking. No test of the competition between regular CL (carload) rail service and TOFC service was conducted.* Accordingly, the modeling problem was attacked by defining several subcommodities which could be shipped only by rail or highway. These consisted of the existing TOFC traffic (commodity no. 9) and all TOFC-compatible highway traffic. A list of the subcommodities is provided in Table 2-1.

Given the identification of the special TOFC-compatible subcommodities, the commodity adjustment elements** of the transportation network model input data were used to describe the characteristics of the rail service hypothesized to be available to these commodities under Run-Through TOFC. The commodity adjustments used are given in Table 2-2. The linehaul and access factors are the standard TOFC adjustments developed for the 1990 (and 1972) baseline. The node time, energy, and cost were set to zero, however, to model an operation in which TOFC trains bypass all intermediate yards. This non-stop TOFC service was assumed to be available everywhere, regardless of trip length and annual traffic level. Hence this option represents a "best case" version of Run-Through TOFC.

Shipments of the newly defined subcommodities were generated by recoding as per Table 2-1 the commodity identifier data for all TOFC-compatible traffic which selected the highway mode in the 1990 baseline run (unconstrained). For example, all shipments of commodity 7, Food and Kindred Products, which moved via highway were recoded to commodity 21. The baseline mode selection information was obtained from the path file produced in the baseline run.

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* Computer capacity limitations which could not be released within the project time and budget constraints precluded analysis of the carload competition with TOFC Services.

** Technically the "impedance commodity factors"; see Volume 2.

Table 2-1. Run-Through TOFC Subcommodities*

Commodity Code		
Baseline	TOFC Recode	Commodity Name
7	21	Food and Kindred Products
8	22	Textiles and Apparel
9	9	TOFC
10	23	Chemicals
11	24	Lumber and Furniture
12	25	Machinery (nonelectrical)
13	26	Electrical Machinery
14	27	Transportation Equipment
15	28	Unidentified Manufactures
16	29	Paper and Allied Products
18	30	Primary Metal Products
19	31	Fabricated Metal Products
20	32	Miscellaneous Manufactures

* Flows of these commodities do not include traffic from places other than manufacturing plants, from manufacturing plants with less than 20 employees, nor truck movements of fresh fruits and vegetables, nor other exempt commodities, nor truck movements incidental to rail, water, and air transportation.

Table 2-2. Run-Through TOFC Commodity Adjustment Factors

Network Element	Impedance Multipliers		
	Time	Energy	Cost
Nodes	0.0	0.0	0.0
Linehaul Links	1.0	1.93	2.03
Access	0.14	1.76	1.39

The net result of the input changes described above is that TOFC-compatible highway shipments and TOFC rail shipments see the characteristics of Run-Through TOFC on all O-D pair routes when they look at the rail network. All other shipments continue to see the same modal operating characteristics as in the baseline run. Since these other shipments (non-TOFC rail, other highway shipments, and all waterway and pipeline shipments) are not a factor in the analysis, they were simply assigned to the same paths as in the baseline run, again using the path file as the data source.

In order to provide computer memory space for the new commodities and their associated commodity adjustment factors, the waterway and pipeline network, were deleted for the Run-Through TOFC transportation network model run. Thus the output reports for this option appearing in the Appendix cover only the rail and highway networks. Results for waterway and pipeline are identical to those in the 1990 baseline run. Some of the tables presented below consolidate numerical results from these two model runs, in order to provide a balanced picture of the effect of the TOFC option on the performance of the intercity freight system.

Results

Network-wide freight operating statistics with Run-Through TOFC in effect are compared with baseline results in Table 2-3. The waterway and pipeline results, of course, are unchanged, but there are significant differences for rail and highway operations. The main effect is a net shift of nearly 500 million tons of freight from truck to rail, or, more precisely, from linehaul truck to Run-Through TOFC.* This represents a loss of 63% of highway tonnage and 83% of highway ton-miles, causing a drop in truck revenues exceeding 80%. This truck revenue loss corresponds to a 44% gain in rail revenue (trucks lose $12.7 billion while rail gains $6.8 billion). The net effect is an 18% drop in total transportation cost. Presumably, some of the linehaul revenue lost by the trucking industry is offset by an increase in revenue for providing TOFC pick-up and delivery services; these latter revenues are included as part of the rail access cost in the model outputs.**

* Only about 40% of total U.S. truck tonnage and 45% of truck ton-miles are included in the demand forecast input data. Truck results and percentage shifts apply only to this portion of the truck traffic, which may not be representative of total truck traffic.

** The extent of these revenues could be determined by processing the output files produced by the model if this becomes an issue.

Table 2-3. Freight Operations with Run-Through TOFC (1990)

Item/Mode	Unadjusted Estimate*		
	Base	TOFC	% Δ
Tons (million)			
Rail	1,505	2,096	+ 39.3
Highway	932	341	- 63.4
Waterway	236	236	--
Pipeline	352	352	--
Total	3,026	3,025	--
Ton-Miles (billion)			
Rail	1,004	1,252	+ 24.7
Highway	265	46	- 82.6
Waterway	157	157	--
Pipeline	201	201	--
Total	1,626	1,656	+ 1.8
Cost ($ million)			
Rail	15,509	22,334	+ 44.0
Highway	15,584	2,882	- 81.5
Waterway	1,675	1,675	--
Pipeline	614	614	--
Total	33,382	27,505	- 17.6
Energy (trillion BTU)			
Rail	624	905	+ 44.9
Highway	606	127	- 79.0
Waterway	57	57	--
Pipeline	75	75	--
Total	1,362	1,164	- 14.6
Service (million ton-days)			
Rail	9,925	10,401	+ 4.8
Highway	727	145	- 80.1
Waterway	2,630	2,630	--
Pipeline	3,088	3,088	--
Total	16,370	16,264	- 0.6
Disutility ($ million)			
Rail	28,721	36,494	+ 27.1
Highway	17,126	3,154	- 81.6
Waterway	3,446	3,446	--
Pipeline	645	645	--
Total	49,938	43,739	- 12.4

* Outputs from unconstrained runs of the transportation network model. Note that only about 40% of total U.S. truck tonnage and 45% of truck ton-miles are included in the demand forecast input data. Truck results and percentage shifts apply only to this portion of the truck traffic, which may not be representative of total truck traffic.

Energy-use effects are very similar to cost changes. Rail energy use increases 45%, truck energy use declines 79%, and the total system energy use is down by 15%. These savings occur despite the fact that TOFC uses more energy than CL rail service. The extra rail energy use in this case is more than offset by the savings achieved by switching from highway to rail. A quite different energy-use picture would emerge if TOFC vs. CL competition were to be analyzed. As shown in Table 2-2, each ton-mile shifted from CL to TOFC incurs a 93% increase in linehaul energy use and a 76% increase in access energy use. Thus if TOFC attracted as much traffic from CL as from truck there would likely be no net energy savings.

The changes discussed above occur without any loss of service quality, at least as measured by ton-days. Apparently the bypassing of intermediate yards coupled with TOFC's low access delay removes the main service gap between truck and rail.

Table 2-4 displays resource intensiveness results. Both rail and highway energy intensiveness are higher with Run-Through TOFC, but the modal shift from truck to rail causes a net 16% reduction in BTU/ton-mile. Highway energy intensiveness is up because the loss of traffic produces less congestion and increased operating speeds. Rail energy intensiveness is higher because of the increased tare weight and wind resistance of TOFC equipment. This increased energy use produces higher average costs for both highway and rail. Reductions in the average length of haul for both modes also contribute to increased average costs, since the terminal and access costs are spread over fewer miles. This same effect accounts for the increase in average door-to-door travel time for truck.

The average traffic density and congestion values of Table 2-5 confirm some of the observations made above. Average rail linehaul traffic volume increases from 13 million tons to 18 million tons, which is still far below the available linehaul capacity. Average truck traffic falls from 5.4 to 1.6 million tons, depressing capacity utilization to 3%. There are, of course, individual links of both modes which depart substantially from these averages.

Table 2-4. Resource Intensiveness with Run-Through TOFC (1990)

Mode	Cost (mills/ton-mile)			Energy (BTU/ton-mile)			Service (days/100 mile)		
	Base	TOFC	% Δ	Base	TOFC	% Δ	Base	TOFC	% Δ
Rail	15.4	17.8	+15.6	662	723	+16.2	0.99	0.83	-16.2
Highway	58.8	62.7	+ 6.6	2,287	2,761	+20.7	0.27	0.32	+18.5
Waterway	10.7	10.7	--	363	363	--	1.68	1.68	--
Pipeline	3.1	3.1	--	373	373	--	1.54	1.54	--
Average	20.5	16.6	-19.0	838	703	-16.1	1.01	0.98	- 3.0

Table 2-5. Average Traffic Density with Run-Through TOFC (1990)

Mode	Kton-miles per Mile			Average Volume/Capacity (%)*		
	Base	TOFC	% Δ	Base	TOFC	% Δ
Rail	13,085	15,700	+ 20.0	13.7	16.5	+ 20.4
Highway	5,372	1,641	- 69.5	12.4	3.4	- 72.6
Waterway	23,680	23,680	--	28.5	28.5	--
Pipeline	14,138	14,138	--	37.1	37.1	--
Average	11,082	12,856	+ 16.0	--	--	--

* Based on linehaul links for all modes except waterway, where average lock capacity utilization is reported

The commodity-specific effect of Run-Through TOFC on modal choice is shown in Table 2-6. This table gives the rail share of that traffic eligible to move by either TOFC or highway; CL traffic, other truck traffic, and modes are not included. As shown in the table, Run-Through TOFC competes strongly across all commodities, particularly in the long haul markets. For perspective, Table 2-7 shows total modal split results. The capture by rail of 71% of the TOFC-compatible shipments translates to a 20% rise in the rail share of all tonnage.

Conclusions

This experiment exhibited both some strong points and some weak points of the TSC Freight Energy Model. Computer memory size limitations of the present version of the model prevented simultaneous representation of CL, Run-Through TOFC, and truck freight services, which would allow a more conclusive analysis. Lack of a complete demand data base and lack of comprehensive data on present TOFC movements, both regular and run-through, also limited the effectiveness of the model. On the other hand, the "subcommodity" technique used to represent Run-Through TOFC service sharing the rails with other traffic demonstrates the flexible approach to application requirements which is possible with the model. The model's systemwide accounting of transportation performance also emerged as a useful analysis tool.

Preliminary indications from the model runs presented above are that Run-Through TOFC can compete successfully with intercity trucking, leading to cost- and energy-use savings for the traffic diverted from truck to rail. Not surprisingly, a rail freight service which offers similar transit time and lower cost than truck can capture significant amounts of traffic. To be truly successful on a large scale, however, the rail service must be offered to nearly all shippers, regardless of annual shipment tonnage, as is essentially the case with truck service. A service with stringent shipper location and volume requirements would undoubtedly attract far less traffic than predicted here.

There appears to be plenty of track capacity available in the rail network to accommodate the extra traffic which would be generated with increased Run-Through TOFC. This study did not address the equally important question of rolling-stock availability.

Table 2-6. Rail Share of TOFC-Compatible Traffic with Run-Through TOFC (1990)

Commodity	% of Tons*	% of Ton-Miles*
9. TOFC**	90.6	98.6
21. Food and Kindred Products	73.8	91.7
22. Textiles and Apparel	75.6	93.2
23. Chemicals	71.5	87.8
24. Lumber and Furniture	70.9	89.6
25. Machinery (nonelectrical)	89.6	97.9
26. Electrical Machinery	88.4	98.1
27. Transportation Equipment	71.5	89.4
28. Unidentified Manufactures	58.2	82.4
29. Paper and Allied Products	70.7	89.6
30. Primary Metal Products	80.8	93.5
31. Fabricated Metal Products	85.7	96.4
32. Miscellaneous Manufactures	66.1	86.2
Total	70.6	89.9

* Considers only that traffic subject to TOFC-highway competition.

** 100% rail in baseline. All others are 100% highway in baseline.

Table 2-7. Modal Traffic Shares with Run-Through TOFC (1990)

	% of Tons			% of Ton-Miles		
Mode	Base	TOFC	Δ	Base	TOFC	Δ
Rail	49.7	69.3	+19.6	61.7	75.6	+13.9
Highway	30.8	11.3	-19.5	16.3	2.8	-13.5
Waterway	7.8	7.8	--	9.7	9.5	- 0.2
Pipeline	11.6	11.6	--	12.3	12.1	- 0.2

The results presented above are clouded by the issue of TOFC vs. CL competition. Run-Through TOFC would likely capture a significant amount of CL traffic. The amount that would be diverted is unclear, because:

- current CL traffic is already moving by rail in the face of substantial truck-service advantages, thus negating somewhat the traffic-capture effectiveness of the improved service
- TOFC cost and energy use are higher than CL, negating some of the potential savings from bypassing yards
- some commodities (e.g., coal, ore) are inherently unsuited to TOFC due to the high net-to-total weight ratios needed for economical movement of large quantities of material.

However, there are likely to be some freight corridors where more CL traffic than truck traffic is susceptible to TOFC penetration. If TOFC captures a considerable amount of this CL traffic, then it is possible that the energy savings would become zero or negative. This is a market-specific situation, the outcome of which depends upon the relative positions of CL, TOFC, and truck in the market at the time when Run-Through TOFC is introduced. If improved TOFC diverts more truck traffic than CL traffic, then there will probably be a net savings in energy use. TOFC can also be an important rail alternative to trucki[illegible] markets where carriers and shippers are losing interest in regular CL service. While introduction of improved TOFC in such a market would have the appearance of diverting traffic from CL, the actual effect would be a TOFC/CL service substitution in place of a CL to truck diversion.

It must be emphasized that the operating results achieved with Run-Through TOFC would probably not be as good as those reported here. As noted earlier these results are contingent upon Run-Through TOFC being available everywhere with uniformly high service frequency, regardless of annual traffic level. This study did not include any analysis of the present extent, quality, or pricing of Run-Through TOFC, nor any detailed comparisons of relative pricing between truck and TOFC. Also, these results ignore any shipper and railroad implementation costs, such as ramp construction and equipment acquisition.

3. DOUBLE TRAILERS OPTION

Introduction

What would be the effect on energy use of allowing double trailers to operate on any divided highway in the U. S.? How much traffic would double trailers attract? What economics are available through use of double trailers? Some preliminary answers to these questions are provided in this chapter.

The double trailers issue is a complex one which could be approached several ways with the TSC Freight Energy Model. For this study, it was decided to analyze double trailers as a submode within the highway mode. The particular method chosen to do this and the related computer and other resource constraints made it necessary to consider only competition between double trailers and single trailers.* Hence this study is restricted to analysis of possible energy and cost savings within the truck transport system with increased use of double trailers.

The procedure followed was to define the divided highway network as a separate mode in parallel with the regular highway network. Transfer links connecting the two networks were also defined. Cost, capacity, and energy functions for the new network (hereafter referred to as the "Double Trailers" network) were estimated assuming the use of twin 40-foot van-type trailers. Shipments input were all those allocated to the highway mode in the 1990 baseline run. The rail, waterway, and pipeline networks, functions, and traffic were completely excluded. Network totals for all modes, when needed for comparative purposes, were obtained by combining the results of the baseline run and the Double Trailers run of the transportation network model. A technical description of the data prepared for the Double Trailers network follows.

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* Looking at 3-way competition between single trailers, double trailers, and rail would be more informative. Computer restrictions which could not be relaxed quickly enough, however, prevented this. The 3-way analysis can be conducted at a later date if necessary.

Data

- Double Trailers Network

The network on which double trailer operations might be permitted was defined by simply extracting all divided highway links from the highway network. Figure 3-1 is a computer plot of the Double Trailers network. For ease of cross reference between the highway and Double Trailers networks, all node, class, and function names for the new network were constructed by appending a "D" to the corresponding name in the highway network (e.g., class "D.L.FREE" becomes "D.L.FREED", and so on).

All but 20 of the access links from the regions to the highway network were carried over to the Double Trailers network. Those 20 links did not access nodes of divided highway links. This resulted in 13 regions lacking direct access to the Double Trailers network.

To allow for transfers between double trailer and single trailer service, transfer links were defined at 76 terminus nodes in the Double Trailers network (these appear as points of discontinuity in Figure 3-1). A transfer link, for example, connects nodes 1242 and 1242D. All transfers were defined in both directions, making a total of 152 transfer links.

The effect of the data inputs described above is that all shipments from or to regions located <u>off</u> the Double Trailers network or between regions with discontinuous divided highway connections choose between using single trailer service all the way or using double trailers for some of the trip, via the transfer links. All shipments between regions connected directly by the Double Trailers network are eligible for double-trailer savings all the way.

This method of defining the Double Trailers network has the great virtue of being very easy to implement, but it does create some problems. Chief among them is that a single physical divided highway link is represented as two separate links in the multimodal network. This means that traffic on the two network links cannot interact in the model, so if both of them are used the link performance functions will be evaluated at incorrect volume

DIVIDED HIGHWAY NETWORK

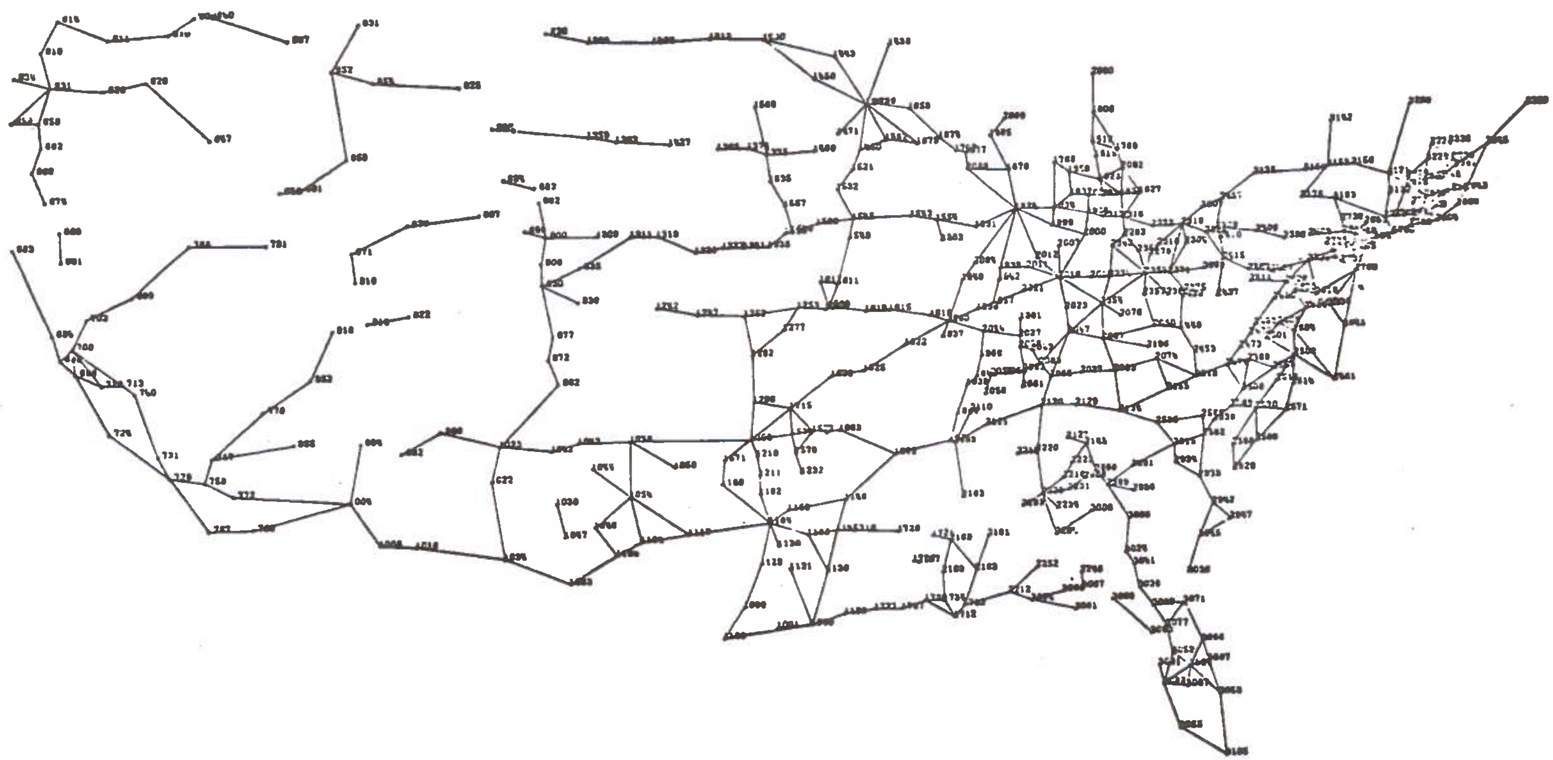

Figure 3-1. Network for Double Trailer Operations

levels and the link capacity will be overstated by a factor of two. This problem can be overcome if a more sophisticated analysis is desired.* Even without adjustment, however, this error is not particularly serious for the present study, for the following reasons:

- the level of congestion on divided highway links is so low and the functions are so flat that appreciable errors in estimated link volume have very little effect on cost, time, and energy use**
- most links will tend to serve predominantly single-trailer or double trailer traffic, rather than large flows of both
- no iterations were performed, so all path selections were based on flow estimates carried over from the 1990 baseline-highway loadings.

Nonetheless, in reviewing the results for this option it should be remembered that highway speeds and energy use are slightly overestimated and costs are underestimated.

- Time Functions

All Double Trailer operating functions are based upon the use of two 40-foot trailers in a 3-S2-3 vehicle configuration. The specifications assumed for this truck are as follows:

Tare weight	43,000 lb.
Max payload	82,000 lb.
Max GVW	125,000 lb.
Axles	8
Wheels	30

Other possibilities which could have been tested include twin 45-foot or triple 27-foot trailers. The exact variant chosen here is not as important as the concept of approximately doubling the payload per tractor-driver combination.

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* One solution would be to externally iterate the model and make volume estimates for both networks equal to the sum of the "twin link" assigned volumes. Upon obtaining the final set of paths, the subcommodity technique could be used for final costing.

* For this application, use of constant cost, time, and energy values would have been appropriate. Since the functions were already available, however, it was simpler (and certainly no less accurate) to use them.

Assuming the use of double 40-foot trailers allowed the transit time functions from the highway network to be used without modification in the Double Trailers network, the implicit assumptions are that 3-S2-3 combinations can attain the same speeds as 3-S2 combinations, and that one double trailer has the same influence on traffic flow as two single trailers. The latter assumption is quite accurate for flows near capacity, where the physical space occupied by a vehicle is the controlling factor. It is also reasonably good for divided highways at all flow levels, since heavy vehicles tend to stay in the outermost lane. The assumption breaks down somewhat for undivided highways, but that is of no concern here since functions are only needed for divided highways.

- Energy Functions

Fuel-use functions for the 3-S2-3 diesel were generated by applying PMM & Co.* relationships between the fuel efficiencies of various vehicles and terrain adjustment factors reported by Winfrey** to the 3-S2 fuel-use functions given in Volume 3 of this report. The PMM & Co. data show that the fuel efficiency in miles per gallon (MPG) of an empty double trailer rig is about 98% of the MPG of an empty single trailer. Ratios between the MPG's of empty and fully loaded twin trailers, derived from PMM & Co. data, are given in Table 3-1. MPG adjustments for operations on rolling grades taken from Winfrey are given in Table 3-2. The resulting fuel efficiency curves for double trailer operations are given in Figure 3-2.

Energy functions were derived from the fuel-use and capacity functions, following the same procedure described for highway link energy functions in Volume 3. These functions are shown in Figure 3-3. Adjustments for lower density commodities are given in Table 3-3. Note that in this case since only one vehicle type is involved the commodity adjustment is simply the inverse of the commodity-density factor.

- Cost Functions

Cost functions for Double Trailer Links were developed in the same manner as the highway link cost functions, as described in Volume 3. Operating

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* Peat, Marwick, Mitchell & Co., "Energy and Economic Impacts of Projected Freight Transportation Improvements," DOT Transportation Systems Center, Cambridge, MA, Nov., 1976.

** Winfrey, R., Economic Analysis for Highways, International Testbook Co, Scranton, PA, 1964.

Table 3-1. Fuel Efficiency of Empty vs. Loaded Double Trailers

Speed, mph	10	20	30	40	50	60	70
Empty/Loaded MPG*	3.61	2.70	3.13	3.50	2.82	2.60	2.28

*Ratio of empty miles per gallon to loaded miles per gallon for 3-S2-3 125-Kip GVW twin vans.

Table 3-2. Double Trailer Fuel Efficiency Adjustments for Rolling Grades

Gross Vehicle Weight (kips)	Ratio of MPG on Grade to MPG on Level Road	
	Rolling Terrain Avg. Grade = 2%	Mountainous Terrain Avg. Grade = 4%
43	0.680	0.492
125	0.515	0.329

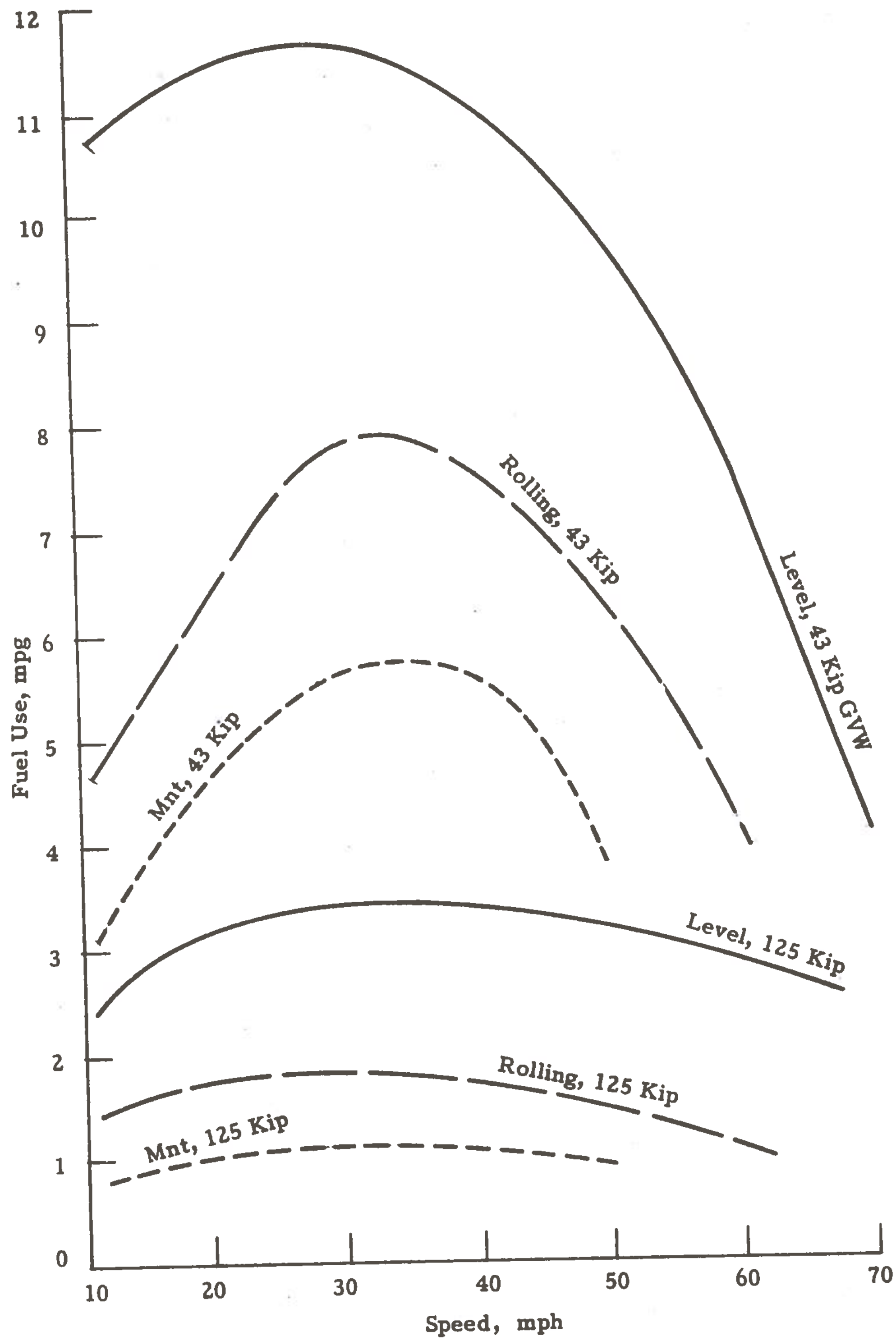

Figure 3-2. Fuel-Use Functions: 3-S2-3 Double Van

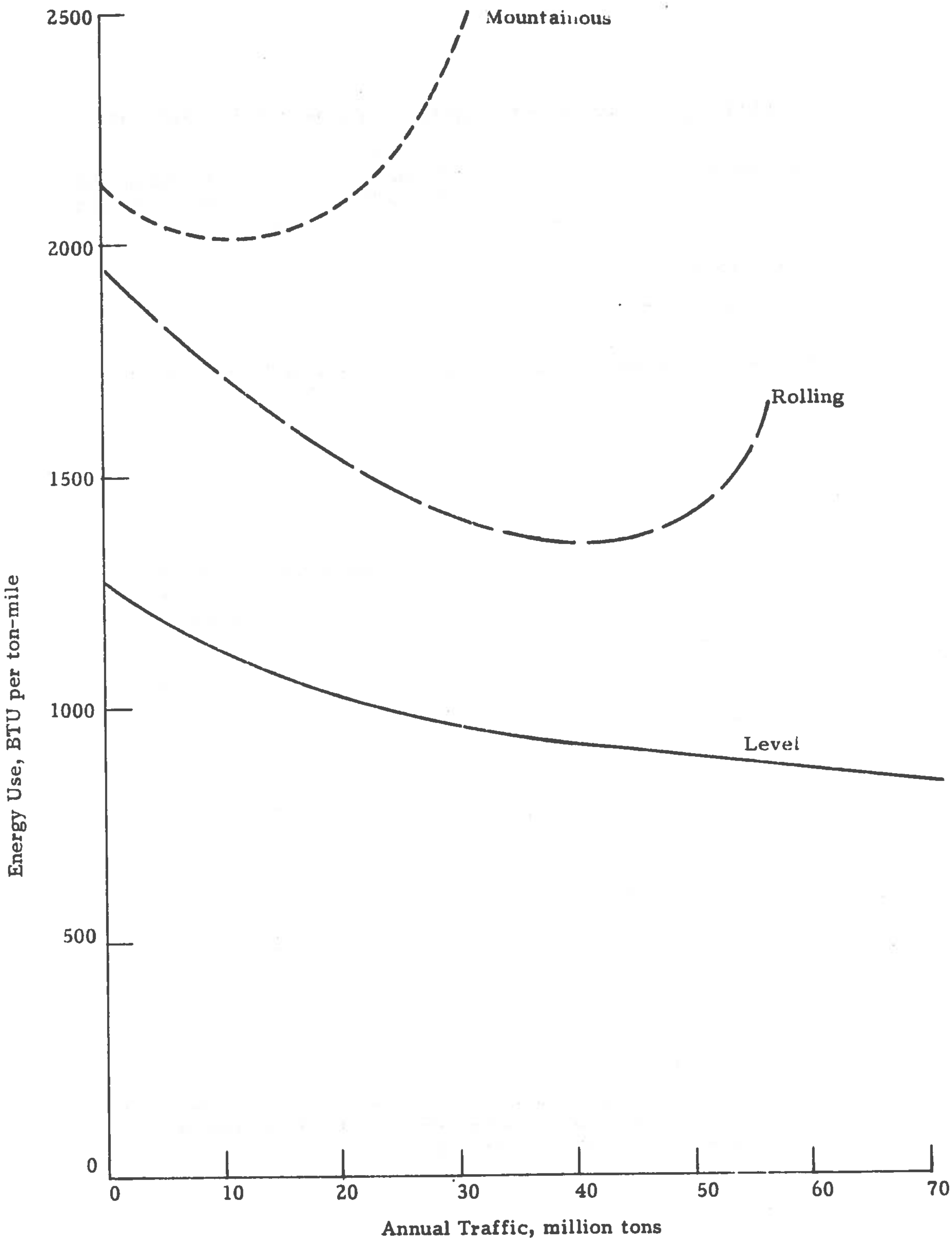

Figure 3-3. Energy Functions for Double Trailers

Table 3-3. Double Trailer Energy Function Commodity Adjustments

Commodity Code	Density Factor*	Multiplier for BTU/ton-mile
1,2,3,7,11,14,15,19	0.9	1.11
8,20	0.75	1.33

* Fraction of weight capacity used when cubic capacity is reached.

Table 3-4. Estimated Double Trailer Operating Costs (1972)

Fuel Efficiency, mpg	Cost, ¢/mile
1	97.2
2	76.7
3	69.8
4	66.4
5	64.4
6	63.0
7	62.0
8	61.3
9	60.7
10	60.3

Based on 3-S2-3 double van, 30¢/gal. fuel price (less tax), and annual utilization of 110,000 miles

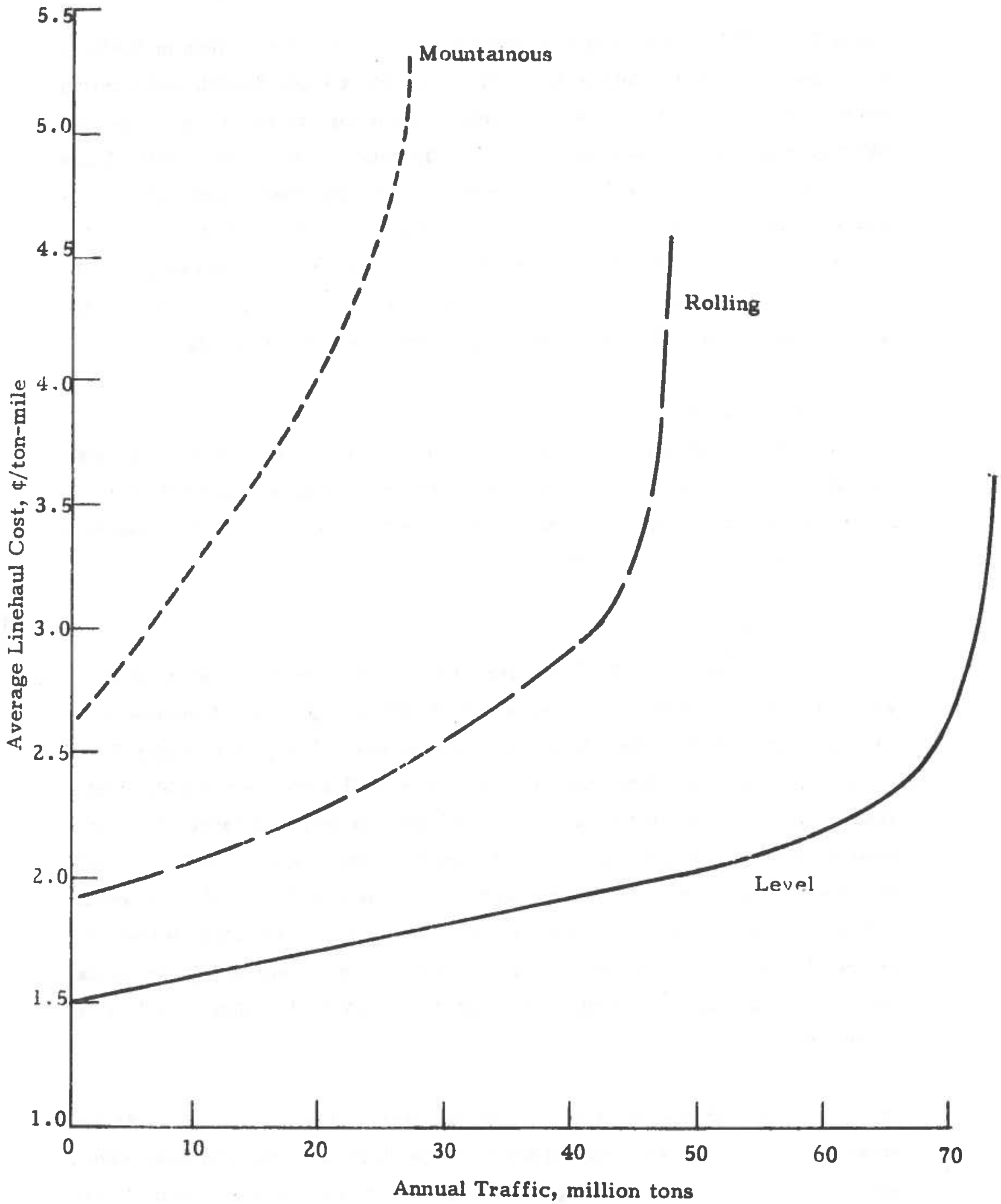

Figure 3-4. Cost Functions for Double Trailers

costs for 3-S2-3 double vans at various fuel efficiencies are given in Table 3-4. These costs were output from the TSC Truck Cost Model, and assume annual utilization of 110,000 miles. Adjusting these to account for relationshps between volume, speed, utilization, and fuel use produced the cost functions of Figure 3-4. Commodity cost adjustments are exactly the same as the energy function adjustments given in Table 3-3. Costs for operating on toll highways are 3 mills per ton-mile higher than indicated in Figure 3-4, which is the same value used for the highway network. This assumes that tolls will increase in direct proportion to vehicle size.

- Node Functions

Time, energy, and cost functions for Double Trailer nodes follow the same assumptions as those for highway nodes (level terrain, average speed of 45 mph, node transit-times as given in the original network data). The resulting node disutility values are given in Table 3-5.

- Access Functions

Double trailers are essentially a linehaul strategy, since they cannot operate as a unit over local streets. Hence the movement portion of access costs should be the same as for single trailer operations. The platform portion of double trailer access time and cost, however, will vary between the single trailer value for simultaneous loading of the trailers and twice the single trailer value for sequential trailer loading. This range of variation only applies to the tractor, driver, and trailer portion of platform costs. Presumably most platform charges relate to provision of warehousing and material handling facilities, and should be allocated uniformly to annual tonnage regardless of whether that tonnage moves in single trailers or double trailers.

In view of the factors cited above, and for lack of any convincing evidence, an arbitrary 20% increase was applied to the platform time and cost values given in Volume 3. Integrating this increase with the data and assumptions of Volume 3 produced the access functions given in Table 3-6.

Table 3-5. Double Trailer Node Time, Energy, and Cost

Node Class	Time, hour	Energy, BTU/ton	Cost $/ton
PEN00D	0	0	0
PEN05D	.0833	3,300	80
PEN07D	.117	4,600	115
PEN11D	.183	7,200	180
PEN18D	.300	11,800	300

Table 3-6. Double Trailer Access Time, Energy, and Cost

Commodities	Avg. % LTL	Cost Calibration Factor #	Disutility Component	Access Class HA25D	HA50D	HA75D
Composite*	0		Time, hr.	4.3	5.1	6.0
			Energy, BTU/ton	40,000	80,000	120,000
		0.65	Cost, $/ton	1.34	2.64	3.94
5,6**	0		Time, hr.	4.3	5.1	6.0
			Energy, BTU/ton	47,850	95,700	143,550
		1.00	Cost, $/ton	2.47	4.87	7.27
7,8,11,15	50		Time, hr.	9.2	10.0	10.9
16, 20			Energy, BTU/ton	40,000	80,000	120,000
		0.65	Cost, $/ton	2.50	3.80	5.10
12, 13, 19	25		Time, hr.	6.7	7.5	8.4
			Energy, BTU/ton	40,000	80,000	120,000
		0.65	Cost, $/ton	1.92	3.22	4.52

* Includes all commodities not specifically listed.

** Load factor = 50%. All others use 60% load factor.

\# The effect of this factor is already included in the costs tabulated. See Volume 3 for details.

- **Transfer Functions**

Impedance values for transfering from Double Trailers to highway or vice versa were assumed to be those for access class HA25D in Table 3-6. In other words, a TL transfer was assumed to take 4.3 hours and cost $1.34 per ton (in 1972 dollars). This probably somewhat overstates the transfer penalty, but the limited ambitions of the present study did not warrant the effort to obtain a better estimate.

Results

Table 3-7 summarizes highway and total system freight operations in 1990 with the Double Trailers option. Results for the other modes are the same as in the 1990 baseline. The opportunity to achieve linehaul economies by running double trailers on divided highways causes some traffic to take a more circuitous route, as evidenced by the increase in ton-miles.

The widespread availability of double trailer service effects cost savings of 22% and energy savings of 18% within the highway mode. Service quality, as measured in ton-days, suffers a 13% decline. This is due to the more circuitous routing noted above, the time penalties incurred by some shipments in transferring between single-trailer and double-trailer service, and the modest increase in terminal times assumed for double trailers. Despite the increased inventory costs, however, the total disutility of highway shipments declines by 19%. Impacts on network totals are roughly one-third to one-half the size of the highway impacts, e.g., the 18% energy savings for highway cargo translates to an 8% reduction in total intercity freight energy use.*

Average (per ton-mile) cost, energy use, and transit time are shown in Table 3-8. This table highlights one of the drawbacks of examining transportation efficiency on the basis of linehaul ton-miles. The cost and energy-use savings shown here are 4 to 5 percent larger than the savings given in Table 3-7. These inflated values are due to the more circuitous routing, which increases ton-miles even though the actual quantity of transportation service rendered to shippers remains constant.

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* Only about 40% of total U.S. truck tonnage and 45% of truck ton-miles are included in the demand forecast input data. Truck results and percentage shifts apply only to this portion of the truck traffic, which may not be representative of total truck traffic.

Table 3-7. **Freight Operations with Double Trailers (1990)**

Item/Mode	Unadjusted Estimate* Base	Doubles	% Δ
Tons (million)			
Highway	932	932	--
Total	3,026	3,026	--
Ton-miles (billion)			
Highway	265	281	+ 6.0
Total	1,626	1,643	+ 1.0
Cost ($ million)			
Highway	15,584	12,110	-22.3
Total	33,382	29,908	-10.4
Energy (trillion BTU)			
Highway	606	498	-17.8
Total	1,362	1,254	- 7.9
Service (million ton-days)			
Highway	727	820	+12.8
Total	16,370	16,463	+ 0.6
Disutility ($ million)			
Highway	17,126	13,852	-19.1
Total	49,938	46,664	- 6.6

* Outputs from unconstrained runs of the transportation network model. Note that only about 40% of total U.S. truck tonnage and 45% of truck ton-miles are included in the demand forecast input data. Truck results and percentage shifts apply only to this portion of the truck traffic, which may not be representative of total truck traffic.

Table 3-8. Resource Intensiveness with Double Trailers (1990)

Mode	Cost (mills/ton-mile)			Energy (BTU/ton-mile)			Service (days/100 mile)		
	Base	Doubles	% Δ	Base	Doubles	% Δ	Base	Doubles	% Δ
Highway	58.8	43.1	-26.7	2,287	1,773	-22.5	0.27	0.29	+ 7.4
Average	20.5	18.2	-11.2	838	764	- 8.8	1.01	1.00	- 1.0

Table 3-9. Average Traffic Density with Double Trailers (1990)

Mode	Kton-miles per Mile			Average Volume/Capacity (%) *		
	Base	Doubles**	% Δ	Base	Doubles**	% Δ
Highway						
Divided	7,487	921	-87.7	12.0	1.4	-88.3
Undivided	2,067	1.345	-34.9	14.9	9.6	-35.6
Mode Total	5,372	1,186	-77.9	12.4	3.5	-71.8
Double Trailers	--	8,940	--	--	14.4	--

* Based on linehaul links

** Values for divided highways in highway network and for Double Trailers network need to be combined to estimate total traffic on divided highway links. Reasonable estimates are 9,167 kton-miles per mile and 14.9% capacity utilization, representing changes from the baseline of +24.4% and +3.5%, respectively.

Traffic density and capacity utilization impacts are presented in Table 3-9. These results must be interpreted with care, since single divided highway links are represented separately in both the highway and Double Trailers networks. The most clear cut result is that the Double Trailers option decreases the truck traffic on undivided highways by 35%. Divided highways experience about a 1.7 million ton increase in average annual truck traffic, which is an increase of 22%. As shown in the table, most of the divided highway truck traffic consists of double trailers.

Sub-modal split results by commodity are displayed in Table 3-10. Double trailers do well in virtually every commodity group. Overall, nearly 82% of highway tonnage* moves in double trailers, and another 5% is partially moved in this manner. There is no apparent relation between commodity density and the attractiveness of double-trailer service. Hence these findings do not support extension of the situation for double 27-foot trailers, where cube-limited commodities find double trailers more advantageous than weight-limited commodities.** The savings achieved by spreading driver- and tractor-related expenses over a double 40-foot payload are much more significant than any density effects.

Some additional insight into the type of traffic attracted to various highway services is provided by average haul length statistics. In the baseline run, the average highway shipment moved 284 miles. With the Double Trailers option average haul lengths are:

single trailer	192 miles
double trailer	302 miles
single/double combination	552 miles
highway average	301 miles

As would be expected, long-haul truck traffic finds double-trailer service more attractive than short-haul traffic. Further, only the longest haul traffic saves enough on the linehaul to offset the fixed charge penalties of combination single trailer-double trailer operations.

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* See footnote to Table 3-7. Recall, also, that virtually <u>all</u> traffic with access to the Double Trailers network is assumed to be able to take full advantage of the service, which will not be true in reality.

** Note, however, that the amount of traffic between two points, as measured in tons, which is sufficient to fill two trailers at a reasonable service frequency is lower for cube-limited commodities than for weight-limited commodities. This threshold consideration was not included in the study.

Conclusions

The TSC Freight Energy Model was somewhat less adaptable to the requirements of this application than was the case for the Run-Through TOFC option. Again, it would have been useful to model a three-way competition situation (rail, single trailer, double trailers), but computer memory limitations prevented this. The parallel mode method of representing double trailers, while useful, has the disadvantage of preventing single- and double-trailer traffic from interacting in the network which precludes meaningful analysis of congestion effects. Lack of a complete data base on truck commodity flows also inhibited a comprehensive analysis. Despite these deficiencies, this application of the model did provide some useful preliminary indications of the potential impacts of doubling effective highway payloads.

Pure indicators of highway transportation efficiency as measured in this modeling experiment strongly favor the Double Trailers option, which seems to be a viable means of improving the performance of intercity trucking. Highway energy and cost savings, although only half of the 40 to 50 percent claimed by some proponents, are nonetheless substantial. It must be noted, however, that any diversions of traffic from the rail mode would reduce these energy savings, since double trailers are about twice as energy intensive as rail service.

There are, of course, major issues concerning double trailers which are not addressed here. Highway safety is of paramount importance, and is likely to influence national and state policies on double trailers much more than energy use and economics will.

There are also a number of economic and operational factors which were not included in this study which could alter the effectiveness of the Double Trailers option. Some of the more important of these are :

- Extraordinary implementation costs such as acquisition of more powerful tractors, more trailers, increased driver training, premium driver wages, higher insurance costs, and special licenses or taxes

Table 3-10. Double Trailer Share of Highway Traffic (1990)

Commodity	% of Tons*		% of Ton-Miles*	
	Doubles	Xfer**	Doubles	Xfer**
1. Farm Products	68.1	2.0	68.1	3.2
2. Forest and Marine Products	100.0	0.0	100.0	0.0
3. Coal	0.0	100.0	0.0	100.0
4. Crude Petroleum	4.4	95.6	1.2	98.8
5. Metallic Ores	0.0	100.0	0.0	100.0
6. Nonmetallic Minerals	0.0	0.0	0.0	0.0
7. Food and Kindred Products	80.1	9.4	79.4	13.8
8. Textiles and Apparel	80.0	6.8	82.6	12.1
10. Chemicals	89.0	4.7	87.2	8.1
11. Lumber and Furniture	69.2	11.6	62.4	26.2
12. Machinery (Nonelectrical)	89.0	4.5	89.7	7.5
13. Electrical Machinery	89.7	5.0	89.5	7.9
14. Transportation Equipment	98.8	0.7	97.9	1.8
15. Unidentified Manufactures	76.7	2.9	81.5	6.1
16. Paper and Allied Products	73.6	7.7	69.6	16.9
17. Petroleum Products	100.0	0.0	100.0	0.0
18. Primary Metal Products	95.9	2.1	95.5	2.2
19. Fabricated Metal Products	95.3	2.3	94.8	4.0
20. Miscellaneous Manufactures	86.5	3.5	84.6	7.6
Total	81.6	5.2	82.0	9.6

* Considers only competition between double trailer and single trailer service within the highway mode. Overall modal shares are the same as in the baseline run.

** Shipments which used a combination of single trailer and double trailer services.

- Changes in other truck transportation and distribution costs, due to provision of larger terminals and warehouses, maintenance of larger on site inventories, and changes in shipment size and frequency

- Impacts of rail/truck competition - presumably double trailers will divert some traffic from rail (unitary cross elasticity of demand would suggest a 20% diversion), which would increase cost and energy use and adversely impact existing rail traffic

- Labor relations problems - union work protection labor contract clauses might impose a surcharge on driver wages to compensate for loss of jobs

- Minimum annual traffic flow and other shipper circumstances required to justify offering double trailer service - recall that this study assumed that virtually all traffic served by divided highways was eligible for double-trailer service

- Possible increases in highway-use taxes to cover increased highway operation and maintenance expenses allocated against larger trucks and to compensate for shrinkage in the fuel use revenue base.

Most of the factors cited above, except for the all-important rail/truck competition issue, would tend to decrease double-trailer traffic and hence eliminate some of the estimated savings. The rail/truck issue tends to increase double-trailer traffic but cancel cost and energy savings. The behavior of that 60% of highway freight tonnage not included in the commodity flow data also remains in question. Thus the estimated savings attributed to the Double Trailers option are probably somewhat on the high side.

4. SUMMARY AND CONCLUSIONS

Demonstration of TSC Freight Energy Model

The primary objective of the model applications presented in this report was to demonstrate the TSC Freight Energy Model. This objective has been met rather successfully. Virtually every feature of the model has been exercised, and a great deal has been learned about the strengths and weaknesses of the model.

Several features of the transportation network model were found to be particularly useful. The ability to use commodity-specific values of cost, time, and energy use was crucial to successful model calibration and application. Also, the output of shipment path selection data and the ability to input fixed paths or modal shares provided mechanisms for introducing network modifications while holding selected aspects of a prior result fixed. (This has the additional advantage of reducing computer costs.)

Some interesting ways to use the model emerged during this demonstration. The transportation network model was run in both a subcommodity and a parallel mode fashion. A subcommodity is created by recoding selected shipments to a new commodity and assigning this new commodity attributes (such as network impedance adjustment factors) which differ from those of the parent commodity. This "subcommodity technique" facilitated analysis of the Run-Through TOFC option. A parallel mode is created by defining parallel representations of selected network elements, coded as different modes. The "parallel mode technique" was used to study the Double Trailers option. It appears that the subcommodity and parallel mode techniques can be applied in a complementary iterative fashion if more sophisticated analyses are desired. It may also prove useful at some point to provide formal subcommodity and parallel mode features within the model code.

As is inevitable in a study of this type, several areas in which the TSC Freight Energy Model could be improved suggest themselves.

- The single area with the largest potential payoff in terms of increased model reliability is the commodity flow data. Efforts should be made to construct baseline flows which account for all intercity freight traffic. Conspicuously underestimated in the present data are truck traffic and petroleum products movements.

- A principal limitation of the model is that it is too expensive to assign all of the shipments in the flow data to the network. This led to the development of a flow sampling procedure (see Volume 3 for details). The implications of alternative sampling and estimation procedures should be investigated, and optimal procedures defined. The recommended procedures should produce model results which fully represent national intercity freight activity, so no subsequent scaling of model outputs is required.

- The iterative solution capability of the transportation network model was exercised only in a limited way. Theoretical and operational issues such as equilibrium uniqueness and stability and user-optimum vs. system-optimum equilibrium need to be investigated.

- The desirability of multiple mode or multiple path shipment assignments needs to be evaluated and appropriate algorithms designed and implemented.

- Methods for representing local traffic and passenger traffic which share facilities with intercity freight traffic need to be developed.

- Techniques for incorporating elements of physical distribution management into the model system need to be explored and evaluated.

- The core storage and execution time requirements of the transportation network model and its preprocessor should be reduced through additional software engineering.

- Further verification and compression of the highway network should be undertaken. The pipeline network, particularly that for petroleum products, also requires further verification.

- The highway and pipeline modal simulators should be brought to the same level of automation as the rail and waterway simulators. Considerable manual computation is presently needed to generate highway and pipeline performance functions.

- The ability to represent multiple classes of freight service available on a single type of network element needs to be incorporated into the model.
- The comparability of modal cost functions needs to be evaluated. Relationships between traffic volume and cost should also be investigated further.
- A user-oriented version of CACI's in-house computer graphics routines should be added to the system. This package should accept as input standard transportation network model files or subfiles.

Analysis of Energy Conservation Options

The numerical results of this set of TSC Freight Energy Model demonstration runs are summarized in Table 4-1. Systemwide freight operating statistics for each case studied are tabulated. The footnotes accompanying the table are intended to remind the reader of some of the more important assumptions and limitations of these results.

Since the totals in Table 4-1 are not scaled up to account for the intercity freight traffic unaccounted for in the traffic flow data, the percentage changes shown are more informative than the raw totals. Regarding the three energy conservation options, these percentages are likely to over-estimate the actual change which would occur, since uniform nationwide implementation of the options is assumed.

These modeling results are discussed in detail in Chapters 2 and 3 of this volume and in Volume 1, Chapter 4. The most obvious conclusion supported by the results is that there is considerable room for holding down energy use in freight transportation, since all three options produce substantial savings. Also, energy conservation is usually accompanied by comparable savings in direct transportation costs and somewhat smaller reductions, or even increases, in full economic costs ("disutility"). Beyond these observations, there is little point in comparing and ranking the options examined since they all produce savings of a similar magnitude, and since these results are preliminary in nature.

Table 4-1. Summary of Model Results

Model Run **	Unadjusted Estimates* Tons (million)	Ton-Miles (billion)	Energy (trillion BTU)	Cost ($ million)	Service (million ton-days)	Disutility ($ million)
Calibration (1972)	2,094	1,067	912	20,874	11,512	30,111
Baseline (1990)	3,026	1,626	1,362	33,382	16,370	49,938
% Change from 1972	+44.5	+52.4	+49.4	+ 59.9	+ 42.2	+ 65.8
Minimum Energy ***	--	1,623	943	26,452	23,906	55,874
% Δ		- 0.2	-30.8	- 20.8	+ 46.0	+ 11.9
Run-Through TOFC #	--	1,656	1,164	27,505	16,264	43,739
% Δ		+ 1.8	-14.6	- 17.6	- 0.6	- 12.4
Double Trailers ##	--	1,643	1,254	29,908	16,463	46,664
% Δ		+ 1.0	- 7.9	- 10.4	+ 0.6	- 6.6

* Output from unconstrained runs of the transportation network model. Results are not scaled to cover total intercity traffic. All costs are expressed in 1972 dollars. Energy use based on 1972 modal technology and operations; modal energy conservation measures currently being implemented are not included. Commodity flows in 1990 are projected from estimated 1972 flows using OBERS Series E economic activity forecasts.

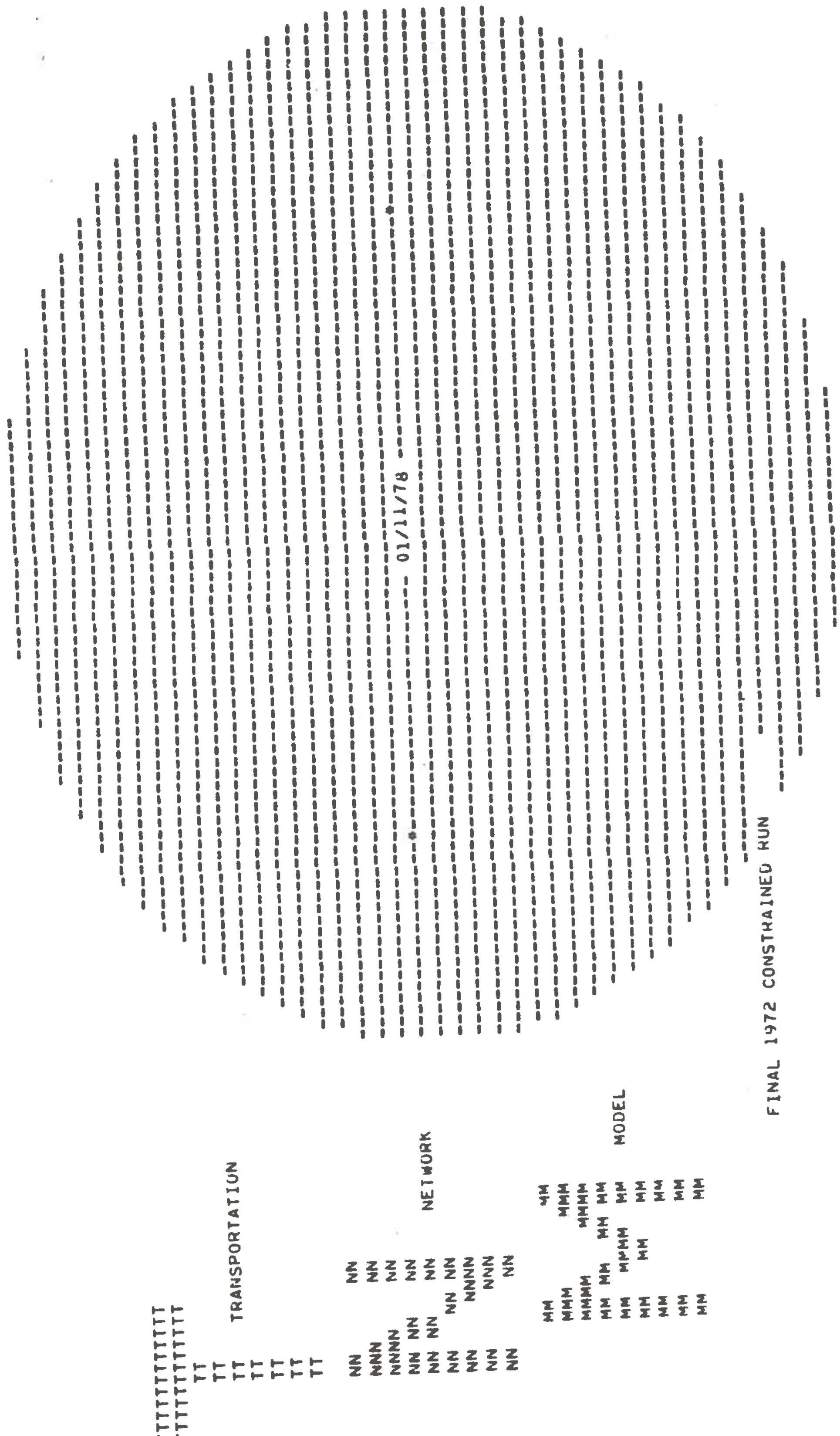
** All runs are 1990 except for the calibration run, which is for 1972. %Δ indicates change with respect to 1990 baseline.

*** Mode and route selection based solely on energy use.

\# Results reflect only rail/highway competition for TOFC-compatible traffic which moved by TOFC or highway in baseline run. In particular, TOFC/rail carload competition is excluded.

\## Results reflect only double trailer/single trailer competition for traffic which moved by highway in baseline run. In particular, rail/double trailer competition is excluded.

APPENDIX - Transportation Network Model Output

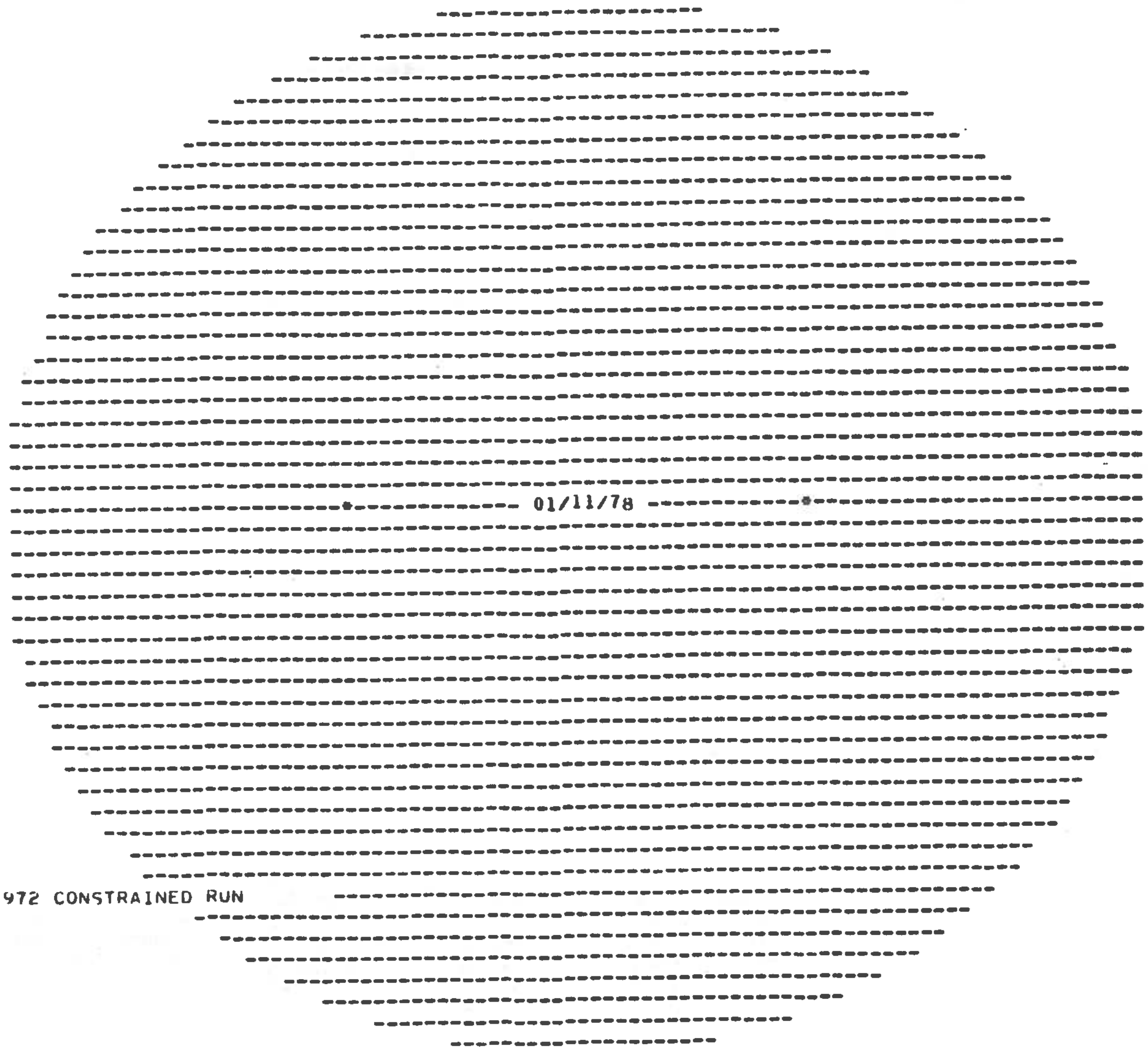


```
TTTTTTTTTTTT
TTTTTTTTTTTT
     TT
     TT
     TT   TRANSPORTATION
     TT
     TT
     TT
     TT

     NN       NN
     NNN      NN
     NNNN     NN
     NN NN    NN
     NN NN    NN     NETWORK
     NN    NN NN
     NN     NNNN
     NN      NNN
     NN       NN

         MM         MM
         MMM       MMM
         MMMM     MMMM
         MM MM   MM MM
         MM  MMMM   MM    MODEL
         MM   MM    MM
         MM         MM
         MM         MM
         MM         MM
```

FINAL 1972 CONSTRAINED RUN



TRANSPORTATION NETWORK MODEL
FINAL 1972 CONSTRAINED RUN

S-Y-S-T-E-M P-A-R-A-M-E-T-E-R-S

MAXIMUM NUMBER OF ITERATIONS	LINK, NODE VOLUME CONVERGENCE CRITERION TO STOP ITERATION	VOLUME VS. ESTIMATION ERROR TOLERANCE	INCLUSION ELLIPSE ECCENTRICITY	BACKUP ELLIPSE ECCENTRICITY	VOLUME ESTIMATE % CHANGE	ENERGY UNITS
1	80.0 %	15.0 %	.60000	.40000	75.0%	BTU

171 REGIONS.

1789 NODES.

3397 LINEHAUL LINKS.

662 ACCESS LINKS.

0 TRANSFER LINKS.

28 NODE CLASSES.
83 LINK CLASSES.
29 ACCESS CLASSES.
0 TRANSFER CLASSES.

20 COMMODITIES.

OUTPUTS SELECTED

INPUT ECHO	NO
PLAYBACK REPORTS	
REGIONS	NO
NODES	NO
LINEHAUL LINKS	NO
ACCESS LINKS	NO
TRANSFER LINKS	NO
COMMODITIES	NO
CLASSES/FUNCTIONS	NO
SHIPMENTS	NO
CONTINUE AFTER PLAYBACK ?	YES
NODE VOLUME ESTIMATE CHANGES	NO
LINK VOLUME ESTIMATE CHANGES	NO
NETWORK FLOW REPORT	NO
NETWORK FILE	YES
NETWORK FLOW FILE	YES
PATH FILE	YES

```
--- ROUTE NODE #  1 IS INVALID FOR   FARM PRO FROM 156      TO 117     .
--- ROUTE NODE #  1 IS INVALID FOR   FARM PRO FROM 159      TO 152     .
--- ROUTE NODE #  1 IS INVALID FOR   FOOD+KIN FROM 156      TO  46     .
--- ROUTE NODE #  1 IS INVALID FOR   FOOD+KIN FROM 156      TO 127     .
--- ROUTE NODE #  1 IS INVALID FOR   TOFC     FROM 155      TO 148     .
--- ROUTE NODE #  1 IS INVALID FOR   TOFC     FROM 157      TO 148     .
--- ROUTE NODE #  1 IS INVALID FOR   TOFC     FROM 157      TO 151     .
--- ROUTE NODE #  1 IS INVALID FOR   LUMBER+F FROM 155      TO 148     .
--- ROUTE NODE #  1 IS INVALID FOR   LUMBER+F FROM 157      TO 107     .
--- ROUTE NODE #  1 IS INVALID FOR   LUMBER+F FROM 157      TO 109     .
--- ROUTE NODE #  1 IS INVALID FOR   LUMBER+F FROM 157      TO 110     .
--- ROUTE NODE #  1 IS INVALID FOR   LUMBER+F FROM 157      TO 111     .
--- ROUTE NODE #  1 IS INVALID FOR   LUMBER+F FROM 157      TO 147     .
--- ROUTE NODE #  1 IS INVALID FOR   LUMBER+F FROM 157      TO 148     .
--- ROUTE NODE #  1 IS INVALID FOR   LUMBER+F FROM 157      TO 151     .
--- ROUTE NODE #  1 IS INVALID FOR   UNID MAN FROM 159      TO 106     .
--- ROUTE NODE #  1 IS INVALID FOR   UNID MAN FROM 159      TO 116     .
--- ROUTE NODE #  1 IS INVALID FOR   UNID MAN FROM 159      TO 162     .
--- ROUTE NODE #  1 IS INVALID FOR   PAPER+AL FROM 155      TO 148     .
--- ROUTE NODE #  1 IS INVALID FOR   PAPER+AL FROM 155      TO 149     .
--- ROUTE NODE #  1 IS INVALID FOR   PAPER+AL FROM 157      TO 103     .
--- ROUTE NODE #  1 IS INVALID FOR   PAPER+AL FROM 157      TO 108     .
--- ROUTE NODE #  1 IS INVALID FOR   PAPER+AL FROM 157      TO 111     .
--- ROUTE NODE #  1 IS INVALID FOR   PAPER+AL FROM 157      TO 148     .
```

TRANSPORTATION NETWORK MODEL
FINAL 1972 CONSTRAINED RUN

ITERATION # 1   PERCENT CONVERGENCE = 21.85

TRANSPORTATION NETWORK MODEL
FINAL 1972 CONSTRAINED RUN

MODAL SUMMARY REPORT - RR

NODES

CLASS NO.	NAME	TOTAL NODES	% USED	KILOTONS CAPACITY	KILOTONS AVG. FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
1	R.EAST	309	80.3	900000.0	16542.8	176.38	10.64	2209.22	723626.8	1819042.3	9063.6	2506175.4
2	R.SOUTH	180	89.4	900000.0	11309.7	172.22	11.32	2089.22	313583.2	858551.5	3804.2	1387197.9
3	R.WEST	406	85.0	900000.0	8842.1	209.04	11.92	2720.54	637686.1	1514620.1	8299.1	2995563.6
SUBTOTALS		895	84.2	900000.0	11901.9	186.64	11.21	2358.68	1674896.0	4192213.9	21166.8	6888936.9

LINEHAUL LINKS

CLASS NO.	NAME	TOTAL LINKS	TOTAL MILES	% USED MILES	KILOTONS CAPACITY	KILOTONS AVG FLOW	MTON-MILES	AVG SPEED (MPH)	AVG PER TON/MILE COST MILLS	AVG PER TON/MILE TIME (MIN.)	AVG PER TON/MILE ENERGY BTU	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
1	EF130	1	126	100.0	62000.	17601.3	2218	40.5	9.20	1.481	651.	20402.9	2281.	1444.	24769.
2	EF125	10	567	80.2	62000.	3791.7	1725	42.5	8.64	1.412	513.	14906.6	1691.	885.	16481.
3	EF120	93	3828	70.6	62000.	5629.3	15205	41.0	6.31	1.465	458.	95941.3	15469.	6959.	111297.
4	EF117	214	8376	61.7	58000.	10581.3	54652	30.8	5.98	1.951	466.	326671.9	74036.	25448.	396781.
5	EF225	4	274	100.0	186000.	11601.4	3179	42.1	8.09	1.424	562.	25729.1	3144.	1786.	30345.
6	EF220	26	930	54.8	186000.	10456.4	5333	41.8	7.43	1.436	506.	39621.3	5319.	2698.	46511.
7	EF217	129	5015	77.5	174000.	9911.4	38506	39.6	6.51	1.515	446.	250788.9	40522.	17185.	287569.
8	EF320	3	157	6.4	310000.	6552.4	66	43.2	12.06	1.388	560.	790.1	63.	37.	888.
9	EF317	65	2434	83.4	290000.	18261.5	37071	40.2	6.83	1.492	508.	253274.4	38422.	18814.	308696.
10	EH125	4	154	70.8	58000.	709.9	77	41.6	11.87	1.444	652.	918.7	78.	50.	1055.
11	EH120	31	1660	61.9	58000.	9700.8	9963	38.1	5.67	1.576	511.	56533.1	10906.	5094.	64582.
12	EH117	6	632	86.6	45000.	5601.0	3064	28.0	6.40	2.140	469.	19604.1	4554.	1437.	22199.
13	EH220	12	633	85.2	174000.	13728.3	7400	39.7	6.13	1.512	508.	45373.4	7772.	3755.	50586.
14	EH217	6	505	56.4	135000.	12063.6	3444	29.7	5.07	2.020	407.	17449.1	4831.	1400.	18670.
15	EH320	6	393	89.1	290000.	32236.2	11283	39.6	5.43	1.514	470.	61282.6	11866.	5305.	65975.
16	SF125	4	249	100.0	60000.	1355.5	338	39.8	10.83	1.509	534.	3655.3	354.	180.	4095.
17	SF120	291	17643	71.9	60000.	6163.5	78177	36.6	6.80	1.642	503.	531952.0	89117.	39286.	653271.
18	SF117	7	450	98.0	60000.	10727.8	4731	34.1	5.61	1.757	466.	26552.2	5774.	2205.	35055.
19	SF220	41	1867	78.1	180000.	7879.1	11496	38.9	7.75	1.544	507.	89070.4	12325.	5823.	106684.
20	SF217	2	156	80.8	180000.	24800.7	3125	38.1	4.83	1.575	407.	15085.3	3419.	1270.	17470.
21	SF320	4	125	100.0	300000.	7939.0	992	39.5	10.00	1.518	493.	9926.7	1046.	489.	11210.
22	SH125	1	130	100.0	45000.	18595.0	2417	27.2	5.91	2.203	511.	14281.4	3698.	1235.	16171.
23	SH120	12	1014	90.6	45000.	9679.6	8896	26.4	5.86	2.276	505.	52157.0	14061.	4494.	62813.
24	SH117	10	621	77.6	45000.	24310.2	11718	22.1	4.90	2.714	412.	57438.6	22087.	4823.	60785.
25	SH225	1	60	100.0	135000.	8377.4	503	31.2	7.67	1.926	474.	3857.8	672.	238.	4015.
26	SH220	1	42	100.0	135000.	27779.7	1167	30.0	5.91	2.003	525.	6889.7	1623.	613.	8470.

CLASS NO.	NAME	TOTAL LINKS	TOTAL MILES	% USED MILES	KILOTONS CAPACITY	KILOTONS AVG FLOW	MTON-MILES	AVG SPEED (MPH)	AVG PER TON/MILE COST MILLS	AVG PER TON/MILE TIME (MIN.)	AVG PER TON/MILE ENERGY BTU	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
28	WF125	67	4903	69.2	70000.	2636.6	8947	47.8	8.39	1.255	536.	75030.9	7798.	4798.	85975.
29	WF120	399	28661	75.0	70000.	6787.1	145806	45.5	6.67	1.318	556.	972967.0	133420.	81109.	1189442.
30	WF117	108	6549	70.1	70000.	3472.1	15930	46.0	7.09	1.305	539.	112874.6	14440.	8580.	136404.
31	WF225	12	930	80.6	210000.	4268.0	3201	49.3	9.73	1.216	509.	31137.2	2704.	1629.	33488.
32	WF220	103	4897	88.4	210000.	6916.2	29940	48.7	8.45	1.232	539.	253106.2	25620.	16131.	291771.
33	WF217	3	113	100.0	210000.	1424.8	161	49.9	12.09	1.203	544.	1947.4	135.	88.	2151.
34	WF320	17	749	78.8	350000.	6983.2	4120	49.1	9.34	1.222	552.	38479.0	3497.	2272.	43835.
35	WH130	47	6337	92.5	62000.	6852.1	40181	41.3	8.80	1.453	788.	353426.4	40537.	31676.	417943.
36	WH230	13	1468	99.1	186000.	9958.5	14490	44.3	9.97	1.354	791.	144446.2	13623.	11467.	166231.
SUBTOTALS		1754	102709	75.3	96285.	7497.7	579520	39.1	6.94	1.533	536.	4023568.5	616903.	310703.	4793684.

ACCESS LINKS

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
1	EAR25	59	98.3	900000.	16560.	1717.85	19.85	15072.52	1650009.7	794513.	14477.	2324096.
3	SOR25	39	100.0	900000.	10693.	1660.13	20.54	13432.89	692290.6	356821.	5602.	1054061.
5	WSR25	80	98.8	900000.	7444.	1826.25	21.77	16846.55	1074021.5	533390.	9907.	1811435.
6	WSR50	17	82.4	900000.	3194.	1925.15	22.34	22287.98	86081.3	41619.	997.	127024.
SUBTOTALS		195	97.4	900000.	10581.	1742.20	20.61	15411.86	3502403.0	1726343.	30983.	5316616.

MODE TOTALS (TOTAL KTONS = 1005122.)

9200867.6	6535460.	362853.	16999237.

TRANSPORTATION NETWORK MODEL
FINAL 1972 CONSTRAINED RUN

MODAL SUMMARY REPORT - HWY

NODES

CLASS NO.	NAME	TOTAL NODES	% USED	KILOTONS CAPACITY	KILOTONS AVG. FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
4	PEN00	514	86.6	900000.0	5208.4	0.	0.	0.	0.	0.	0.	0.
5	PEN05	30	96.7	900000.0	15717.7	169.85	.08	4921.69	77421.0	1582.1	2243.4	80669.7
6	PEN07	23	100.0	900000.0	14178.1	237.23	.12	6870.05	77358.3	1589.7	2240.3	80638.4
7	PEN11	1[illegible]	100.0	900000.0	29326.5	374.56	.18	10778.11	131813.2	2683.4	3793.0	137285.0
8	PEN18	3	100.0	900000.0	45270.9	602.27	.30	17517.04	81796.3	1697.7	2379.0	85132.9
SUBTOTALS		582	88.0	900000.0	7006.6	102.69	.05	2970.35	368388.8	7552.8	10655.7	383726.0

LINEHAUL LINKS

CLASS NO.	NAME	TOTAL LINKS	TOTAL MILES	% USED MILES	KILOTONS CAPACITY	KILOTONS AVG FLOW	MTON-MILES	AVG SPEED (MPH)	AVG PER TON/MILE COST MILLS	AVG PER TON/MILE TIME (MIN.)	AVG PER TON/MILE ENERGY BTU	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
37	D.L.FREE	247	17090	90.2	75000.	5116.9	78918	63.3	30.80	.947	1989.	2430608.9	51909.	157002.	2535481.
38	D.R.FREE	129	9063	84.1	48000.	5293.1	40365	51.6	39.09	1.163	2303.	1578071.3	32602.	92965.	1645364.
39	D.M.FREE	81	7413	83.6	28000.	2792.9	17299	38.3	54.40	1.565	2589.	940991.3	18804.	44793.	979272.
40	D.L.TOLL	40	2998	90.3	75000.	7600.5	20567	59.0	37.44	1.016	1768.	770119.5	14513.	36361.	799284.
41	D.R.TOLL	33	2031	74.2	48000.	7721.9	11629	42.9	52.42	1.399	2111.	609634.4	11296.	24544.	632476.
42	D.M.TOLL	15	749	100.0	28000.	3654.8	2737	38.9	57.98	1.544	2602.	158712.6	2934.	7124.	165131.
43	U.LEVEL	443	34384	56.0	15200.	1033.5	19884	49.6	38.96	1.209	1513.	774602.7	16692.	30084.	808183.
44	U.ROLLING	165	14320	36.1	9500.	1687.1	8712	34.3	60.06	1.748	1976.	523271.6	10576.	17215.	544398.
45	U.MOUNT	139	15530	37.6	5000.	726.7	4249	20.0	116.61	2.997	2856.	495485.3	8844.	12133.	512778.
SUBTOTALS		1292	103578	62.2	36664.	3170.6	204361	50.6	40.52	1.185	2066.	8281497.6	168171.	422222.	8622367.

ACCESS LINKS

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
7	HA25	134	98.5	900000.	7033.	1968.27	6.40	39998.07	1827241.8	247514.	37132.	2351143.
8	HA50	55	94.5	900000.	3040.	3287.57	7.28	79988.90	519767.9	47965.	12646.	621674.
9	HA75	5	100.0	900000.	1133.	4161.93	6.38	120023.93	23581.5	1506.	680.	25806.

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	DISUTILITY WEIGHTED SUM(000)
SUBTOTALS		194	97.4	900000.	5778.	2170.64	6.53	46202.55	2370591.2	296985.	50459.	2998704.
MODE TOTALS		(TOTAL KTONS =		546025.)					11020477.6	472709.	483336.	12004797.

TRANSPORTATION NETWORK MODEL
FINAL 1972 CONSTRAINED RUN

MODAL SUMMARY REPORT - WTR

NODES

CLASS NO.	NAME	TOTAL NODES	% USED	KILOTONS CAPACITY	KILOTONS AVG. FLOW	AVG DISUTILITY PER KTON COST($)	TIME(HR)	ENERGY (KBTU)	TOTAL DISUTILITY COST ($K)	KTON DAYS	ENERGY BBTU	WEIGHTED SUM(000)
9	MAJR.FLEET	7	100.0	900000.0	58250.3	225.00	24.00	2700.00	91744.2	407751.9	1100.9	435097.1
10	INMD.FLEET	3	100.0	900000.0	51601.7	150.00	16.00	1800.00	23220.6	103203.4	278.6	125648.2
11	MINR.FLEET	5	100.0	900000.0	21131.4	75.00	8.00	900.00	7924.3	35219.0	95.1	31020.1
12	THRU+ACCES	95	92.6	900000.0	20186.8	0.	0.	0.	0.	0.	0.	0.
13	UM600.110	23	100.0	50000.0	12304.2	22.76	1.32	1444.25	6441.7	15540.0	408.7	20013.7
14	UM.LD26	1	100.0	70000.0	42246.2	49.66	2.93	2733.21	2098.1	5166.3	115.5	8090.7
15	IL600.110	24	100.0	50000.0	22118.0	38.63	2.29	2058.07	20506.3	50586.4	1092.5	54081.5
16	AK600.110	32	96.9	45000.0	2877.5	11.93	.73	508.46	1064.2	2710.9	45.4	1687.3
17	OH12+6.110	10	100.0	120000.0	25112.9	14.56	.93	871.59	3655.3	9761.6	218.9	10278.0
18	OH.NAVPASS	2	100.0	195000.0	47056.2	14.38	.77	685.34	1353.0	3031.8	64.5	3279.7
19	OH.GALLPLS	1	100.0	60000.0	20824.6	23.58	1.52	1268.56	490.9	1319.8	26.4	1299.6
20	OH600+360	7	100.0	60000.0	12389.4	17.12	1.00	969.66	1484.7	3629.6	84.1	3675.2
21	MN360.56	12	16.7	40000.0	7847.2	28.28	1.12	972.66	443.8	733.7	15.3	451.1
22	MN720.XX+	4	100.0	100000.0	7847.2	9.54	.66	548.85	299.5	868.7	17.2	308.2
23	TNUM.360+	4	75.0	30000.0	2803.7	35.04	1.59	1608.04	294.8	556.5	13.5	815.3
24	XX400+.75+	5	100.0	35000.0	5801.7	48.91	1.53	1727.16	1418.7	1853.9	50.1	2436.4
25	KW2X360.56	4	25.0	60000.0	7937.5	24.21	1.43	882.51	192.1	474.5	7.0	654.8
26	GIWW.XXXX	7	100.0	55000.0	25358.8	23.63	1.38	735.67	4194.9	10218.7	130.6	12196.4
27	KY145.XX	6	100.0	4500.0	140.0	43.27	.94	2420.45	36.3	32.7	2.0	53.6
SUBTOTALS		252	91.3	433921.7	17884.9	40.56	3.81	915.60	166863.6	652659.6	3766.4	711087.0

LINEHAUL LINKS

CLASS NO.	NAME	TOTAL LINKS	TOTAL MILES	% USED MILES	KILOTONS CAPACITY	KILOTONS AVG FLOW	MTON-MILES	AVG SPEED (MPH)	AVG PER TON/MILE COST MILLS	TIME (MIN.)	ENERGY BTU	TOTAL DISUTILITY COST ($K)	KTON DAYS	ENERGY BBTU	WEIGHTED SUM(000)
46	LWR.MISS.R	9	665	98.5	900000.	78682.1	51537	8.4	3.40	7.155	290.	175390.0	256090.	14948.	426444.
47	UPR.MISS.R	46	733	100.0	900000.	17765.0	13022	7.1	3.76	8.492	306.	48953.8	76790.	3988.	121864.
48	ARKANSAS.R	25	440	100.0	900000.	771.6	340	4.7	5.35	12.746	267.	1814.8	3005.	91.	4330.
49	OHIO.RIVER	49	997	100.0	900000.	27315.4	27233	8.8	2.75	6.806	191.	74892.0	128708.	5202.	144053.
50	L.MONONGHL	3	42	100.0	900000.	7847.2	330	7.6	3.15	7.920	187.	1038.2	1813.	62.	1056.
51	U.MONONGHL	8	82	100.0	900000.	7847.2	643	7.6	3.15	7.920	187.	2026.9	3539.	120.	2062.
53	TENNESSEE	17	553	84.6	900000.	6210.8	2907	8.6	3.15	7.007	196.	9155.9	14143.	570.	16777.
54	CLINCH/EMY	2	51	100.0	900000.	236.7	12	7.8	3.00	7.678	223.	36.2	64.	3.	45.
55	CUMBERLAND	4	91	100.0	900000.	13799.9	1256	7.8	3.00	7.680	223.	3767.4	6698.	280.	6333.
57	KENTUCKY.R	7	108	100.0	900000.	140.0	15	7.2	5.50	8.342	719.	83.2	88.	11.	129.

CLASS NO.	NAME	TOTAL LINKS	TOTAL MILES	% USED MILES	KILOTONS CAPACITY	KILOTONS AVG FLOW	MTON-MILES	AVG SPEED (MPH)	AVG PER TON/MILE COST MILLS	AVG PER TON/MILE TIME (MIN.)	AVG PER TON/MILE ENERGY BTU	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
58	ILLINOIS.R	13	326	100.0	900000.	22395.1	7301	7.4	3.15	8.100	248.	22997.6	41067.	1811.	73086.
59	GIWW.WEST	15	549	98.7	900000.	29606.6	16047	6.5	3.60	9.300	175.	57768.4	103635.	2808.	135868.
60	GIWW.EAST	4	245	100.0	900000.	12714.2	3115	6.1	4.70	9.790	203.	14631.7	21177.	631.	29114.
61	BW/TOMB/MO	10	375	100.0	900000.	9070.0	3401	6.5	3.15	9.300	164.	10713.9	21966.	558.	15997.
62	ALABA/COOS	4	275	100.0	900000.	133.0	37	6.8	5.00	8.760	527.	182.8	222.	19.	510.
63	MISSOURI.R	3	224	100.0	900000.	1280.0	287	6.1	8.25	9.901	473.	2365.8	1971.	135.	4171.
64	AP/CHAT/FL	7	287	100.0	900000.	989.3	284	5.6	14.60	10.624	589.	4145.6	2095.	167.	6662.
65	ATCHAF/OLD	4	121	100.0	900000.	3083.6	373	6.9	10.20	8.649	238.	3805.5	2241.	89.	7087.
66	RED.RIVER	2	69	100.0	900000.	322.8	22	7.4	6.30	8.100	514.	140.3	125.	11.	291.
67	OUACHTA/BL	6	359	61.3	900000.	773.4	170	6.6	5.50	8.760	556.	935.8	1035.	95.	2144.
68	P.ALLEN.RT	3	64	100.0	900000.	17362.9	1111	7.4	3.60	8.100	293.	4000.4	6251.	326.	10529.
SUBTOTALS		255	6810	94.2	900000.	20178.0	129442	7.8	3.39	7.706	247.	438846.1	692725.	31924.	1008553.

ACCESS LINKS

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
10	WA025	50	90.0	900000.	10249.	1602.23	42.13	26613.02	738928.8	809592.	12274.	1221350.
11	WA050	15	53.3	900000.	3202.	2052.03	56.75	34998.45	52558.6	60565.	896.	76017.
12	WA075	16	31.3	900000.	6667.	2595.39	69.12	47375.77	86512.2	95998.	1579.	163686.
13	WA100	16	18.7	900000.	32.	6281.74	49.63	114840.96	603.0	199.	11.	926.
14	WA125	12	16.7	900000.	2996.	4398.55	50.04	97403.69	26360.5	12496.	584.	32844.
15	WA150	9	22.2	900000.	104.	9294.65	49.48	171905.00	1933.3	429.	36.	1938.
16	WA175	9	22.2	900000.	163.	7000.98	77.26	165886.24	2289.3	1053.	54.	3541.
SUBTOTALS		129	51.9	900000.	7862.	1726.00	44.67	29299.91	909185.8	980331.	15434.	1500301.

MODE TOTALS (TOTAL KTONS = 263370.) 1514895.5 2325715. 51124. 3219942.

TRANSPORTATION NETWORK MODEL
FINAL 1972 CONSTRAINED RUN

MODAL SUMMARY REPORT - PPL

NODES

CLASS NO.	NAME	TOTAL NODES	% USED	KILOTONS CAPACITY	KILOTONS AVG. FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
28	PIPELINE	60	81.7	900000.0	19202.1	0.	0.	0.	0.	0.	0.	0.
SUBTOTALS		60	81.7	900000.0	19202.1	0.	0.	0.	0.	0.	0.	0.

LINEHAUL LINKS

CLASS NO.	NAME	TOTAL LINKS	TOTAL MILES	% USED MILES	KILOTONS CAPACITY	KILOTONS AVG FLOW	MTON-MILES	AVG SPEED (MPH)	AVG PER TON/MILE COST MILLS	AVG PER TON/MILE TIME (MIN.)	AVG PER TON/MILE ENERGY BTU	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
69	P06	3	348	39.9	1000.	329.6	46	2.1	7.56	28.672	1476.	346.5	912.	68.	356.
70	P10	5	1763	71.6	4000.	742.9	937	1.5	2.97	39.396	182.	2781.1	25648.	171.	3038.
71	P14	5	1631	60.1	8000.	1746.1	1713	1.8	3.17	33.665	236.	5436.7	40045.	405.	5837.
72	P16	5	1236	60.3	11000.	1259.7	938	1.5	2.80	40.217	140.	2630.0	26210.	131.	2925.
73	P18	18	4284	57.3	14000.	2686.6	6596	2.0	3.96	29.463	384.	26141.0	134948.	2532.	28203.
74	P20	6	1772	56.5	18000.	7936.7	7945	2.8	2.79	21.211	320.	22175.6	117025.	2543.	23690.
75	P22	5	1123	37.6	24000.	6150.3	2595	2.0	2.11	30.655	148.	5480.4	55253.	383.	6033.
76	P24	8	2634	59.5	30000.	9549.6	14974	2.2	2.74	27.773	292.	40991.6	288801.	4371.	45059.
77	P28	11	2313	66.5	44000.	11148.7	17136	2.1	2.28	28.943	147.	39101.0	344414.	2526.	42873.
78	P32	12	3118	51.8	61000.	17210.7	27776	3.0	2.38	20.028	367.	65974.6	386345.	10182.	70002.
79	P34	7	1615	100.0	71000.	30182.3	48744	3.6	1.73	16.753	254.	84554.6	567094.	12375.	90743.
80	P36	5	2159	50.8	82000.	25517.1	27967	4.4	1.69	13.673	331.	47292.2	265539.	9244.	49983.
81	P40	3	995	100.0	106000.	10676.5	10623	1.1	4.23	52.944	47.	44982.1	390577.	504.	48886.
82	P42	1	419	100.0	120000.	917.0	384	.7	5.91	85.879	3.	2272.2	22914.	1.	2501.
83	P48	2	573	100.0	168000.	216.8	124	.7	5.15	88.565	2.	640.0	7641.	.	746.
SUBTOTALS		96	25983	63.2	45879.	10260.6	168500	2.6	2.32	22.847	270.	390799.7	2673366.	45436.	420878.

ACCESS LINKS

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
18	PA010	7	100.0	900000.	8278.	11.00	4.00	620.58	637.5	9656.	36.	740.

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	DISUTILITY WEIGHTED SUM(000)
19	PA025	41	78.0	900000.	7790.	27.02	8.99	1558.11	6736.0	93419.	388.	7980.
20	PA050	17	82.4	900000.	6085.	54.04	18.99	3114.72	4603.3	67397.	265.	5481.
21	PA075	11	90.9	900000.	7936.	81.00	28.00	4650.02	6428.3	92589.	369.	7354.
22	PA100	26	61.5	900000.	2470.	108.31	36.91	6318.92	4280.7	60777.	250.	5630.
23	PA125	8	62.5	900000.	4257.	135.06	45.98	7772.67	2874.9	40783.	165.	3358.
24	PA150	13	69.2	900000.	772.	162.00	55.00	9301.89	1125.1	15915.	65.	1287.
26	PA200	13	53.8	900000.	1604.	216.00	74.00	12399.72	2424.8	34613.	139.	2771.
27	PA250	4	50.0	900000.	1154.	270.00	92.00	15500.00	623.2	8847.	36.	712.
28	PA300	1	100.0	900000.	1767.	324.00	110.00	18600.21	572.5	8099.	33.	654.
SUBTOTALS		144	71.5	900000.	5387.	54.62	18.69	3147.55	30306.2	432094.	1746.	35966.
MODE TOTALS		(TOTAL KTONS =		277416.)					421105.9	3105460.	47183.	456844.

TRANSPORTATION NETWORK MODEL
FINAL 1972 CONSTRAINED RUN

MODAL SUMMARY REPORT - INTERMODAL TRANSFERS

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	DISUTILITY WEIGHTED SUM(000)
NETWORK TOTALS		(TOTAL KTONS = 2091934.)							22157346.	612439344.	944496.	32680820.

TRANSPORTATION NETWORK MODEL
FINAL 1972 CONSTRAINED RUN

COMMODITY SUMMARY REPORT

COMMODITY NO.	NAME	MODE	KTONS	PER-CENT	MTON-MILES	PER-CENT	COST($K)	PER-CENT	KTON DAYS	PER-CENT	ENERGY BBTU	PER-CENT	TOTAL DISUTILITY	PER-CENT
1	FARM PROD.	RR	93481	56.9	55455	56.5	819040	44.2	638819	61.8	32916	42.1	1758103	52.1
		HWY	41301	25.0	15322	15.6	763753	41.2	26542	2.6	35547	45.5	802769	23.8
		WTR	29841	18.1	27304	27.8	271847	14.7	369075	35.7	9679	12.4	814386	24.1
		TOTAL	165023	100.0	98081	100.0	1854639	100.0	1034435	100.0	78142	100.0	3375259	100.0
2	FOREST+MAR	RR	700	8.4	697	36.6	9225	24.1	6988	15.9	425	35.2	12370	21.3
		WTR	7658	91.6	1208	63.4	29130	75.9	36870	84.1	783	64.8	45722	78.7
		TOTAL	8358	100.0	1905	100.0	38356	100.0	43858	100.0	1208	100.0	58092	100.0
3	COAL	RR	354304	82.6	127390	83.9	1874098	84.3	1588908	76.4	58817	83.1	1889987	84.2
		HWY	470	.1	44	.0	3457	.2	199	.0	153	.2	3459	.2
		WTR	73936	17.2	24405	16.1	345057	15.5	491695	23.6	11793	16.7	349974	15.6
		TOTAL	428710	100.0	151839	100.0	2222612	100.0	2080802	100.0	70763	100.0	2243420	100.0
4	CRUDE PETR	RR	6742	2.1	3018	1.7	67352	11.2	38080	1.1	2339	4.5	67733	10.6
		WTR	38303	11.9	10159	5.6	115678	19.2	288919	8.4	2815	5.4	118567	18.6
		PPL	276123	86.0	168087	92.7	419573	69.6	3099044	90.5	46992	90.1	450563	70.7
		TOTAL	321168	100.0	181264	100.0	602602	100.0	3426044	100.0	52146	100.0	636863	100.0
5	METAL ORES	RR	60962	90.5	23357	82.0	405607	88.4	361473	83.2	13509	87.9	456213	87.8
		WTR	6412	9.5	5134	18.0	53389	11.6	73065	16.8	1861	12.1	63618	12.2
		TOTAL	67374	100.0	28491	100.0	458996	100.0	434537	100.0	15370	100.0	519831	100.0
6	MINERALS N	RR	71906	78.4	23107	71.8	447581	75.4	376548	69.7	13194	75.7	451346	75.3
		WTR	19807	21.6	9097	28.2	146144	24.6	163310	30.3	4231	24.3	147778	24.7
		TOTAL	91713	100.0	32205	100.0	593725	100.0	539858	100.0	17425	100.0	599124	100.0
7	FOOD+KINDR	RR	69362	41.9	55247	58.0	1037520	34.4	578691	80.2	42465	33.6	2183328	49.1
		HWY	88813	53.6	36205	38.0	1904337	63.2	89113	12.3	81899	64.8	2080780	46.8
		WTR	7484	4.5	3852	4.0	73623	2.4	53907	7.5	1959	1.6	180358	4.1
		TOTAL	165658	100.0	95304	100.0	3015480	100.0	721711	100.0	126323	100.0	4444467	100.0
8	TEXTILES+A	RR	1126	9.3	1331	17.6	30594	7.9	12583	50.2	1498	8.9	76397	16.0
		HWY	11011	90.7	6248	82.4	356530	92.1	12494	49.8	15312	91.1	402009	84.0
		TOTAL	12137	100.0	7578	100.0	387125	100.0	25078	100.0	16810	100.0	478407	100.0
9	TOFC	RR	17627	100.0	14441	100.0	345406	100.0	121913	100.0	16645	100.0	528275	100.0

TRANSPORTATION NETWORK MODEL
FINAL 1972 CONSTRAINED RUN

COMMODITY NO.	NAME	MODE	KTONS	PER-CENT	MTON-MILES	PER-CENT	COST($K)	PER-CENT	KTON DAYS	PER-CENT	ENERGY BBTU	PER-CENT	TOTAL DISUTILITY	PER-CENT
		TOTAL	17627	100.0	14441	100.0	345406	100.0	121913	100.0	16645	100.0	528275	100.0
10	CHEMICALS	RR	49664	45.9	43375	59.4	612530	37.0	466406	70.6	25512	36.1	1489373	51.4
		HWY	45182	41.8	18137	24.8	941524	56.9	29703	4.5	40635	57.5	997365	34.4
		WTR	13245	12.3	11491	15.7	102060	6.2	164562	24.9	4530	6.4	411435	14.2
		TOTAL	108091	100.0	73003	100.0	1656113	100.0	660671	100.0	70677	100.0	2898174	100.0
11	LUMBER+FUR	RR	26759	55.2	41592	84.1	513022	52.1	285587	92.9	28774	57.8	1189863	69.5
		HWY	21646	44.7	7830	15.8	470473	47.8	21478	7.0	20996	42.2	521376	30.5
		WTR	35	.1	8	.0	381	.0	223	.1	10	.0	910	.1
		TOTAL	48440	100.0	49430	100.0	983876	100.0	307288	100.0	49780	100.0	1712149	100.0
12	MACHINERY	RR	3092	21.6	3583	34.3	83792	21.9	34079	75.2	3912	20.7	148201	31.7
		HWY	11202	78.4	6870	65.7	298477	78.1	11201	24.7	14994	79.3	319448	68.3
		WTR	3	.0	2	.0	30	.0	34	.1	1	.0	94	.0
		TOTAL	14298	100.0	10455	100.0	382300	100.0	45314	100.0	18906	100.0	467943	100.0
13	ELEC MACHI	RR	2181	28.0	2548	40.3	75883	31.3	23360	79.6	3552	30.0	99477	36.5
		HWY	5596	72.0	3777	59.7	166745	68.7	5980	20.4	8285	70.0	172785	63.5
		TOTAL	7778	100.0	6324	100.0	242628	100.0	29340	100.0	11836	100.0	272262	100.0
14	TRANSP EQU	RR	7101	48.9	6508	71.3	158296	53.2	65140	92.7	6954	50.4	199334	58.3
		HWY	7369	50.8	2561	28.3	138760	46.7	4637	6.6	6842	49.6	141681	41.5
		WTR	39	.3	36	.4	348	.1	457	.7	12	.1	636	.2
		TOTAL	14509	100.0	9125	100.0	297404	100.0	70233	100.0	13808	100.0	341651	100.0
15	UNID MANUF	RR	127078	44.8	98859	64.7	1456223	34.6	1042706	80.6	60669	34.2	3541636	52.1
		HWY	137586	48.6	47798	31.3	2620724	62.3	131128	10.1	113891	64.1	2882980	42.4
		WTR	18719	6.6	6184	4.0	126956	3.0	120314	9.3	3061	1.7	367585	5.4
		TOTAL	283383	100.0	152842	100.0	4203903	100.0	1294149	100.0	177621	100.0	6792200	100.0
16	PAPER+ALLI	RR	27128	54.8	25915	76.0	427712	50.1	248860	91.7	19269	50.9	808468	63.7
		HWY	22281	45.0	8147	23.9	424737	49.8	21777	8.0	18569	49.0	458056	36.1
		WTR	112	.2	53	.2	981	.1	839	.3	28	.1	2264	.2
		TOTAL	49521	100.0	34114	100.0	853429	100.0	271476	100.0	37866	100.0	1268787	100.0
17	PETPL PROD	RR	17659	21.5	11058	25.6	164924	24.0	134701	20.2	6093	22.7	264602	22.4
		HWY	19712	24.0	4622	10.7	302195	44.0	10456	1.6	11350	42.3	309933	26.3
		WTR	43365	52.9	27148	62.8	218266	31.8	513730	77.2	9197	34.3	598426	50.7
		PPL	1293	1.6	414	1.0	1533	.2	6416	1.0	191	.7	6281	.5

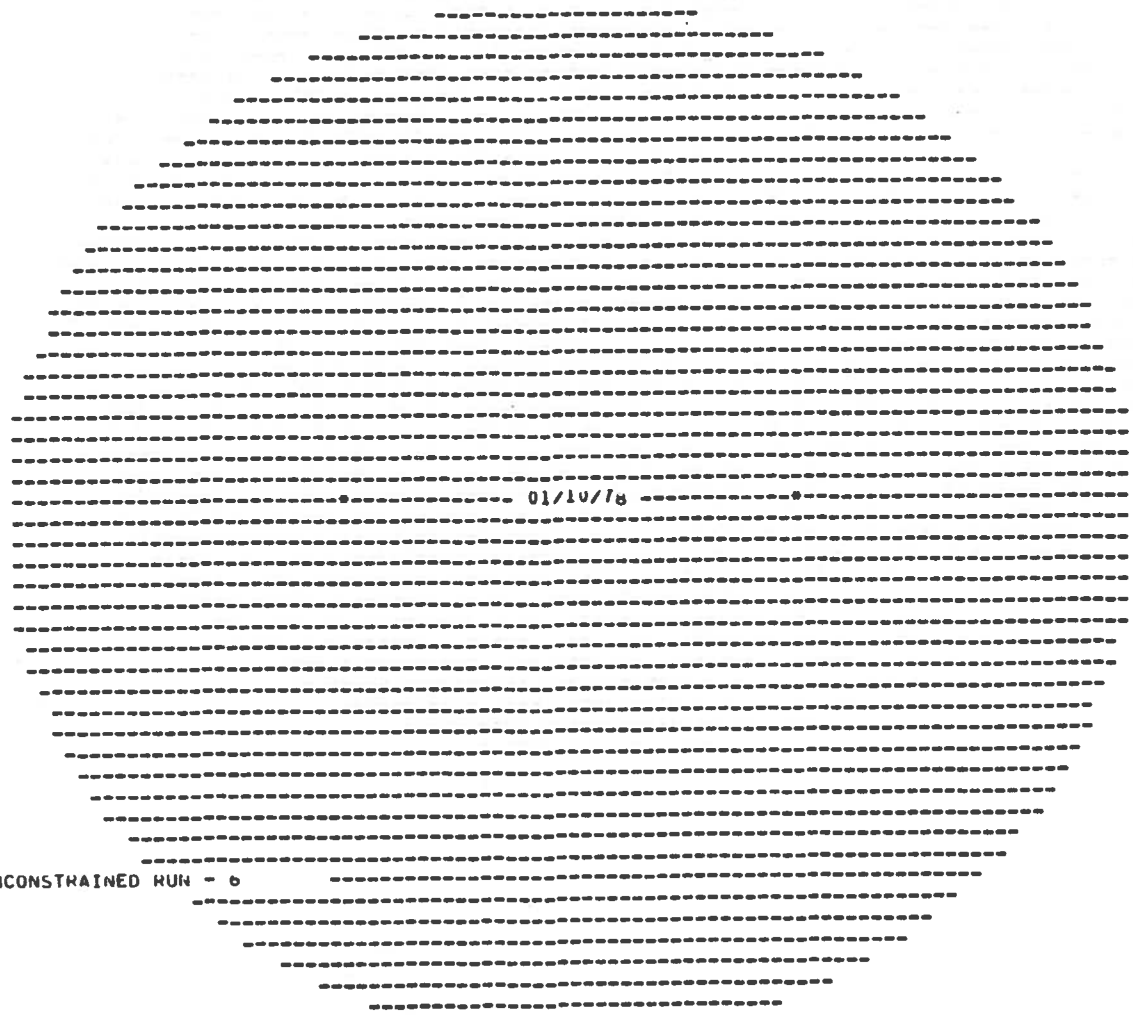
TRANSPORTATION NETWORK MODEL
FINAL 1972 CONSTRAINED RUN

COMMODITY NO.	NAME	MODE	KTONS	PER-CENT	MTON-MILES	PER-CENT	COST($K)	PER-CENT	KTON DAYS	PER-CENT	ENERGY BBTU	PER-CENT	TOTAL DISUTILITY	PER-CENT
		TOTAL	82029	100.0	43242	100.0	686918	100.0	665302	100.0	26831	100.0	1179241	100.0
18	PRMY METAL	RR	35996	38.5	22703	51.0	340255	27.0	276538	78.2	13559	23.9	788247	43.0
		HWY	53944	57.7	18715	42.0	893374	71.0	33864	9.6	42209	74.3	948233	51.8
		WTR	3562	3.8	3135	7.0	25074	2.0	43268	12.2	1040	1.8	95168	5.2
		TOTAL	93501	100.0	44552	100.0	1258703	100.0	353669	100.0	56808	100.0	1831648	100.0
19	FABR METAL	RR	6845	26.7	5492	39.6	109132	20.1	59264	77.5	4585	18.9	251959	34.6
		HWY	18687	73.0	8331	60.0	433202	79.8	16392	21.4	19645	81.0	472707	65.0
		WTR	68	.3	62	.4	794	.1	846	1.1	25	.1	2832	.4
		TOTAL	25600	100.0	13884	100.0	543128	100.0	76502	100.0	24255	100.0	727499	100.0
20	MISCELLANE	RR	25010	28.7	13846	41.0	222676	14.6	174816	73.7	8166	13.3	794324	34.5
		HWY	61225	70.4	19735	58.5	1302189	85.1	57745	24.3	53009	86.5	1491016	64.7
		WTR	780	.9	165	.5	5138	.3	4602	1.9	101	.2	20188	.9
		TOTAL	87016	100.0	33746	100.0	1530003	100.0	237164	100.0	61276	100.0	2305528	100.0
TOTAL, ALL COMMODITIES-														
		RR	1005122	48.0	579520	53.6	9200868	41.5	6535461	52.5	362853	38.4	16999237	52.0
		HWY	546025	26.1	204361	18.9	11020478	49.7	472709	3.8	483336	51.2	12004797	36.7
		WTR	263370	12.6	129442	12.0	1514896	6.8	2325715	18.7	51124	5.4	3219942	9.9
		PPL	277416	13.3	168500	15.6	421106	1.9	3105460	25.0	47183	5.0	456844	1.4
		XFR	0	0.	0	0.	0	0.	0	0.	0	0.	0	0.
TOTAL, ALL MODES=			2091934	100.0	1081824	100.0	22157347	100.0	12439344	100.0	944496	100.0	32680820	100.0

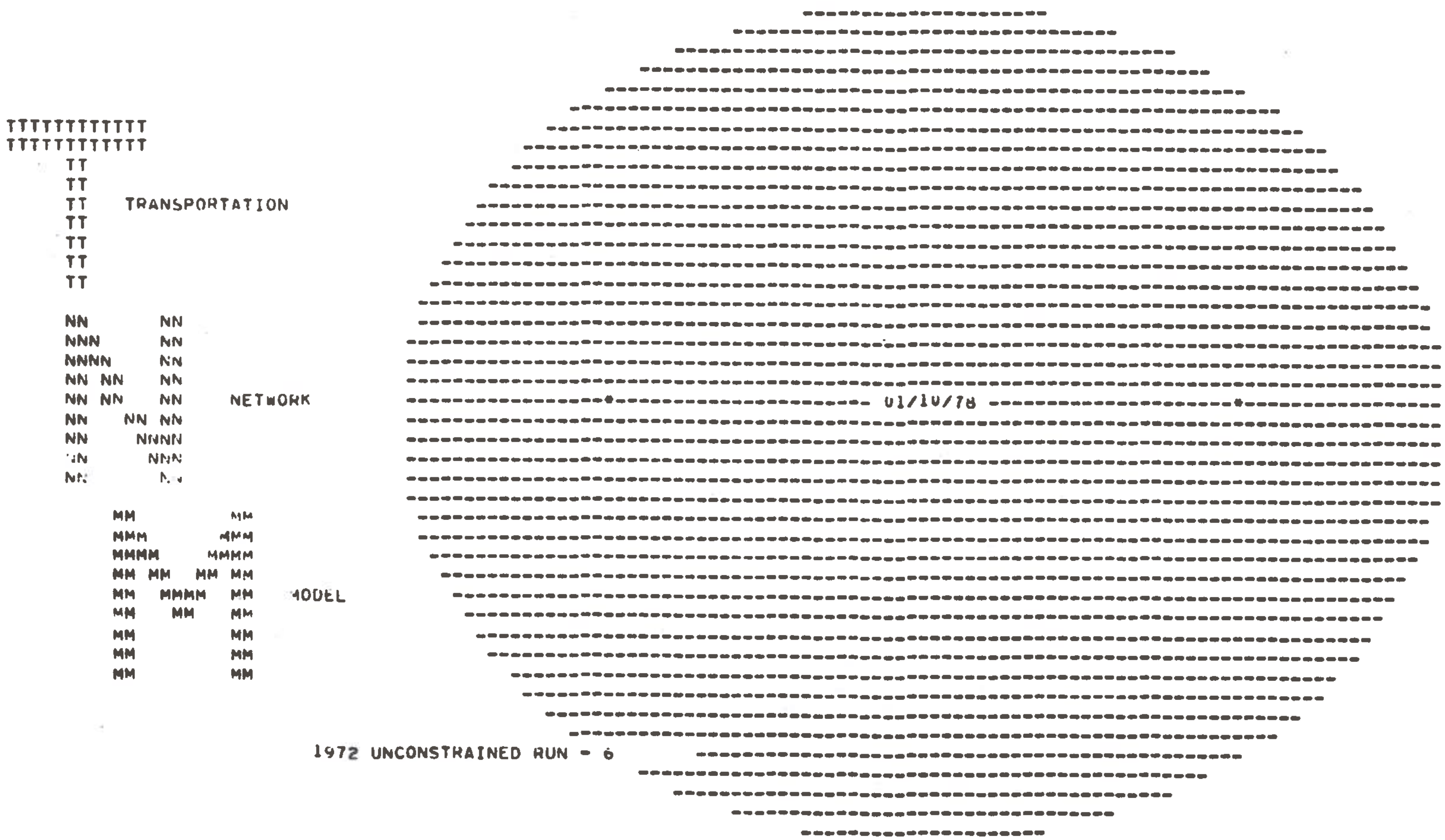
TRANSPORTATION

NETWORK

MODEL



1972 UNCONSTRAINED RUN - 6



TRANSPORTATION
NETWORK
MODEL
01/10/78
1972 UNCONSTRAINED RUN = 6

TRANSPORTATION NETWORK MODEL
1972 UNCONSTRAINED RUN - 6

S-Y-S-T-E-M P-A-R-A-M-E-T-E-R-S

MAXIMUM NUMBER OF ITERATIONS	LINK, NODE VOLUME CONVERGENCE CRITERION TO STOP ITERATION	VOLUME VS. ESTIMATION ERROR TOLERANCE	INCLUSION ELLIPSE ECCENTRICITY	BACKUP ELLIPSE ECCENTRICITY	VOLUME ESTIMATE % CHANGE	ENERGY UNITS
1	80.0 %	15.0 %	.60000	.40000	75.0%	BTU

171 REGIONS.

1789 NODES.

3397 LINEHAUL LINKS.

662 ACCESS LINKS.

0 TRANSFER LINKS.

28 NODE CLASSES.
83 LINK CLASSES.
29 ACCESS CLASSES.
0 TRANSFER CLASSES.

20 COMMODITIES.

OUTPUTS SELECTED

INPUT ECHO	NO
PLAYBACK REPORTS	
REGIONS	NO
NODES	NO
LINEHAUL LINKS	NO
ACCESS LINKS	NO
TRANSFER LINKS	NO
COMMODITIES	NO
CLASSES/FUNCTIONS	NO
SHIPMENTS	NO
CONTINUE AFTER PLAYBACK ?	YES
NODE VOLUME ESTIMATE CHANGES	NO
LINK VOLUME ESTIMATE CHANGES	NO
NETWORK FLOW REPORT	NO
NETWORK FILE	YES
NETWORK FLOW FILE	YES
PATH FILE	YES

TRANSPORTATION NETWORK MODEL
1972 UNCONSTRAINED RUN - 6

ITERATION # 1   PERCENT CONVERGENCE = 64.79

TRANSPORTATION NETWORK MODEL
1972 UNCONSTRAINED RUN - 6

MODAL SUMMARY REPORT - RR

NODES

CLASS NO.	NAME	TOTAL NODES	% USED	KILOTONS CAPACITY	KILOTONS AVG. FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
1	R.EAST	309	73.1	900000.0	16798.7	168.91	10.53	2116.73	641267.3	1665521.8	8036.2	2090146.6
2	R.SOUTH	180	81.7	900000.0	12631.1	164.79	11.31	1999.40	305975.4	874975.4	3712.4	1218981.1
3	R.WEST	406	81.5	900000.0	8441.7	211.42	11.90	2752.59	590757.6	1385077.2	7691.3	2737908.2
SUBTOTALS		895	78.7	900000.0	11999.3	182.07	11.15	2301.26	1538000.2	3925574.4	19439.9	6047035.9

LINEHAUL LINKS

CLASS NO.	NAME	TOTAL LINKS	TOTAL MILES	% USED MILES	KILOTONS CAPACITY	KILOTONS AVG FLOW	MTON-MILES	AVG SPEED (MPH)	AVG PER TON/MILE COST MILLS	AVG PER TON/MILE TIME (MIN.)	AVG PER TON/MILE ENERGY BTU	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
1	EF130	1	126	100.0	62000.	33051.1	4164	36.4	8.39	1.648	602.	34954.2	4767.	2507.	43379.
2	EF125	10	567	80.2	62000.	2809.9	1278	42.8	9.78	1.403	589.	12506.0	1245.	753.	14334.
3	EF120	93	3828	60.2	62000.	7107.4	16375	40.8	6.07	1.472	458.	99385.6	16738.	7505.	116953.
4	EF117	214	8376	52.6	58000.	12041.6	53092	31.0	5.80	1.935	457.	308097.4	71354.	24249.	376007.
5	EF225	4	274	100.0	186000.	4542.4	1245	42.8	10.16	1.403	558.	12644.7	1212.	694.	14234.
6	EF220	26	930	47.1	186000.	9038.5	3959	42.3	7.39	1.420	486.	29261.2	3903.	1922.	33417.
7	EF217	129	5015	71.2	174000.	10463.6	37355	39.7	6.27	1.513	439.	234388.1	39249.	16389.	267611.
8	EF320	3	157	6.4	310000.	9849.6	98	43.2	10.36	1.390	514.	1020.5	95.	51.	1178.
9	EF317	65	2434	80.9	290000.	19131.7	37651	40.0	6.67	1.502	504.	251292.4	39267.	18962.	308692.
10	EH125	4	154	70.8	58000.	1171.5	128	41.2	9.82	1.455	619.	1254.0	129.	79.	1462.
11	EH120	31	1660	50.4	58000.	11788.8	9855	38.2	5.64	1.569	512.	55590.8	10740.	5048.	63455.
12	EH117	6	632	86.6	45000.	4847.1	2651	27.6	6.15	2.176	446.	16298.3	4006.	1183.	17747.
13	EH220	12	633	83.1	174000.	13834.4	7277	39.7	6.33	1.510	512.	46051.0	7630.	3727.	51574.
14	EH217	6	505	56.4	135000.	13406.4	3821	29.5	4.99	2.036	404.	19081.7	5401.	1545.	20313.
15	EH320	6	393	89.1	290000.	33442.7	11705	39.6	5.35	1.516	467.	62580.7	12322.	5461.	67079.
16	SF125	4	249	50.6	60000.	1535.3	193	39.7	11.14	1.510	561.	2154.4	203.	109.	2552.
17	SF120	291	17643	65.0	60000.	7601.2	87110	34.1	6.45	1.757	489.	561980.8	106290.	42615.	686124.
18	SF117	7	450	75.1	60000.	13656.9	4616	34.1	5.58	1.760	469.	25745.3	5642.	2166.	33619.
19	SF220	41	1867	62.3	180000.	10491.3	12201	38.5	7.09	1.560	489.	86477.0	13216.	5965.	102220.
20	SF217	2	156	80.8	180000.	24109.1	3038	38.2	4.78	1.572	397.	14522.0	3316.	1205.	16547.
21	SF320	4	125	100.0	300000.	6541.0	818	39.6	10.22	1.517	483.	8358.9	861.	395.	9236.
22	SH125	1	130	100.0	45000.	16931.0	2201	27.7	5.62	2.167	479.	12360.1	3313.	1055.	13224.
23	SH120	12	1014	90.6	45000.	9396.9	8636	25.8	5.81	2.324	500.	50209.5	13937.	4315.	60884.
24	SH117	10	621	77.6	45000.	25250.2	12171	21.9	4.96	2.744	417.	60332.1	23192.	5080.	64335.
25	SH225	1	60	100.0	135000.	8655.3	519	31.2	7.66	1.926	477.	3978.9	695.	248.	4177.
26	SH220	1	42	100.0	135000.	28592.1	1201	29.9	5.74	2.007	510.	6888.9	1674.	613.	8397.

CLASS NO.	NAME	TOTAL LINKS	TOTAL MILES	% USED MILES	KILOTONS CAPACITY	KILOTONS AVG FLOW	MTON-MILES	AVG SPEED (MPH)	AVG PER TON/MILE COST MILLS	AVG PER TON/MILE TIME (MIN.)	AVG PER TON/MILE ENERGY BTU	TOTAL COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
28	WF125	67	4903	60.3	70000.	3235.2	9563	47.9	8.02	1.252	542.	76688.9	8315.	5183.	88771.
29	WF120	399	28661	70.5	70000.	7774.5	156982	44.5	6.64	1.347	563.	1042546.3	146895.	88388.	1288676.
30	WF117	108	6549	69.8	70000.	2536.2	11593	45.1	7.29	1.332	538.	84459.0	10721.	6237.	101872.
31	WF225	12	930	80.6	210000.	3526.1	2645	49.3	9.97	1.217	521.	26376.3	2234.	1378.	28896.
32	WF220	103	4897	80.7	210000.	7065.1	27928	48.6	8.19	1.234	540.	228855.9	23926.	15071.	264246.
33	WF217	3	113	100.0	210000.	398.7	45	50.0	12.57	1.201	527.	566.4	38.	24.	615.
34	WF320	17	749	72.0	350000.	12960.7	6986	48.9	8.89	1.227	558.	62128.0	5954.	3900.	68564.
35	WH130	47	6337	89.6	62000.	7676.5	43603	40.4	8.90	1.484	807.	387962.3	44929.	35193.	467571.
36	WH230	13	1468	99.1	186000.	12037.9	17515	44.0	9.66	1.362	805.	169276.5	16569.	14108.	197869.
SUBTOTALS		1754	102709	69.5	96708.	8408.0	600219	38.5	6.82	1.559	539.	4096274.3	649978.	323323.	4905830.

ACCESS LINKS

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
1	EAR25	59	100.0	900000.	15490.	1683.89	19.72	14592.06	1538911.8	750879.	13336.	2095488.
3	SOR25	39	100.0	900000.	10261.	1570.27	20.39	12198.56	628390.8	339923.	4882.	866810.
5	WSR25	80	98.8	900000.	6857.	1827.96	21.75	16434.71	990280.8	490953.	8903.	1643068.
6	WSR50	17	88.2	900000.	3017.	1991.10	22.61	23374.79	90105.3	42641.	1058.	141305.
SUBTOTALS		195	98.5	900000.	9901.	1708.34	20.51	14822.39	3247688.7	1624397.	28178.	4746672.
MODE TOTALS	(TOTAL KTONS = 950476.)								8881963.2	6199949.	370942.	15699536.

TRANSPORTATION NETWORK MODEL
1972 UNCONSTRAINED RUN - 6

MODAL SUMMARY REPORT - HWY

NODES

CLASS NO.	NAME	TOTAL NODES	% USED	KILOTONS CAPACITY	KILOTONS AVG. FLOW	AVG DISUTILITY PER KTON COST($)	TIME(HR)	ENERGY (KBTU)	TOTAL DISUTILITY COST ($K)	KTON DAYS	ENERGY BBTU	WEIGHTED SUM(000)
4	PEN00	514	76.8	900000.0	5954.2	0.	0.	0.	0.	0.	0.	0.
5	PEN05	30	96.7	900000.0	16678.4	169.06	.08	4923.67	81769.1	1678.8	2381.5	85267.1
6	PEN07	23	100.0	900000.0	16277.6	236.09	.12	6868.19	88386.6	1825.1	2571.3	92178.5
7	PEN11	12	100.0	900000.0	28777.7	373.02	.18	10776.93	128815.4	2633.2	3721.6	134278.9
8	PEN18	3	100.0	900000.0	46964.2	592.14	.30	17360.23	83428.3	1761.2	2445.9	86855.5
SUBTOTALS		582	79.4	900000.0	8000.4	103.46	.05	3008.59	382399.4	7898.2	11120.3	398580.0

LINEHAUL LINKS

CLASS NO.	NAME	TOTAL LINKS	TOTAL MILES	% USED MILES	KILOTONS CAPACITY	KILOTONS AVG FLOW	MTON-MILES	AVG SPEED (MPH)	AVG PER TON/MILE COST MILLS	TIME (MIN.)	ENERGY BTU	TOTAL DISUTILITY COST ($K)	KTON DAYS	ENERGY BBTU	WEIGHTED SUM(000)
37	D.L.FREE	247	17090	90.8	75000.	6139.5	95304	63.0	30.91	.953	1954.	2946159.6	63078.	186224.	3074600.
38	D.R.FREE	129	9063	79.5	48000.	4368.6	31489	51.2	39.18	1.171	2290.	1233723.3	25601.	72110.	1287754.
39	D.M.FREE	81	7413	40.0	28000.	1535.0	4554	39.7	51.11	1.511	2565.	232780.2	4778.	11683.	240305.
40	D.L.TOLL	40	2998	88.4	75000.	6609.7	17509	61.7	35.08	.972	1861.	614204.4	11817.	32583.	638369.
41	D.R.TOLL	33	2031	91.3	48000.	5465.3	10138	47.7	45.84	1.259	2159.	464739.5	8863.	21889.	483586.
42	D.M.TOLL	15	749	64.8	28000.	3416.1	1657	38.6	58.87	1.555	2646.	97527.0	1789.	4384.	101847.
43	U.LEVEL	443	34384	53.2	15200.	1499.9	27458	47.3	41.14	1.268	1477.	1129479.2	24178.	40544.	1178687.
44	U.ROLLING	165	14320	26.2	9500.	1377.9	5162	34.1	60.43	1.761	1963.	311923.2	6313.	10133.	324920.
45	U.MOUNT	139	15530	11.2	5000.	805.0	1406	18.1	126.58	3.312	2868.	178008.5	3235.	4034.	181346.
SUBTOTALS		1292	103578	52.6	40692.	3573.0	194677	54.2	37.03	1.107	1970.	7208545.0	149653.	383584.	7511614.

ACCESS LINKS

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	TIME(HR)	ENERGY (KBTU)	TOTAL DISUTILITY COST ($K)	KTON DAYS	ENERGY BBTU	WEIGHTED SUM(000)
7	HA25	134	98.5	900000.	8596.	1972.13	6.42	39998.87	2237741.0	303293.	45386.	2881081.
8	HA50	55	78.2	900000.	3770.	3211.77	6.96	80001.90	520649.7	47010.	12969.	617444.
9	HA75	5	100.0	900000.	2606.	4315.11	7.03	120012.16	56230.2	3815.	1564.	62709.

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL COST ($K)	TOTAL KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	TOTAL DISUTILITY WEIGHTED SUM(000)
SUBTOTALS		194	92.8	900000.	7277.	2148.86	6.49	45745.79	2814620.8	354118.	59919.	3561234.
MODE TOTALS		(TOTAL KTONS =	654896.)						10405565.2	511669.	454623.	11471428.

TRANSPORTATION NETWORK MODEL
1972 UNCONSTRAINED RUN - 6

MODAL SUMMARY REPORT - WTR

NODES

CLASS NO.	NAME	TOTAL NODES	% USED	KILOTONS CAPACITY	KILOTONS AVG. FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
9	MAJR.FLEET	7	100.0	900000.0	42130.7	225.00	24.00	2700.00	66355.9	294914.9	796.3	335303.1
10	INMD.FLEET	3	100.0	900000.0	41713.5	150.00	16.00	1800.00	18771.1	83427.0	225.3	106020.4
11	MINR.FLEET	5	100.0	900000.0	17976.3	75.00	8.00	900.00	6741.1	29960.5	80.9	23015.1
12	THRU+ACCES	95	94.7	900000.0	16411.8	0.	0.	0.	0.	0.	0.	0.
13	UM600.110	23	100.0	50000.0	14455.3	23.24	1.35	1462.54	7726.9	18640.0	486.3	26655.4
14	UM.LD26	1	100.0	70000.0	46847.4	56.73	3.35	3122.17	2657.7	6544.0	146.3	10506.8
15	IL600.110	24	100.0	50000.0	17556.7	30.89	1.83	1760.05	13015.7	32067.9	741.6	34634.4
16	AK600.110	32	87.5	45000.0	3321.2	11.74	.72	500.41	1091.7	2781.4	46.5	1674.2
17	OH12+6.110	10	100.0	120000.0	19698.6	14.51	.93	871.49	2858.4	7633.5	171.7	7677.6
18	OH.NAVPASS	2	100.0	195000.0	27910.6	13.45	.72	641.32	751.0	1683.0	35.8	1660.7
19	OH.GALLPLS	1	100.0	60000.0	14578.6	21.41	1.38	1151.46	312.1	838.7	16.8	514.7
20	OH600+360	7	100.0	60000.0	13981.3	16.73	.98	947.88	1637.8	4004.0	92.8	3359.7
21	MN360.56	12	83.3	40000.0	2027.4	29.03	1.15	998.79	588.6	973.3	20.2	626.1
22	MN720.XX+	4	100.0	100000.0	9671.1	9.66	.67	550.10	373.6	1083.6	21.3	412.7
23	TNUM.360+	4	100.0	30000.0	4101.6	36.45	1.65	1672.28	598.0	1128.9	27.4	1575.5
24	XX400+.75+	5	60.0	35000.0	5950.6	23.01	.72	811.09	410.8	535.8	14.5	700.3
25	KW2X360.56	4	100.0	60000.0	2805.3	25.00	1.48	911.48	280.5	692.8	10.2	1072.6
26	GIWW.XXXX	7	100.0	55000.0	18172.1	16.48	1.08	663.36	2350.7	5727.4	84.4	7456.5
27	KY145.XX	6	100.0	4500.0	158.0	43.38	.94	2426.91	41.1	37.1	2.3	41.5
SUBTOTALS		252	94.8	426472.8	14554.5	36.38	3.40	868.32	126562.7	492673.8	3020.5	563109.1

LINEHAUL LINKS

CLASS NO.	NAME	TOTAL LINKS	TOTAL MILES	% USED MILES	KILOTONS CAPACITY	KILOTONS AVG FLOW	MTON-MILES	AVG SPEED (MPH)	AVG PER TON/MILE COST MILLS	AVG PER TON/MILE TIME (MIN.)	AVG PER TON/MILE ENERGY BTU	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
46	LWR.MISS.R	9	665	98.5	900000.	55970.3	36661	10.2	3.34	5.888	266.	122605.3	149902.	9750.	286299.
47	UPR.MISS.R	46	733	100.0	900000.	22068.7	16176	7.1	3.74	8.439	304.	60431.8	94795.	4923.	159804.
48	ARKANSAS.R	25	440	100.0	900000.	1647.4	725	6.4	3.94	9.396	197.	2856.0	4729.	143.	6165.
49	OHIO.RIVER	49	997	100.0	900000.	17380.9	17329	9.2	2.75	6.519	191.	47654.2	78452.	3310.	70111.
50	L.MONONGHL	3	42	100.0	900000.	9671.1	406	7.6	3.15	7.920	187.	1279.5	2234.	76.	1360.
51	U.MONONGHL	6	82	100.0	900000.	9640.1	790	7.6	3.15	7.920	187.	2490.0	4348.	148.	2622.
52	ALLEGHENY	10	68	100.0	900000.	117.3	8	7.2	2.75	8.343	198.	21.9	46.	2.	29.
53	TENNESSEE	17	553	94.6	900000.	7062.2	3694	8.6	3.15	6.996	196.	11634.6	17946.	723.	17004.
54	CLINCH/EMY	2	51	100.0	900000.	2473.3	126	7.8	3.00	7.680	223.	378.4	673.	28.	422.
55	CUMBERLAND	4	91	100.0	900000.	14183.4	1291	7.8	3.00	7.680	223.	3872.1	6884.	288.	5429.

CLASS NO.	NAME	TOTAL LINKS	TOTAL MILES	% USED MILES	KILOTONS CAPACITY	KILOTONS AVG FLOW	MTON-MILES	AVG SPEED (MPH)	AVG PER TON/MILE COST MILLS	AVG PER TON/MILE TIME (MIN.)	AVG PER TON/MILE ENERGY BTU	TOTAL COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
56	KANAWHA.R	4	86	100.0	900000.	51.0	4	6.9	3.00	8.753	187.	13.2	27.	1.	66.
57	KENTUCKY.R	7	108	100.0	900000.	158.0	17	7.2	5.50	8.340	719.	93.9	99.	12.	95.
58	ILLINOIS.R	13	326	100.0	900000.	23934.6	7803	7.4	3.15	8.100	248.	24578.4	43890.	1935.	81923.
59	GIWW.WEST	15	549	98.7	900000.	21773.1	11801	6.5	3.60	9.300	175.	42483.7	76215.	2065.	112237.
60	GIWW.EAST	4	245	100.0	900000.	6622.4	1622	6.1	4.68	9.763	202.	7600.4	11001.	328.	16068.
61	BW/TOMB/MO	10	375	100.0	900000.	5709.4	2141	6.5	3.15	9.300	164.	6744.2	13827.	351.	9849.
63	MISSOURI.R	3	224	100.0	900000.	7848.0	1758	6.2	8.01	9.610	459.	14078.2	11732.	806.	30948.
64	AP/CHAT/FL	7	287	46.3	900000.	875.0	116	6.1	13.52	9.839	545.	1573.5	795.	63.	2267.
65	ATCHAF/OLD	4	121	100.0	900000.	13765.4	1666	6.3	11.24	9.536	262.	18729.7	11030.	437.	38282.
66	RED.RIVER	2	69	100.0	900000.	605.0	42	7.4	6.30	8.100	514.	263.0	235.	21.	656.
67	OUACHTA/BL	6	359	61.3	900000.	6.0	1	6.8	5.50	8.773	556.	7.3	8.	1.	11.
68	P.ALLEN.RT	3	64	100.0	900000.	10633.9	681	7.4	3.60	8.100	293.	2450.0	3828.	199.	4740.
SUBTOTALS		255	6810	91.0	900000.	16926.2	104858	6.2	3.55	7.315	244.	371839.2	532694.	25611.	846387.

ACCESS LINKS

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
10	WA025	50	88.0	900000.	8453.	1579.57	41.22	28080.47	587462.5	638827.	10444.	926249.
11	WA050	15	66.7	900000.	1036.	2213.75	55.12	36121.17	22943.3	23802.	374.	38982.
12	WA075	16	68.8	900000.	1388.	2647.74	66.53	52335.86	40420.4	42319.	799.	77308.
13	WA100	16	68.8	900000.	169.	5490.37	54.57	105244.32	10217.6	4231.	196.	15369.
14	WA125	12	83.3	900000.	591.	3128.89	68.53	69327.38	18479.2	16864.	409.	26917.
15	WA150	9	22.2	900000.	145.	1223.99	131.89	40166.85	356.2	1599.	12.	1540.
16	WA175	9	66.7	900000.	107.	6107.99	90.69	141820.24	3933.5	2433.	91.	6293.
17	WA200	2	100.0	900000.	316.	3573.84	136.84	97880.34	2258.7	3603.	62.	5215.
SUBTOTALS		129	74.4	900000.	4238.	1686.18	43.28	30444.08	686071.4	733680.	12387.	1097873.

MODE TOTALS (TOTAL KTONS = 203436.) 1184473.3 1759048. 41019. 2507369.

TRANSPORTATION NETWORK MODEL
1972 UNCONSTRAINED RUN - 6

MODAL SUMMARY REPORT - PPL

NODES

CLASS NO.	NAME	TOTAL NODES	% USED	KILOTONS CAPACITY	KILOTONS AVG. FLOW	AVG DISUTILITY PER KTON COST($)	TIME(HR)	ENERGY (KBTU)	TOTAL DISUTILITY COST ($K)	KTON DAYS	ENERGY BBTU	WEIGHTED SUM(000)
28	PIPELINE	60	76.7	900000.0	20584.3	0.	0.	0.	0.	0.	0.	0.
SUBTOTALS		60	76.7	900000.0	20584.3	0.	0.	0.	0.	0.	0.	0.

LINEHAUL LINKS

CLASS NO.	NAME	TOTAL LINKS	TOTAL MILES	% USED MILES	KILOTONS CAPACITY	KILOTONS AVG FLOW	MTON-MILES	AVG SPEED (MPH)	AVG PER TON/MILE COST MILLS	TIME (MIN.)	ENERGY BTU	TOTAL DISUTILITY COST ($K)	KTON DAYS	ENERGY BBTU	WEIGHTED SUM(000)
69	P06	3	348	10.1	1000.	1000.0	35	4.7	7.18	12.639	1917.	251.2	307.	67.	254.
70	P10	5	1763	71.6	4000.	768.7	970	1.6	2.77	37.297	183.	2687.2	25126.	178.	2938.
71	P14	5	1631	60.1	8000.	1942.5	1906	1.7	3.09	34.575	227.	5884.8	45754.	432.	6342.
72	P16	5	1236	34.7	11000.	1863.3	799	1.3	2.75	45.499	121.	2200.6	25257.	97.	2453.
73	P18	18	4284	53.2	14000.	2537.9	5779	1.8	3.77	32.868	295.	21784.0	131898.	1704.	23103.
74	P20	6	1772	56.5	18000.	6530.6	6537	2.3	3.12	25.721	324.	20365.1	116763.	2121.	21533.
75	P22	5	1123	37.6	24000.	6657.5	2809	2.0	2.17	30.621	148.	6091.1	59742.	416.	6688.
76	P24	8	2634	59.5	30000.	6670.5	10459	1.6	2.54	37.364	118.	26556.2	271395.	1233.	29270.
77	P28	11	2313	67.2	44000.	9844.1	15298	2.3	2.13	25.902	167.	32527.0	275168.	2560.	35279.
78	P32	12	3118	51.8	61000.	20925.3	33773	3.1	2.23	19.246	347.	75304.1	451385.	11730.	79818.
79	P34	7	1615	100.0	71000.	30058.3	48544	3.6	1.74	16.789	254.	84538.0	565961.	12327.	90198.
80	P36	5	2159	28.9	82000.	46012.0	28666	5.0	1.64	12.004	362.	47063.8	238966.	10371.	49453.
81	P40	3	995	73.0	106000.	15232.1	11059	1.2	3.96	48.400	54.	43837.6	371688.	602.	47554.
83	P48	2	573	21.6	168000.	4304.0	538	.7	4.87	81.992	9.	2621.0	30633.	5.	2927.
SUBTOTALS		96	25983	54.8	39014.	11746.2	167172	2.7	2.22	22.483	262.	371711.5	2610044.	43843.	397812.

ACCESS LINKS

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	TIME(HR)	ENERGY (KBTU)	TOTAL DISUTILITY COST ($K)	KTON DAYS	ENERGY BBTU	WEIGHTED SUM(000)
18	PA010	7	85.7	900000.	9733.	11.00	4.00	620.00	642.4	9733.	36.	740.
19	PA025	41	75.6	900000.	8635.	27.00	9.00	1550.00	7227.4	100380.	415.	8231.

CLASS		TOTAL		KILOTONS		AVG DISUTILITY PER KTON			TOTAL		DISUTILITY	
NO.	NAME	LINKS	% USED	CAPACITY	AVG FLOW	COST($)	TIME(HR)	ENERGY (KBTU)	COST ($K)	KTON DAYS	ENERGY BBTU	WEIGHTED SUM(000)
20	PA050	17	76.5	900000.	6739.	54.00	19.00	3100.00	4730.5	69351.	272.	5424.
21	PA075	11	81.8	900000.	9313.	81.00	28.00	4650.00	6789.3	97788.	390.	7767.
22	PA100	26	57.7	900000.	2017.	108.00	37.00	6200.00	3267.5	46643.	188.	3734.
23	PA125	8	50.0	900000.	5331.	135.00	46.00	7750.00	2878.9	40873.	165.	3288.
24	PA150	13	69.2	900000.	927.	162.00	55.00	9300.00	1351.7	19122.	78.	1543.
26	PA200	13	46.2	900000.	1578.	216.00	74.00	12400.00	2044.9	29190.	117.	2337.
27	PA250	4	25.0	900000.	2081.	270.00	92.00	15500.00	561.9	7977.	32.	642.
28	PA300	1	100.0	900000.	2186.	324.00	110.00	18600.00	708.3	10019.	41.	808.
SUBTOTALS		144	66.0	900000.	6012.	52.88	18.11	3034.52	30202.6	431076.	1733.	34513.
MODE TOTALS		(TOTAL KTONS =		285578.)					401914.1	3041120.	45576.	432325.

TRANSPORTATION NETWORK MODEL
1972 UNCONSTRAINED RUN - 6

MODAL SUMMARY REPORT - INTERMODAL TRANSFERS

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	DISUTILITY WEIGHTED SUM(000)
NETWORK TOTALS		(TOTAL KTONS = 2094386.)							20873915.8	11511785.	912159.	30110661.

TRANSPORTATION NETWORK MODEL
1972 UNCONSTRAINED RUN - 6

COMMODITY SUMMARY REPORT

COMMODITY NO.	NAME	MODE	KTONS	PER-CENT	MTON-MILES	PER-CENT	COST($K)	PER-CENT	KTON DAYS	PER-CENT	ENERGY BBTU	PER-CENT	TOTAL DISUTILITY	PER-CENT
1	FARM PROD.	RR	78494	47.5	59695	60.3	785062	46.9	584015	61.5	34707	47.3	1643565	53.5
		HWY	59860	36.3	12498	12.6	632474	37.8	28687	3.0	29527	40.2	674643	22.0
		WTR	26760	16.2	26751	27.0	256036	15.3	336877	35.5	9137	12.5	751246	24.5
		TOTAL	165114	100.0	98944	100.0	1673572	100.0	949579	100.0	73372	100.0	3069454	100.0
2	FOREST+MAR	RR	510	6.1	563	29.3	7150	18.9	5159	12.0	346	28.8	9471	16.6
		HWY	346	4.1	0	0.	1896	5.0	133	.3	58	4.8	1956	3.4
		WTR	7502	89.8	1361	70.7	28763	76.1	37628	87.7	798	66.4	45696	80.0
		TOTAL	8358	100.0	1924	100.0	37809	100.0	42920	100.0	1203	100.0	57123	100.0
3	COAL	RR	346485	80.8	126507	85.1	1842920	82.0	1568968	76.9	58011	81.5	1858609	82.0
		HWY	1647	.4	650	.4	64785	2.9	1682	.1	1974	2.8	64802	2.9
		WTR	80578	18.8	21495	14.5	338575	15.1	468447	23.0	11161	15.7	343260	15.1
		TOTAL	428710	100.0	148652	100.0	2246280	100.0	2039096	100.0	71146	100.0	2266671	100.0
4	CRUDE PETR	RR	16690	5.2	5388	3.0	143661	23.2	80344	2.5	4088	7.9	144465	22.2
		HWY	364	.1	164	.1	13334	2.2	335	.0	466	.9	13337	2.0
		WTR	19279	6.0	5605	3.1	59508	9.6	149897	4.6	1504	2.9	61007	9.4
		PPL	285578	88.7	167172	93.7	401914	65.0	3041120	93.0	45576	88.3	432325	66.4
		TOTAL	321911	100.0	178328	100.0	618418	100.0	3271695	100.0	51634	100.0	651134	100.0
5	METAL ORES	RR	61282	91.0	22622	86.2	395551	74.2	367397	90.3	12713	73.9	446987	75.7
		HWY	2908	4.3	1154	4.4	111391	20.9	3016	.7	3528	20.5	111813	18.9
		WTR	3184	4.7	2452	9.3	26371	4.9	36359	8.9	952	5.5	31461	5.3
		TOTAL	67374	100.0	26229	100.0	533313	100.0	406772	100.0	17194	100.0	590261	100.0
6	MINERALS N	RR	79895	87.1	24712	77.5	487059	84.3	409439	79.7	14157	81.9	491154	84.3
		HWY	1993	2.2	63	.2	8575	1.5	689	.1	316	1.8	8582	1.5
		WTR	9825	10.7	7109	22.3	81862	14.2	103664	20.2	2803	16.2	82899	14.2
		TOTAL	91713	100.0	31884	100.0	577496	100.0	513792	100.0	17276	100.0	582634	100.0
7	FOOD+KINDR	RR	41327	24.9	50992	54.8	780418	26.8	409142	72.1	37983	30.6	1590519	39.4
		HWY	118803	71.7	39005	41.9	2080369	71.5	109834	19.4	84830	68.3	2297840	57.0
		WTR	5671	3.4	3088	3.3	50193	1.7	48252	8.5	1428	1.1	145731	3.6
		TOTAL	165800	100.0	93086	100.0	2910980	100.0	567227	100.0	124240	100.0	4034090	100.0
8	TEXTILES+A	RR	784	6.5	1790	23.3	33518	9.4	12202	50.1	1991	12.0	77932	17.6
		HWY	11353	93.5	5891	76.7	321715	90.6	12150	49.9	14587	88.0	365942	82.4

TRANSPORTATION NETWORK MODEL
1972 UNCONSTRAINED RUN - 6

COMMODITY NO.	NAME	MODE	KTONS	PER-CENT	MTON-MILES	PER-CENT	COST($K)	PER-CENT	KTON DAYS	PER-CENT	ENERGY BBTU	PER-CENT	TOTAL DISUTILITY	PER-CENT
		TOTAL	12137	100.0	7681	100.0	355233	100.0	24352	100.0	16578	100.0	443875	100.0
9	TOFC	RR	17646	100.0	14392	100.0	348285	100.0	123001	100.0	16607	100.0	532787	100.0
		TOTAL	17646	100.0	14392	100.0	348285	100.0	123001	100.0	16607	100.0	532787	100.0
10	CHEMICALS	RR	41185	38.1	46648	64.5	590168	39.8	440401	72.4	27001	41.2	1418122	54.0
		HWY	56367	52.1	15040	20.8	791952	53.4	29995	4.9	34380	52.5	848342	32.3
		WTR	10538	9.7	10686	14.8	100764	6.8	137586	22.6	4155	6.3	359426	13.7
		TOTAL	108089	100.0	72375	100.0	1482884	100.0	607982	100.0	65536	100.0	2625891	100.0
11	LUMBER+FUR	RR	25110	51.0	42580	84.7	505264	54.9	270030	91.3	29546	61.2	1145234	70.6
		HWY	23819	48.3	7422	14.8	412026	44.8	21705	7.3	18583	38.5	463468	28.6
		WTR	339	.7	263	.5	3416	.4	3994	1.4	137	.3	12881	.8
		TOTAL	49268	100.0	50265	100.0	920706	100.0	295729	100.0	48265	100.0	1621582	100.0
12	MACHINERY	RR	1732	12.1	3008	29.3	57877	16.7	20716	60.0	3346	18.1	97030	23.6
		HWY	12375	86.5	7054	68.8	285605	82.6	11482	33.3	15053	81.5	307307	74.8
		WTR	192	1.3	189	1.8	2202	.6	2320	6.7	73	.4	6587	1.6
		TOTAL	14299	100.0	10250	100.0	345684	100.0	34518	100.0	18473	100.0	410924	100.0
13	ELEC MACHI	RR	1327	17.1	2756	44.0	67691	31.2	18771	75.9	3792	32.8	86650	35.8
		HWY	6451	82.9	3513	56.0	149229	68.8	5965	24.1	7782	67.2	155254	64.2
		TOTAL	7778	100.0	6269	100.0	216920	100.0	24736	100.0	11574	100.0	241904	100.0
14	TRANSP EQU	RR	6594	45.4	6866	75.0	156779	58.3	64154	93.7	7314	55.3	197196	63.2
		HWY	7915	54.6	2288	25.0	112114	41.7	4302	6.3	5907	44.7	114824	36.8
		TOTAL	14509	100.0	9155	100.0	268893	100.0	68456	100.0	13222	100.0	312020	100.0
15	UNID MANUF	RR	121850	43.0	104492	69.1	1427728	36.8	972474	84.3	63833	38.1	3372676	54.6
		HWY	157298	55.5	43818	29.0	2407908	62.1	138234	12.0	102308	61.1	2684377	43.4
		WTR	4377	1.5	2999	2.0	39755	1.0	42916	3.7	1246	.7	125588	2.0
		TOTAL	283525	100.0	151309	100.0	3875391	100.0	1153625	100.0	167388	100.0	6182641	100.0
16	PAPER+ALLI	RR	24653	49.6	25203	74.0	392899	50.3	219054	83.7	18742	51.7	728052	61.6
		HWY	23107	46.5	7425	21.8	365320	46.8	21072	8.0	16749	46.2	397561	33.6
		WTR	1963	3.9	1429	4.2	22868	2.9	21704	8.3	761	2.1	56075	4.7
		TOTAL	49723	100.0	34057	100.0	781087	100.0	261831	100.0	36253	100.0	1181688	100.0
17	PETRL PROD	RR	43286	52.8	22164	53.6	349463	63.6	282573	45.5	12305	61.1	558568	55.4

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     NNNN     NN
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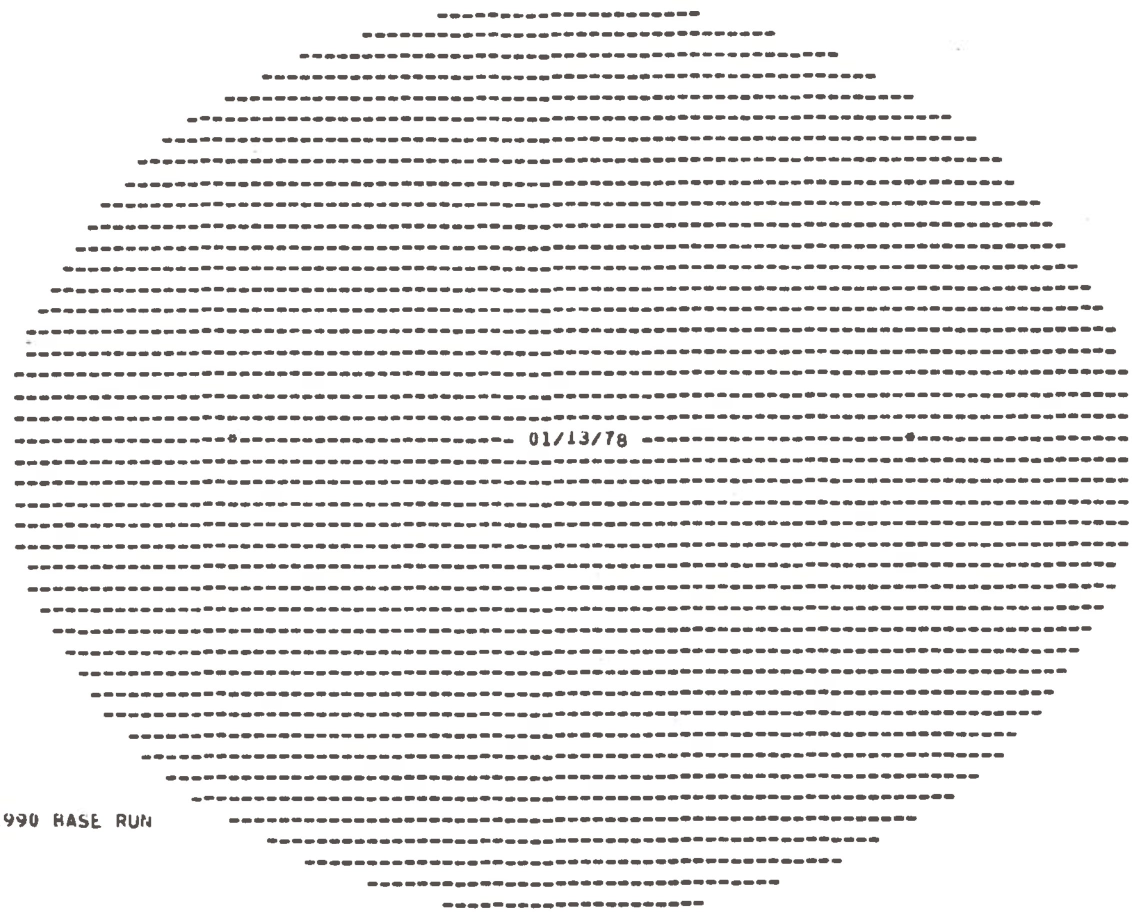

1990 BASE RUN

TRANSPORTATION NETWORK MODEL
1990 BASE RUN

S-Y-S-T-E-M P-A-R-A-M-E-T-E-R-S

MAXIMUM NUMBER OF ITERATIONS	LINK, NODE VOLUME CONVERGENCE CRITERION TO STOP ITERATION	VOLUME VS. ESTIMATION ERROR TOLERANCE	INCLUSION ELLIPSE ECCENTRICITY	BACKUP ELLIPSE ECCENTRICITY	VOLUME ESTIMATE % CHANGE	ENERGY UNITS
1	80.0 %	15.0 %	.60000	.40000	75.0%	BTU

171 REGIONS.

1795 NODES.

3404 LINEHAUL LINKS.

662 ACCESS LINKS.

0 TRANSFER LINKS.

28 NODE CLASSES.
84 LINK CLASSES.
29 ACCESS CLASSES.
0 TRANSFER CLASSES.

20 COMMODITIES.

OUTPUTS SELECTED

INPUT ECHO	NO
PLAYBACK REPORTS	
REGIONS	NO
NODES	NO
LINEHAUL LINKS	NO
ACCESS LINKS	NO
TRANSFER LINKS	NO
COMMODITIES	NO
CLASSES/FUNCTIONS	NO
SHIPMENTS	NO
CONTINUE AFTER PLAYBACK ?	YES
NODE VOLUME ESTIMATE CHANGES	NO
LINK VOLUME ESTIMATE CHANGES	NO
NETWORK FLOW REPORT	NO
NETWORK FILE	YES
NETWORK FLOW FILE	YES
PATH FILE	YES

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--- LARGE ELLIPSE USED FOR FARM PROD. FROM  47        TO  48        (   222.8 KTONS)
--- LARGE ELLIPSE USED FOR TEXTILES+A FROM  28        TO  27        (    46.5 KTONS)
--- LARGE ELLIPSE USED FOR TOFC       FROM 167        TO 171        (    23.5 KTONS)
--- LARGE ELLIPSE USED FOR TOFC       FROM 171        TO 167        (    52.7 KTONS)
--- LARGE ELLIPSE USED FOR CHEMICALS  FROM  47        TO  48        (   438.0 KTONS)
--- LARGE ELLIPSE USED FOR LUMBER+FUR FROM  48        TO  47        (    97.7 KTONS)
--- LARGE ELLIPSE USED FOR UNID MANUF FROM  47        TO  48        (   573.6 KTONS)
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TRANSPORTATION NETWORK MODEL
1990 BASE RUN

ITERATION # 1 PERCENT CONVERGENCE = 21.99

TRANSPORTATION NETWORK MODEL
1990 BASE RUN

MODAL SUMMARY REPORT - RR
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NODES

CLASS NO.	NAME	TOTAL NODES	% USED	KILOTONS CAPACITY	KILOTONS AVG. FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
1	R.EAST	309	76.7	900000.0	24932.7	169.15	9.83	2119.96	999495.3	2421332.4	12526.9	3893346.2
2	R.SOUTH	180	89.4	900000.0	19455.1	164.66	10.84	1997.48	515769.9	1414160.9	6256.6	2393757.2
3	R.WEST	406	84.2	900000.0	14384.2	211.88	11.70	2756.15	1042303.9	2399169.8	13558.6	4997674.4
SUBTOTALS		895	82.7	900000.0	18865.8	183.20	10.72	2316.65	2557569.1	6234663.1	32342.1	11284777.8

LINEHAUL LINKS

CLASS NO.	NAME	TOTAL LINKS	TOTAL MILES	% USED MILES	KILOTONS CAPACITY	KILOTONS AVG FLOW	MTON-MILES	AVG SPEED (MPH)	AVG PER TON/MILE COST MILLS	AVG PER TON/MILE TIME (MIN.)	AVG PER TON/MILE ENERGY BTU	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
1	EF130	1	126	100.0	62000.	58785.0	7407	20.3	11.01	2.951	663.	81520.7	15179.	4908.	109431.
2	EF125	10	567	80.2	62000.	5786.8	2633	42.1	8.37	1.424	558.	22031.0	2605.	1468.	26236.
3	EF120	93	3828	65.8	62000.	11892.3	29933	35.9	6.02	1.672	483.	180097.8	34757.	14471.	227479.
4	EF117	214	8376	58.0	58000.	16681.3	81038	23.2	6.64	2.583	474.	538450.0	145351.	38441.	696619.
5	EF225	4	274	100.0	186000.	12754.3	3495	41.8	7.42	1.436	517.	25934.6	3484.	1807.	31707.
6	EF220	26	930	50.6	186000.	12438.3	5858	41.0	7.18	1.463	497.	42051.0	5952.	2909.	49349.
7	EF217	129	5015	72.7	174000.	15720.5	57285	38.2	5.90	1.571	446.	337986.2	62492.	25531.	403356.
8	EF320	3	157	6.4	310000.	14205.7	142	43.0	9.74	1.396	525.	1383.3	138.	75.	1635.
9	EF317	65	2434	81.0	290000.	33076.2	65193	38.6	6.36	1.554	511.	414334.9	70374.	33301.	528795.
10	EH125	4	154	70.8	58000.	2543.2	277	41.1	9.86	1.459	647.	2733.3	281.	179.	3251.
11	EH120	31	1660	59.2	58000.	15795.2	15511	35.1	5.68	1.712	528.	88149.9	18439.	8186.	107207.
12	EH117	6	632	86.6	45000.	8854.8	4844	26.1	5.22	2.296	456.	25300.8	7723.	2210.	29725.
13	EH220	12	633	83.1	174000.	21236.9	11171	38.6	5.90	1.554	527.	65887.1	12054.	5883.	77623.
14	EH217	6	505	75.6	135000.	13333.7	5093	28.3	4.97	2.118	397.	25290.5	7493.	2021.	27600.
15	EH320	6	393	89.1	290000.	42393.5	14838	38.5	5.11	1.558	468.	75780.9	16050.	6940.	84194.
16	SF125	4	249	100.0	60000.	1573.2	392	39.[illegible]	10.10	1.516	553.	3958.3	413.	217.	4788.
17	SF120	291	17643	72.1	60000.	12055.5	153249	30.0	6.36	2.002	496.	974440.1	213025.	76040.	1260824.
18	SF117	7	450	100.0	60000.	19796.6	8908	16.1	6.87	3.726	497.	61236.9	23050.	4428.	94261.
19	SF220	41	1867	70.4	180000.	15795.7	20756	37.8	6.61	1.585	494.	137112.6	22852.	10243.	170869.
20	SF217	2	156	80.8	180000.	37489.1	4724	36.8	4.47	1.629	399.	21114.7	5344.	1883.	25380.
21	SF320	4	125	100.0	300000.	11104.3	1388	39.4	9.26	1.524	507.	12851.0	1469.	704.	14673.
22	SH125	1	130	100.0	45000.	21611.0	2809	25.6	5.25	2.341	465.	14743.6	4568.	1306.	16340.
23	SH120	12	1014	90.6	45000.	16366.8	15041	20.1	6.53	2.982	501.	98230.5	31152.	7529.	125414.
24	SH117	10	621	88.7	45000.	27067.7	14914	17.9	5.28	3.353	408.	78752.5	34729.	6083.	89970.
25	SH225	1	60	100.0	135000.	12957.7	777	30.3	6.47	1.981	458.	5029.6	1070.	356.	5449.
26	SH220	1	42	100.0	135000.	46674.4	1960	27.9	5.52	2.147	502.	10828.8	2923.	983.	13533.

CLASS NO.	NAME	TOTAL LINKS	TOTAL MILES	% USED MILES	KILOTONS CAPACITY	KILOTONS AVG FLOW	MTON-MILES	AVG SPEED (MPH)	AVG PER TON/MILE COST MILLS	AVG PER TON/MILE TIME (MIN.)	AVG PER TON/MILE ENERGY BTU	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
28	WF125	67	4903	63.9	70000.	4219.6	13216	47.2	7.56	1.271	543.	99856.2	11666.	7172.	116603.
29	WF120	399	28661	77.1	70000.	12027.0	265616	39.3	6.51	1.528	565.	1730192.6	281872.	150017.	2208065.
30	WF117	108	6549	73.3	70000.	4608.5	22116	45.2	6.55	1.326	529.	144760.0	20367.	11697.	179372.
31	WF225	12	930	80.6	210000.	6049.8	4537	48.4	8.29	1.240	512.	37630.1	3909.	2324.	42296.
32	WF220	103	4897	84.0	210000.	13099.0	53863	47.2	6.97	1.272	543.	375239.4	47568.	29243.	450599.
33	WF217	3	113	100.0	210000.	1374.9	155	49.9	11.47	1.203	500.	1761.4	130.	78.	1957.
34	WF320	17	749	78.8	350000.	20803.2	12274	47.8	7.70	1.254	552.	94464.3	10691.	6777.	108065.
35	WH130	47	6337	91.3	62000.	11775.0	68142	35.9	8.98	1.669	820.	612180.2	78982.	55868.	753412.
36	WH230	13	1468	99.1	186000.	23611.6	34355	42.3	8.94	1.417	809.	307217.4	33803.	27806.	368445.
SUBTOTALS		1754	102709	74.7	95442.	13084.9	1003912	34.0	6.72	1.767	547.	6748554.1	1231955.	549086.	8454521.

ACCESS LINKS

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
1	EAR25	59	100.0	900000.	23648.	1708.51	18.45	13716.24	2383792.8	1072445.	19138.	3444601.
3	SOR25	39	100.0	900000.	16671.	1600.79	19.32	11719.73	1040797.1	523506.	7620.	1526017.
5	WSR25	80	98.8	900000.	11386.	1842.43	21.38	16260.06	1657323.6	801146.	14626.	2807591.
6	WSR50	17	86.2	900000.	4374.	1996.50	22.29	22554.46	130994.5	60926.	1480.	213922.
SUBTOTALS		195	98.5	900000.	15660.	1731.54	19.60	14237.75	5212908.0	2458023.	42864.	7992131.
MODE TOTALS	(TOTAL KTONS = 1505303.)								14519031.2	9924641.	624292.	27731429.

TRANSPORTATION NETWORK MODEL
1990 BASE RUN

MODAL SUMMARY REPORT - HWY

NODES

CLASS NO.	NAME	TOTAL NODES	% USED	KILOTONS CAPACITY	KILOTONS AVG. FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
4	PEN00	514	72.2	900000.0	8602.8	0.	0.	0.	0.	0.	0.	0.
5	PEN05	30	96.7	900000.0	21697.4	170.18	.08	4457.52	107080.3	2183.9	3119.4	111717.2
6	PEN07	23	100.0	900000.0	25551.2	236.58	.12	6899.41	139034.4	2864.9	4054.6	145024.0
7	PEN11	12	100.0	900000.0	36096.6	375.44	.18	10836.49	162634.5	3303.0	4694.2	169563.9
8	PEN18	3	100.0	900000.0	65190.7	597.51	.30	17494.92	116855.8	2444.7	3421.5	121671.3
SUBTOTALS		582	75.3	900000.0	11500.6	104.34	.05	3035.32	525605.1	10796.5	15289.7	547976.3

LINEHAUL LINKS

CLASS NO.	NAME	TOTAL LINKS	TOTAL MILES	% USED MILES	KILOTONS CAPACITY	KILOTONS AVG FLOW	MTON-MILES	AVG SPEED (MPH)	AVG PER TON/MILE COST MILLS	AVG PER TON/MILE TIME (MIN.)	AVG PER TON/MILE ENERGY BTU	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
37	D.L.FREE	247	17090	91.4	75000.	8818.8	137777	61.8	31.94	.971	1888.	4400100.5	92922.	260189.	4593626.
38	D.R.FREE	129	9063	76.0	48000.	6015.4	41458	49.0	41.49	1.224	2214.	1720295.0	35226.	91783.	1795836.
39	D.M.FREE	81	7413	39.4	28000.	1990.1	5817	39.0	52.69	1.537	2570.	306518.2	6210.	14949.	316928.
40	D.L.TOLL	40	2998	88.4	75000.	9169.9	24291	61.0	35.94	.983	1828.	872939.3	16589.	44400.	907279.
41	D.R.TOLL	33	2031	72.4	48000.	8862.5	13037	47.3	46.57	1.269	2154.	607128.0	11486.	28078.	631910.
42	D.M.TOLL	15	749	64.8	28000.	5129.6	2488	37.7	59.71	1.591	2598.	148546.9	2749.	6464.	154976.
43	U.LEVEL	443	34384	44.7	15200.	2201.6	33807	42.3	46.65	1.420	1428.	1577128.6	33337.	48261.	1645982.
44	U.ROLLING	165	14320	21.0	9500.	1575.3	4734	30.7	67.59	1.955	2024.	319951.1	6428.	9581.	333251.
45	U.MOUNT	139	15530	5.4	5000.	1391.0	1174	17.5	129.67	3.424	2824.	152238.4	2791.	3315.	153514.
SUBTOTALS		1292	103578	47.5	43320.	5372.4	264582	53.1	38.19	1.131	1916.	10104845.9	207738.	507020.	10533303.

ACCESS LINKS

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
7	HA25	134	97.0	900000.	12662.	1985.43	6.47	40000.03	3268225.3	443862.	65844.	4229156.
8	HA5	55	80.0	900000.	4610.	3238.62	7.07	80003.22	656957.8	59788.	16229.	781094.
9	HA75	5	80.0	900000.	3842.	4322.11	7.06	119991.15	66426.6	4520.	1844.	74205.

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	DISUTILITY WEIGHTED SUM(000)
SUBTOTALS		194	91.8	900000.	10474.	2141.05	6.54	45012.08	3991609.7	508170.	83917.	5084455.
MODE TOTALS		(TOTAL KTONS = 932165.)							14622060.7	726705.	606227.	16165734.

TRANSPORTATION NETWORK MODEL
1990 BASE RUN

MODAL SUMMARY REPORT - WTR

NODES

CLASS NO.	NAME	TOTAL NODES	% USED	KILOTONS CAPACITY	KILOTONS AVG. FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
9	MAJR.FLEET	7	100.0	900000.0	55683.3	225.00	24.00	2700.00	87701.1	389782.7	1052.4	383165.7
10	INMD.FLEET	3	100.0	900000.0	53426.2	150.00	16.00	1800.00	24041.8	106852.5	288.5	101531.8
11	MINR.FLEET	5	100.0	900000.0	26840.3	75.00	8.00	900.00	10065.1	44733.9	120.8	36647.5
12	THRU+ACCES	97	96.9	900000.0	23086.9	0.	0.	0.	0.	0.	0.	0.
13	UM600.110	23	100.0	50000.0	17474.7	24.61	1.42	1514.83	9890.8	23858.3	608.8	37504.1
14	UM.LD26	1	100.0	90000.0	56569.7	52.06	3.08	2865.12	2945.0	7251.7	162.1	8739.6
15	IL600.110	12	100.0	50000.0	27182.9	59.34	3.52	2855.37	19356.2	47832.4	931.4	47793.3
16	AK600.110	42	90.5	45000.0	15001.9	106.35	6.45	4491.18	60626.0	153110.4	2560.3	158842.7
17	OH12+6.110	16	100.0	120000.0	30539.6	15.20	.97	873.08	7426.8	19835.6	426.6	17185.1
18	OH.NAVPASS	2	100.0	195000.0	27721.8	13.53	.73	645.00	750.2	1681.2	35.8	2270.7
19	OH.GALLPLS	1	100.0	80000.0	28160.7	23.70	1.53	1275.04	667.3	1793.8	35.9	1324.5
20	OH600+360	7	100.0	60000.0	12683.0	17.89	1.05	1013.56	1586.5	3883.6	90.0	3715.4
21	MN360.56	12	83.3	40000.0	739.4	25.99	1.03	894.16	192.2	317.7	6.6	227.9
22	MN720.XX+	4	100.0	100000.0	2908.2	9.26	.64	545.71	107.7	312.1	6.3	120.0
23	TNUM.360+	4	100.0	30000.0	3625.4	42.59	1.93	1953.10	617.6	1165.5	28.3	1914.4
24	XX400+.75+	5	100.0	35000.0	5790.6	54.86	1.72	1937.68	1588.3	2075.8	56.1	3122.1
25	KW2X360.56	4	100.0	60000.0	3478.4	25.76	1.53	939.46	358.5	865.5	13.1	1325.3
26	GIWW.XXXX	7	100.0	55000.0	31109.3	49.05	2.87	1092.39	10681.0	26008.8	237.9	31229.4
27	KY145.XX	6	100.0	4500.0	203.7	43.68	.94	2443.53	53.4	48.1	3.0	58.8
SUBTOTALS		258	96.5	426534.1	20745.3	46.20	3.86	1290.06	238657.4	831429.6	6663.9	836718.3

LINEHAUL LINKS

CLASS NO.	NAME	TOTAL LINKS	TOTAL MILES	% USED MILES	KILOTONS CAPACITY	KILOTONS AVG FLOW	MTON-MILES	AVG SPEED (MPH)	AVG PER TON/MILE COST MILLS	AVG PER TON/MILE TIME (MIN.)	AVG PER TON/MILE ENERGY BTU	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
46	LWR.MISS.R	9	665	98.5	900000.	63413.9	41536	8.8	3.55	6.799	291.	147411.8	196107.	12104.	293589.
47	UPR.MISS.R	46	733	100.0	900000.	27122.9	19881	7.1	3.74	8.459	305.	74454.3	116791.	6066.	187932.
48	ARKANSAS.R	25	440	100.0	900000.	1858.4	818	6.3	4.02	9.585	201.	3286.7	5443.	164.	7851.
49	OHIO.RIVER	43	997	100.0	900000.	27877.5	27794	8.8	2.75	6.783	191.	76433.0	130926.	5309.	127495.
50	L.MONONGHL	3	42	100.0	900000.	2908.2	122	7.6	3.15	7.920	187.	384.7	672.	23.	411.
51	U.MONONGHL	8	82	100.0	900000.	2898.6	238	7.6	3.15	7.920	187.	748.7	1307.	44.	792.
52	ALLEGHENY	10	68	100.0	900000.	197.8	13	7.2	2.75	8.338	198.	37.0	78.	3.	68.
53	TENNESSEE	17	553	100.0	900000.	10368.1	5734	8.2	3.15	7.306	204.	18060.6	29090.	1171.	41668.
54	CLINCH/EMY	2	51	100.0	900000.	207.8	11	7.8	3.00	7.676	223.	31.8	57.	2.	139.
[illegible]	CUMBERLAND	4	91	100.0	900000.	18527.6	1686	7.8	3.00	7.680	223.	5058.0	8992.	376.	10579.

CLASS NO.	NAME	TOTAL LINKS	TOTAL MILES	% USED MILES	KILOTONS CAPACITY	KILOTONS AVG FLOW	MTON-MILES	AVG SPEED (MPH)	AVG PER TON/MILE COST MILLS	AVG PER TON/MILE TIME (MIN.)	AVG PER TON/MILE ENERGY BTU	TOTAL COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
56	KANAWHA.R	4	86	100.0	900000.	71.2	6	6.9	3.00	8.759	187.	18.4	37.	1.	92.
57	KENTUCKY.R	7	108	100.0	900000.	203.7	22	7.2	5.50	8.339	719.	121.0	127.	16.	135.
58	ILLINOIS.R	13	326	100.0	900000.	32828.0	10702	7.4	3.15	8.100	248.	33711.1	60198.	2654.	65287.
59	GIWW.WEST	15	549	98.7	900000.	30366.9	16459	6.5	3.60	9.300	175.	59251.9	106297.	2880.	150503.
60	GIWW.EAST	4	245	100.0	900000.	29523.9	7233	6.1	4.73	9.850	204.	34185.8	49480.	1475.	67105.
61	BW/TOMB/MO	11	375	100.0	900000.	23826.2	8935	6.5	3.15	9.300	164.	28144.7	57704.	1465.	66567.
63	MISSOURI.R	3	224	100.0	900000.	10076.7	2257	7.6	6.58	7.898	377.	14856.5	12380.	851.	36028.
64	AP/CHAT/FL	7	287	100.0	900000.	1029.2	295	6.1	13.44	9.782	542.	3970.9	2007.	160.	6352.
65	ATCHAF/OLD	4	121	100.0	900000.	9276.1	1122	7.5	9.40	7.968	219.	10546.5	6211.	246.	20948.
66	RED.RIVER	2	69	100.0	900000.	1129.1	78	7.4	6.30	8.100	514.	490.8	438.	40.	1280.
67	OUACHTA/BL	6	359	61.3	900000.	6.4	1	6.8	5.50	8.778	556.	7.7	9.	1.	12.
68	P.ALLEN.RT	3	64	100.0	900000.	15080.5	965	7.4	3.60	8.100	293.	3474.5	5429.	283.	6757.
84	TENN.TOM	12	265	100.0	900000.	43109.6	11424	6.5	3.15	9.300	164.	35985.8	73780.	1874.	81841.
SUBTOTALS		262	7075	93.9	900000.	23680.4	157333	7.6	3.50	7.904	236.	550672.3	863559.	37209.	1173430.

ACCESS LINKS

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
10	WA025	50	90.0	900000.	8938.	1544.11	43.30	24330.14	621052.6	725678.	9786.	1057997.
11	WA050	15	80.0	900000.	1370.	2111.26	55.74	35349.34	34709.1	38181.	581.	60397.
12	WA075	17	70.6	900000.	3333.	2079.73	76.46	36318.13	83172.4	127404.	1452.	137657.
13	WA100	15	86.7	900000.	353.	4585.99	64.44	88487.96	21063.5	12333.	406.	33691.
14	WA125	12	75.0	900000.	790.	3546.95	65.42	77373.61	25211.7	19375.	550.	36120.
15	WA150	9	33.3	900000.	137.	1730.55	126.30	48831.25	713.0	2168.	20.	2361.
16	WA175	9	66.7	900000.	112.	4890.49	101.33	119116.64	3276.6	2829.	80.	5847.
17	WA200	2	100.0	900000.	634.	4682.83	130.50	112747.27	5937.8	6895.	143.	11860.
SUBTOTALS		129	79.1	900000.	4634.	1682.15	47.47	27541.55	795136.7	934863.	13019.	1345930.

MODE TOTALS (TOTAL KTONS = 236347.) 1584466.4 2629851. 56891. 3356079.

TRANSPORTATION NETWORK MODEL
1990 BASE RUN

MODAL SUMMARY REPORT - PPL

NODES

CLASS NO.	NAME	TOTAL NODES	% USED	KILOTONS CAPACITY	KILOTONS AVG. FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
28	PIPELINE	60	75.0	900000.0	25388.7	0.	0.	0.	0.	0.	0.	0.
SUBTOTALS		60	75.0	900000.0	25388.7	0.	0.	0.	0.	0.	0.	0.

LINEHAUL LINKS

CLASS NO.	NAME	TOTAL LINKS	TOTAL MILES	% USED MILES	KILOTONS CAPACITY	KILOTONS AVG FLOW	MTON-MILES	AVG SPEED (MPH)	AVG PER TON/MILE COST MILLS	AVG PER TON/MILE TIME (MIN.)	AVG PER TON/MILE ENERGY BTU	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
69	P06	3	348	39.9	1000.	202.6	28	.9	5.34	65.304	108.	150.6	1278.	3.	163.
70	P10	5	1763	71.6	4000.	1123.2	1418	2.2	2.60	27.424	320.	3681.0	26996.	454.	3952.
71	P14	5	1631	60.1	8000.	2393.5	2348	2.0	3.37	29.844	306.	7901.8	48663.	719.	8390.
72	P16	5	1236	34.7	11000.	2163.3	928	1.4	2.82	41.923	134.	2619.0	27019.	124.	2664.
73	P18	18	4284	58.2	14000.	2527.7	6299	1.8	3.45	33.480	247.	21742.7	146456.	1558.	23210.
74	P20	6	1772	56.5	18000.	6727.0	6734	3.5	4.78	16.966	640.	32186.0	79335.	4311.	32986.
75	P22	5	1123	37.6	24000.	8623.6	3639	2.5	2.17	23.995	204.	7897.2	60641.	741.	8505.
76	P24	8	2634	59.5	30000.	8143.1	12768	1.9	2.31	31.284	164.	29506.0	277396.	2094.	32283.
77	P28	11	2313	55.0	44000.	16257.7	20664	3.2	2.13	18.592	261.	44005.8	266788.	5396.	46682.
78	P32	12	3118	49.1	61000.	24548.5	37584	3.4	2.21	17.557	359.	83033.6	458239.	13499.	87637.
79	P34	7	1615	100.0	71000.	37213.9	60100	4.4	1.71	13.565	330.	102579.9	566163.	19815.	108273.
80	P36	5	2159	28.9	82000.	62942.2	39213	7.1	2.10	8.426	609.	82275.2	229444.	23886.	84607.
81	P40	3	995	73.0	106000.	11281.5	8190	1.1	4.46	56.830	41.	36512.8	323237.	339.	39746.
83	P48	2	573	21.8	168000.	5016.7	627	.7	4.81	80.566	10.	3018.7	35085.	6.	3370.
SUBTOTALS		96	25983	54.6	38128.	14137.5	200540	3.3	2.28	18.287	364.	457110.4	2546740.	72945.	482693.

ACCESS LINKS

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
18	PA010	7	85.7	900000.	10203.	11.00	4.00	620.02	673.4	10203.	38.	776.
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	DISUTILITY WEIGHTED SUM(000)
20	PA050	17	70.6	900000.	9529.	54.00	19.00	3100.02	6175.2	90531.	354.	7081.
21	PA075	11	81.8	900000.	11444.	81.00	28.00	4649.92	8342.6	120161.	479.	9545.
22	PA100	26	57.7	900000.	2559.	108.01	37.00	6200.31	4145.1	59171.	238.	4737.
23	PA125	8	50.0	900000.	6571.	135.01	46.00	7750.50	3548.8	50385.	204.	4053.
24	PA150	13	69.2	900000.	1259.	162.00	55.00	9300.12	1835.5	25965.	105.	2095.
26	PA200	13	46.2	900000.	1860.	215.99	74.00	12399.69	2410.9	34415.	138.	2755.
27	PA250	4	25.0	900000.	4081.	269.98	91.99	15499.05	1101.8	15643.	63.	1258.
28	PA300	1	100.0	900000.	2276.	323.96	109.98	18597.45	737.3	10430.	42.	842.
SUBTOTALS		144	65.3	900000.	7497.	53.85	18.45	3090.57	37952.4	541649.	2178.	43372.
MODE TOTALS		(TOTAL KTONS =	352371.)						495062.8	3088390.	75123.	526066.

TRANSPORTATION NETWORK MODEL
1990 BASE RUN

MODAL SUMMARY REPORT - INTERMODAL TRANSFERS

CLASS NO.	CLASS NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	DISUTILITY WEIGHTED SUM(000)
NETWORK TOTALS		(TOTAL KTONS = 3026186.)							31220621.016369587.		1362533.	47779309.

TRANSPORTATION NETWORK MODEL
1990 BASE RUN

COMMODITY SUMMARY REPORT

COMMODITY NO.	NAME	MODE	KTONS	PER-CENT	MTON-MILES	PER-CENT	COST($K)	PER-CENT	KTON DAYS	PER-CENT	ENERGY BBTU	PER-CENT	TOTAL DISUTILITY	PER-CENT
1	FARM PROD.	RR	96198	52.1	75263	65.7	955670	51.1	755051	66.8	43441	53.2	2065664	58.5
		HWY	62032	33.6	12734	11.1	652546	34.9	29567	2.6	28855	35.3	696055	19.7
		WTR	26541	14.4	26485	23.1	260833	14.0	346445	30.6	9353	11.5	770122	21.8
		TOTAL	184771	100.0	114482	100.0	1869049	100.0	1131063	100.0	81649	100.0	3531841	100.0
2	FOREST+MAR	RR	456	4.9	398	20.7	5472	13.4	4116	8.7	245	19.9	7325	11.8
		HWY	414	4.4	3	.2	2278	5.6	159	.3	73	6.0	2350	3.8
		WTR	8496	90.7	1518	79.1	33124	81.0	43226	91.0	912	74.1	52577	84.5
		TOTAL	9366	100.0	1919	100.0	40874	100.0	47501	100.0	1231	100.0	62252	100.0
3	COAL	RR	475709	91.4	176101	92.5	2276447	89.8	1658569	84.9	71228	89.3	2293146	89.8
		HWY	1522	.3	604	.3	60767	2.4	1568	.1	1832	2.3	60786	2.4
		WTR	43174	8.3	13694	7.2	198112	7.8	292468	15.0	6711	8.4	201047	7.9
		TOTAL	520405	100.0	190399	100.0	2535326	100.0	1952605	100.0	79771	100.0	2554979	100.0
4	CRUDE PETR	RR	23433	5.6	7228	3.1	193929	21.5	112969	3.1	5533	6.2	195067	20.8
		HWY	471	.1	181	.1	21181	2.4	472	.0	565	.6	21187	2.3
		WTR	40945	9.8	22574	9.8	190328	21.1	471698	12.8	7579	8.5	195057	20.8
		PPL	352371	84.5	200540	87.0	495063	55.0	3088390	84.1	75123	84.6	526066	56.1
		TOTAL	417219	100.0	230523	100.0	900501	100.0	3673528	100.0	88800	100.0	937377	100.0
5	METAL ORES	RR	77857	81.8	23510	54.4	463962	59.9	411091	62.8	13935	56.4	521537	60.2
		HWY	4244	4.5	1821	4.2	165033	21.3	4500	.7	5341	21.6	165671	19.1
		WTR	13105	13.8	17914	41.4	145834	18.8	239349	36.5	5438	22.0	179352	20.7
		TOTAL	95205	100.0	43245	100.0	774829	100.0	654940	100.0	24713	100.0	866560	100.0
6	MINERALS N	RR	136968	88.3	43243	78.2	825699	85.1	697615	79.7	25149	83.7	832715	85.0
		HWY	3047	2.0	100	.2	12867	1.3	1048	.1	475	1.6	12879	1.3
		WTR	15048	9.7	11985	21.7	131825	13.6	176538	20.2	4436	14.8	133598	13.6
		TOTAL	155063	100.0	55328	100.0	970392	100.0	875201	100.0	30060	100.0	979191	100.0
7	FOOD+KINDR	RR	68476	31.1	82576	63.7	1268521	33.8	696108	79.6	61537	38.9	2646914	48.3
		HWY	145441	66.1	44132	34.1	2424833	64.7	131796	15.1	95044	60.1	2685939	49.0
		WTR	6034	2.7	2833	2.2	56466	1.5	46649	5.3	1463	.9	148832	2.7
		TOTAL	219951	100.0	129540	100.0	3749820	100.0	874553	100.0	158044	100.0	5481686	100.0
8	TEXTILES+A	RR	997	5.7	2296	21.8	44317	8.7	16477	48.3	2633	11.6	104298	16.5
		HWY	16624	94.3	8227	78.2	463851	91.3	17621	51.7	20046	88.4	528025	83.5

TRANSPORTATION NETWORK MODEL
1990 BASE RUN

COMMODITY NO.	NAME	MODE	KTONS	PER-CENT	MTON-MILES	PER-CENT	COST($K)	PER-CENT	KTON DAYS	PER-CENT	ENERGY BBTU	PER-CENT	TOTAL DISUTILITY	PER-CENT
		TOTAL	17621	100.0	10523	100.0	508168	100.0	34098	100.0	22679	100.0	632323	100.0
9	TOFC	RR	27095	100.0	21413	100.0	515832	100.0	191018	100.0	24902	100.0	802398	100.0
		TOTAL	27095	100.0	21413	100.0	515832	100.0	191018	100.0	24902	100.0	802398	100.0
10	CHEMICALS	RR	113067	50.7	123269	79.2	1597630	54.6	1237159	86.8	72769	57.2	3923604	70.0
		HWY	98033	44.0	22584	14.5	1236981	42.3	49266	3.5	51028	40.1	1329681	23.7
		WTR	11876	5.3	9856	6.3	91875	3.1	138753	9.7	3481	2.7	352737	6.3
		TOTAL	222977	100.0	155710	100.0	2926486	100.0	1425178	100.0	127279	100.0	5606023	100.0
11	LUMBER+FUR	RR	43605	56.2	66631	85.9	812171	58.2	456675	92.5	46465	64.1	1894565	73.8
		HWY	33450	43.1	10542	13.6	577681	41.4	30458	6.2	25798	35.6	649907	25.3
		WTR	572	.7	389	.5	6101	.4	6685	1.4	193	.3	21944	.9
		TOTAL	77626	100.0	77562	100.0	1395953	100.0	493818	100.0	72456	100.0	2566416	100.0
12	MACHINERY	RR	4574	18.5	8617	44.7	164541	26.8	62510	71.8	9503	30.7	282701	36.3
		HWY	19592	79.2	10171	52.8	443691	72.2	17905	20.6	21258	68.7	477565	61.3
		WTR	568	2.3	480	2.5	6052	1.0	6689	7.7	195	.6	18695	2.4
		TOTAL	24733	100.0	19268	100.0	614285	100.0	87104	100.0	30956	100.0	778960	100.0
13	ELEC MACHI	RR	3070	15.0	5906	38.8	148529	26.6	42949	72.6	8263	29.6	191921	31.1
		HWY	17395	85.0	9322	61.2	408916	73.4	16240	27.4	19672	70.4	425350	68.9
		TOTAL	20465	100.0	15228	100.0	557446	100.0	59189	100.0	27935	100.0	617271	100.0
14	TRANSP EQU	RR	11938	47.5	11864	76.2	276644	58.7	118249	94.2	12943	58.6	351161	63.8
		HWY	13215	52.5	3702	23.8	194541	41.3	7294	5.8	9137	41.4	199151	36.2
		TOTAL	25152	100.0	15566	100.0	471185	100.0	125542	100.0	22080	100.0	550312	100.0
15	UNID MANUF	RR	231069	49.8	194789	75.5	2681734	43.8	1901045	87.7	120414	46.8	6484015	62.0
		HWY	225504	48.6	59086	22.9	3367023	55.0	196093	9.1	135005	52.4	3759424	36.0
		WTR	7126	1.5	4239	1.6	73174	1.2	69452	3.2	2058	.8	212082	2.0
		TOTAL	463698	100.0	258114	100.0	6121931	100.0	2166591	100.0	257476	100.0	10455521	100.0
16	PAPER+ALLI	RR	47557	52.5	46520	74.6	730912	53.1	419438	80.8	35170	56.7	1372709	63.2
		HWY	37757	41.7	11503	18.5	587530	42.7	34175	6.6	24822	40.0	639857	29.5
		WTR	5286	5.8	4304	6.9	58639	4.3	65277	12.6	2003	3.2	158516	7.3
		TOTAL	90599	100.0	62328	100.0	1377081	100.0	518890	100.0	61995	100.0	2171081	100.0
17	PETRL PROD	RR	62081	48.8	30067	43.9	489634	57.0	383539	35.8	17438	54.9	773481	46.8

TRANSPORTATION NETWORK MODEL
1990 BASE RUN

COMMODITY NO.	NAME	MODE	KTONS	PER-CENT	MTON-MILES	PER-CENT	COST($K)	PER-CENT	KTON DAYS	PER-CENT	ENERGY BBTU	PER-CENT	TOTAL DISUTILITY	PER-CENT
		HWY	11909	9.4	677	1.0	71318	8.3	4439	.4	2490	7.8	74607	4.5
		WTR	53294	41.9	37674	55.1	298236	34.7	682146	63.7	11842	37.3	803042	48.6
		TOTAL	127284	100.0	68416	100.0	859189	100.0	1070124	100.0	31771	100.0	1651130	100.0
18	PRMY METAL	RR	30481	28.0	28483	54.8	352865	26.0	287362	77.4	16592	27.0	818418	41.8
		HWY	74494	68.3	20219	38.9	972745	71.6	40943	11.0	43716	71.1	1039142	53.0
		WTR	4058	3.7	3301	6.3	32244	2.4	42929	11.6	1184	1.9	101791	5.2
		TOTAL	109033	100.0	52003	100.0	1357854	100.0	371234	100.0	61493	100.0	1959351	100.0
19	FABR METAL	RR	9508	19.0	14031	46.6	215370	21.0	105255	76.1	11765	24.4	469053	34.5
		HWY	40441	81.0	16051	53.4	812005	79.0	33080	23.9	36538	75.6	891785	65.5
		TOTAL	49949	100.0	30082	100.0	1027375	100.0	138335	100.0	48303	100.0	1360838	100.0
20	MISCELLANE	RR	41166	24.5	41704	55.8	499149	18.9	367447	76.7	24367	22.4	1700738	40.4
		HWY	126583	75.4	32924	44.1	2146273	81.1	110082	23.0	84530	77.6	2506374	59.5
		WTR	225	.1	87	.1	1624	.1	1549	.3	42	.0	6687	.2
		TOTAL	167974	100.0	74714	100.0	2647046	100.0	479077	100.0	108939	100.0	4213800	100.0
TOTAL, ALL COMMODITIES-														
		RR	1505303	49.7	1003912	61.7	14519031	46.5	9924642	60.6	624292	45.8	27731429	58.0
		HWY	932165	30.8	264582	16.3	14622061	46.8	726705	4.4	606227	44.5	16165734	33.8
		WTR	236347	7.8	157333	9.7	1584466	5.1	2629852	16.1	56891	4.2	3356079	7.0
		PPL	352371	11.6	200540	12.3	495063	1.6	3088390	18.9	75123	5.5	526066	1.1
		XFR	0	0.	0	0.	0	0.	0	0.	0	0.	0	0.
TOTAL, ALL MODES=			3026186	100.0	1626367	100.0	31220621	100.0	16369587	100.0	1362533	100.0	47779309	100.0

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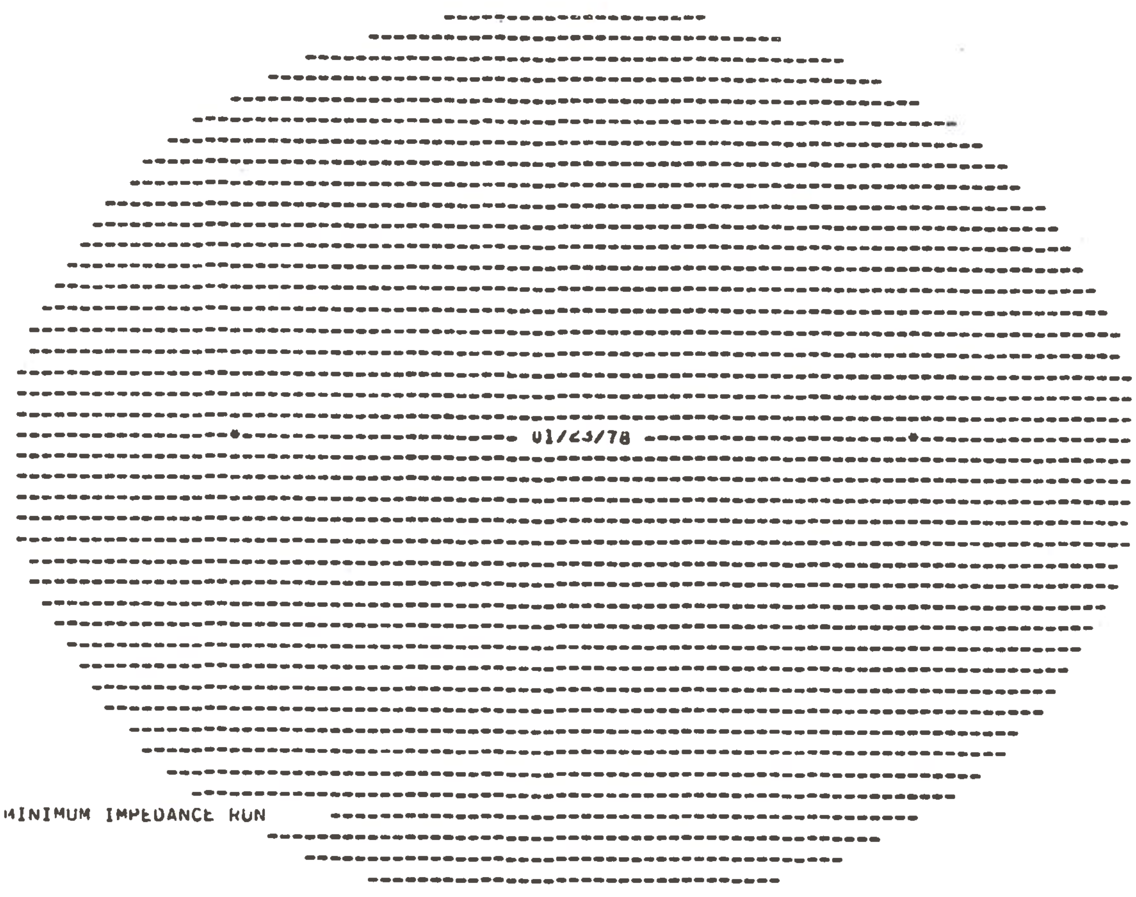

1990 TOFC MINIMUM IMPEDANCE RUN

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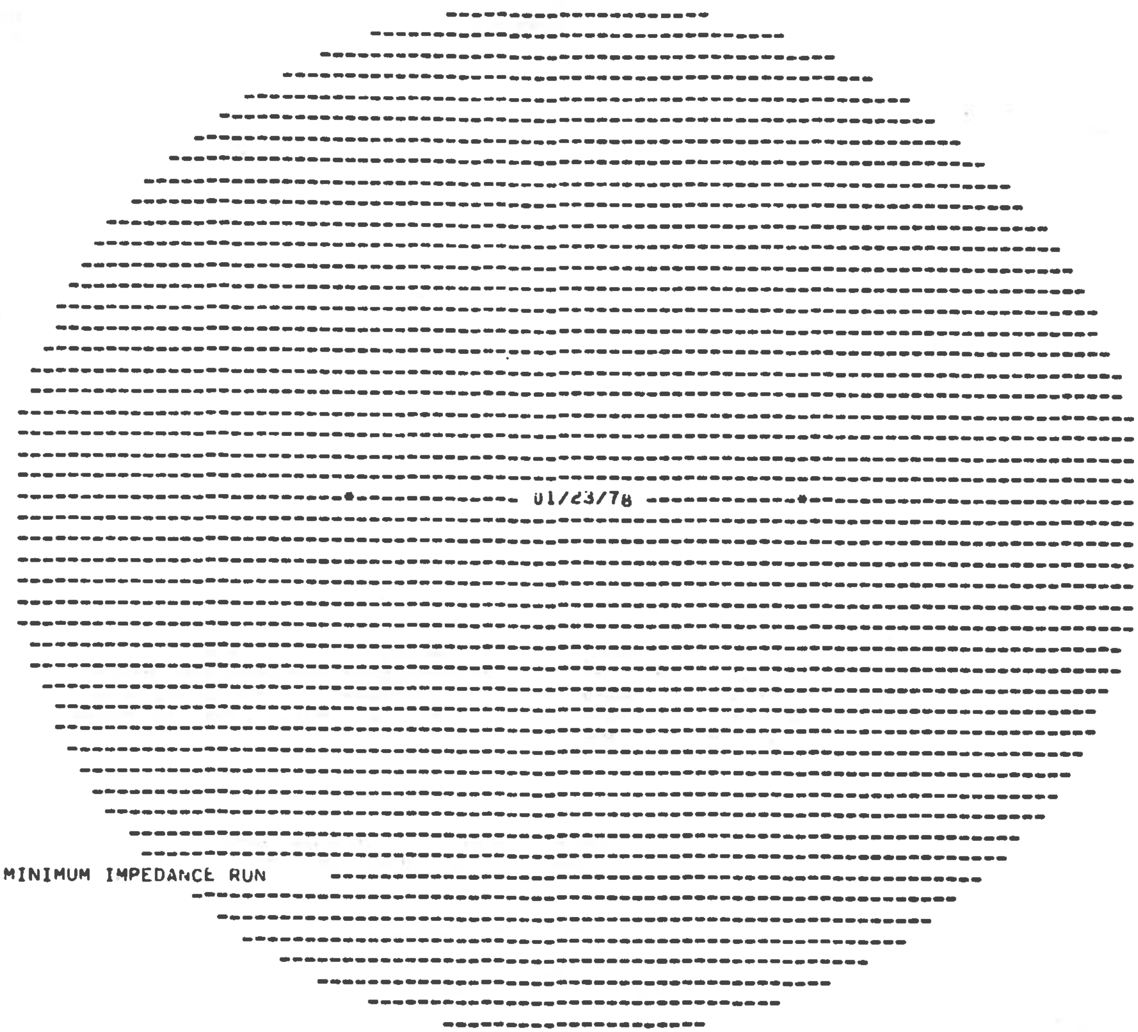

1990 TOFC MINIMUM IMPEDANCE RUN

TRANSPORTATION NETWORK MODEL
1990 TOFC MINIMUM IMPEDANCE RUN

S-Y-S-T-E-M P-A-R-A-M-E-T-E-R-S

MAXIMUM NUMBER OF ITERATIONS	LINK, NODE VOLUME CONVERGENCE CRITERION TO STOP ITERATION	VOLUME VS. ESTIMATION ERROR TOLERANCE	INCLUSION ELLIPSE ECCENTRICITY	BACKUP ELLIPSE ECCENTRICITY	VOLUME ESTIMATE % CHANGE	ENERGY UNITS
1	80.0 %	15.0 %	.60000	.40000	75.0%	BTU

171 REGIONS.

1477 NODES.

3046 LINEHAUL LINKS.

389 ACCESS LINKS.

0 TRANSFER LINKS.

8 NODE CLASSES.
45 LINK CLASSES.
9 ACCESS CLASSES.
0 TRANSFER CLASSES.

32 COMMODITIES.

OUTPUTS SELECTED

INPUT ECHO	NO
PLAYBACK REPORTS	
REGIONS	NO
NODES	NO
LINEHAUL LINKS	NO
ACCESS LINKS	NO
TRANSFER LINKS	NO
COMMODITIES	NO
CLASSES/FUNCTIONS	NO
SHIPMENTS	NO
CONTINUE AFTER PLAYBACK ?	YES
NODE VOLUME ESTIMATE CHANGES	NO
LINK VOLUME ESTIMATE CHANGES	NO
NETWORK FLOW REPORT	NO
NETWORK FILE	YES
NETWORK FLOW FILE	YES

```
--- LARGE ELLIPSE USED FOR TF-TEXTILE FROM  28        TO  27        (    46.5 KTONS)
--- LARGE ELLIPSE USED FOR TF-CHEMCLS FROM  47        TO  48        (   438.0 KTONS)
--- LARGE ELLIPSE USED FOR TF-LUMBER  FROM  48        TO  47        (    97.7 KTONS)
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TRANSPORTATION NETWORK MODEL
1990 TOFC MINIMUM IMPEDANCE RUN

ITERATION # 1   PERCENT CONVERGENCE = 19.81

TRANSPORTATION NETWORK MODEL
1990 TOFC MINIMUM IMPEDANCE RUN

MODAL SUMMARY REPORT - RR

NODES

CLASS NO.	NAME	TOTAL NODES	% USED	KILOTONS CAPACITY	KILOTONS AVG. FLOW	AVG DISUTILITY PER KTON COST($)	TIME(HR)	ENERGY (KBTU)	TOTAL DISUTILITY COST ($K)	KTON DAYS	ENERGY BBTU	WEIGHTED SUM(000)
1	R.EAST	309	84.5	900000.0	35116.0	105.00	6.16	1310.02	962368.8	2351635.1	12006.7	3751672.4
2	R.SOUTH	180	91.7	900000.0	26166.8	116.19	7.70	1404.73	501651.3	1384711.1	6064.9	2335463.2
3	R.WEST	406	88.4	900000.0	17701.7	159.17	8.84	2063.06	1011524.5	2340265.6	13110.5	4878537.4
SUBTOTALS		895	87.7	900000.0	25271.0	124.79	7.35	1571.86	2475544.5	6076611.8	31182.2	10965673.0

LINEHAUL LINKS

CLASS NO.	NAME	TOTAL LINKS	TOTAL MILES	% USED MILES	KILOTONS CAPACITY	KILOTONS AVG FLOW	MTON-MILES	AVG SPEED (MPH)	AVG PER TON/MILE COST MILLS	TIME (MIN.)	ENERGY BTU	TOTAL DISUTILITY COST ($K)	KTON DAYS	ENERGY BBTU	WEIGHTED SUM(000)
1	EF130	1	126	100.0	62000.	57484.8	7243	21.8	10.45	2.757	644.	75714.3	13870.	4665.	101324.
2	EF125	10	567	81.8	62000.	5757.7	2672	42.1	8.45	1.426	564.	22576.3	2646.	1508.	26871.
3	EF120	93	3628	74.4	62000.	14446.7	41130	34.8	7.86	1.724	621.	323275.3	49250.	25541.	399766.
4	EF117	214	8376	63.9	58000.	20658.4	110522	17.1	9.39	3.507	618.	1037879.2	269179.	68290.	1368113.
5	EF225	4	274	100.0	186000.	14483.2	3968	41.6	8.20	1.444	577.	32549.4	3979.	2290.	39632.
6	EF220	26	930	63.1	186000.	19815.6	11632	40.2	9.95	1.494	730.	115693.0	12068.	8496.	135659.
7	EF217	129	5015	79.0	174000.	21778.9	86244	36.6	7.89	1.638	612.	680522.3	98074.	52806.	818231.
8	EF320	3	157	6.4	310000.	21712.8	217	42.8	11.12	1.402	674.	2414.5	211.	146.	2838.
9	EF317	65	2434	87.4	290000.	43197.4	91924	38.4	8.16	1.562	634.	750376.8	99732.	58267.	924047.
10	EH125	4	154	70.8	58000.	2668.1	291	41.1	10.28	1.459	674.	2990.9	295.	196.	3537.
11	EH120	31	1660	59.2	58000.	16854.6	16551	34.4	6.11	1.745	567.	101075.5	20056.	9386.	123533.
12	EH117	6	632	100.0	45000.	8419.2	5321	23.9	6.17	2.515	515.	32843.2	9295.	2739.	39404.
13	EH220	12	633	83.1	174000.	24847.8	13070	37.8	6.90	1.587	615.	90132.8	14405.	8043.	106923.
14	EH217	6	505	77.4	135000.	15913.2	6222	27.6	6.24	2.172	517.	38798.9	9387.	3215.	44707.
15	EH320	6	393	89.1	290000.	55041.3	19264	38.1	6.74	1.576	620.	129820.5	21090.	11948.	148915.
16	SF125	4	249	100.0	60000.	2739.9	682	39.2	11.77	1.532	752.	8031.6	726.	513.	9490.
17	SF120	291	17643	74.6	60000.	15353.7	202147	27.3	8.06	2.195	620.	1628444.4	308170.	125252.	2096684.
18	SF117	7	450	100.0	60000.	23728.4	10678	7.3	9.40	8.220	639.	100381.3	60955.	6821.	193002.
19	SF220	41	1867	65.7	180000.	22168.5	27179	37.6	8.14	1.597	606.	221348.4	30149.	16458.	271308.
20	SF217	2	156	80.8	180000.	49604.6	6250	36.2	5.96	1.659	525.	37229.0	7202.	3282.	45139.
21	SF320	4	125	100.0	300000.	18052.3	2257	39.0	11.20	1.537	683.	25283.4	2409.	1542.	29228.
22	SH125	1	130	100.0	45000.	26566.6	3454	24.0	6.92	2.496	612.	23898.1	5986.	2112.	28250.
23	SH120	12	1014	90.6	45000.	19719.2	18122	18.6	8.21	3.224	612.	148790.2	40577.	11090.	192558.
24	SH117	10	621	100.0	45000.	25261.0	15687	16.6	6.16	3.624	445.	96655.9	39479.	6982.	113451.
25	SH225	1	60	100.0	135000.	17179.6	1031	30.2	8.43	1.984	643.	8689.4	1420.	663.	10020.
26	SH220	1	42	100.0	135000.	59353.6	2493	26.8	7.03	2.239	634.	17531.2	3876.	1580.	22340.

CLASS NO.	CLASS NAME	TOTAL LINKS	TOTAL MILES	% USED MILES	KILOTONS CAPACITY	KILOTONS AVG FLOW	MTON-MILES	AVG SPEED (MPH)	AVG PER TON/MILE COST MILLS	AVG PER TON/MILE TIME (MIN.)	AVG PER TON/MILE ENERGY BTU	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
28	WF125	67	4903	62.5	70000.	5038.3	15448	46.5	5.59	1.291	620.	132626.7	13848.	9581.	153856.
29	WF120	399	28661	80.8	70000.	13177.8	305158	37.3	7.37	1.609	627.	2248484.5	341028.	191360.	2840099.
30	WF117	108	6549	72.9	70000.	7730.4	36920	42.2	8.42	1.423	717.	310853.6	36496.	26485.	378844.
31	WF225	12	930	80.6	210000.	6055.1	4541	46.4	8.31	1.240	513.	37723.8	3912.	2328.	42399.
32	WF220	103	4897	83.4	210000.	15942.2	65124	46.8	7.99	1.282	626.	520584.2	57979.	40746.	617673.
33	WF217	3	113	100.0	210000.	3075.7	348	49.5	14.68	1.211	768.	5102.9	292.	267.	5604.
34	WF320	17	749	75.4	350000.	24720.4	13967	47.8	8.22	1.255	609.	114855.6	12173.	8502.	131674.
35	WH130	47	6337	93.3	52000.	11577.5	68458	35.9	9.05	1.669	823.	619427.4	79366.	56332.	761730.
36	WH230	13	1468	99.1	186000.	24418.3	35529	42.3	9.16	1.418	831.	325317.6	34978.	29513.	388950.
SUBTOTALS		1754	102709	77.6	95021.	15699.6	1251743	30.6	8.04	1.901	638.	10067924.4	1704557.	798944.	12615799.

ACCESS LINKS

CLASS NO.	CLASS NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
1	EAR25	59	100.0	900000.	33699.	2011.41	13.93	17944.49	3999169.2	1153726.	35678.	5231034.
3	SOH25	39	100.0	900000.	23915.	1896.90	14.47	15563.76	1769206.2	562396.	14516.	2340570.
5	WSR25	80	98.8	900000.	15191.	2031.94	16.63	19006.28	2438547.0	841820.	22810.	3674188.
6	WSR50	17	88.2	900000.	4754.	2077.90	20.78	24182.55	148177.5	61730.	1724.	232740.
SUBTOTALS		195	98.5	900000.	21835.	1992.94	15.00	17824.90	8355099.8	2619674.	74728.	11478532.

MODE TOTALS (TOTAL KTONS = 2096141.) 20898568.810400842. 904854. 35060005.

TRANSPORTATION NETWORK MODEL
1990 TOFC MINIMUM IMPEDANCE RUN

MODAL SUMMARY REPORT - HWY

NODES

CLASS NO.	NAME	TOTAL NODES	% USED	KILOTONS CAPACITY	KILOTONS AVG. FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
4	PEN00	514	47.5	900000.0	2455.2	0.	0.	0.	0.	0.	0.	0.
5	PEN05	30	86.7	900000.0	5830.1	154.99	.08	4680.17	23493.5	526.1	709.4	24496.3
6	PEN07	23	87.0	900000.0	6634.8	214.81	.12	6562.99	28504.9	646.9	870.9	29853.5
7	PEN11	12	91.7	900000.0	8954.5	346.28	.18	10296.38	34108.3	751.1	1014.2	35533.3
8	PEN18	3	66.7	900000.0	22945.8	552.67	.30	16900.00	25362.8	573.6	775.6	26465.7
SUBTOTALS		582	52.1	900000.0	3391.9	108.46	.06	3279.12	111469.4	2497.7	3370.1	116346.8

LINEHAUL LINKS

CLASS NO.	NAME	TOTAL LINKS	TOTAL MILES	% USED MILES	KILOTONS CAPACITY	KILOTONS AVG FLOW	MTON-MILES	AVG SPEED (MPH)	AVG PER TON/MILE COST MILLS	AVG PER TON/MILE TIME (MIN.)	AVG PER TON/MILE ENERGY BTU	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
37	D.L.FREE	247	17090	67.5	75000.	2265.0	26126	64.2	27.79	.934	1992.	725931.3	16949.	52043.	759242.
38	D.R.FREE	129	9063	33.8	48000.	1517.7	4655	54.0	33.71	1.112	2429.	156918.0	3593.	11307.	164255.
39	D.M.FREE	81	7413	9.5	28000.	2859.8	2022	37.9	50.90	1.583	2438.	102914.8	2223.	4929.	103792.
40	D.L.TOLL	40	2998	70.2	75000.	1971.5	4152	63.9	31.76	.939	1959.	131850.7	2708.	8135.	136741.
41	D.R.TOLL	33	2031	13.4	48000.	942.8	257	54.2	37.06	1.106	2451.	9539.2	198.	631.	9882.
42	D.M.TOLL	15	749	24.7	28000.	1716.6	318	39.9	50.13	1.503	2542.	15921.6	331.	807.	16724.
43	U.LEVEL	443	34384	24.8	15200.	843.6	7181	51.6	34.18	1.163	1531.	245458.6	5798.	10994.	256505.
44	U.ROLLING	165	14320	9.1	9500.	509.2	664	42.2	42.59	1.420	1930.	28276.7	655.	1281.	29586.
45	U.MOUNT	139	15530	4.0	5000.	1753.5	1087	17.0	132.41	3.531	2824.	143952.2	2666.	3070.	144972.
SUBTOTALS		1292	103578	27.3	47801.	1641.2	46462	55.1	33.59	1.089	2006.	1560763.1	35122.	93197.	1621698.

ACCESS LINKS

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
7	HA25	134	92.5	900000.	5001.	1330.00	3.70	39999.86	824836.5	95611.	24807.	1014519.
8	HA50	55	49.1	900000.	1770.	2630.16	4.50	80005.00	125706.1	8962.	3824.	137748.
9	HA75	5	80.0	900000.	3670.	3929.78	5.40	119993.13	57689.1	3303.	1761.	62953.

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	DISUTILITY WEIGHTED SUM(000)
SUBTOTALS		194	79.9	900000.	4404.	1476.93	3.79	44520.90	1008231.6	107875.	30392.	1215220.
MODE TOTALS		(TOTAL KTONS =		341327.)					2680464.1	145495.	126960.	2953267.

TRANSPORTATION NETWORK MODEL
1990 TOFC MINIMUM IMPEDANCE RUN

MODAL SUMMARY REPORT - INTERMODAL TRANSFERS

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL COST ($K)	TOTAL KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	TOTAL DISUTILITY WEIGHTED SUM(000)
NETWORK TOTALS	(TOTAL KTONS = 2437468.)								23579033.0	10546337.	1031813.	38013271.

TRANSPORTATION NETWORK MODEL
1990 TOFC MINIMUM IMPEDANCE RUN

COMMODITY SUMMARY REPORT

COMMODITY NO.	NAME	MODE	KTONS	PER-CENT	MTON-MILES	PER-CENT	COST($K)	PER-CENT	KTON DAYS	PER-CENT	ENERGY BBTU	PER-CENT	TOTAL DISUTILITY	PER-CENT
1	FARM PROD.	RR	96198	60.8	75263	85.5	957559	60.6	765318	96.3	43668	58.5	2082646	75.8
		HWY	62032	39.2	12734	14.5	622977	39.4	29102	3.7	30975	41.5	665806	24.2
		TOTAL	158229	100.0	87997	100.0	1580537	100.0	794420	100.0	74643	100.0	2748452	100.0
2	FOREST+MAN	RR	456	52.4	398	99.2	5491	70.7	4174	96.3	247	76.9	7370	75.9
		HWY	414	47.6	3	.8	2274	29.3	159	3.7	74	23.1	2346	24.1
		TOTAL	870	100.0	401	100.0	7765	100.0	4332	100.0	321	100.0	9715	100.0
3	COAL	RR	475709	99.7	176101	99.7	2299675	97.4	1703211	99.9	71876	97.5	2316821	97.4
		HWY	1522	.3	604	.3	60767	2.6	1568	.1	1832	2.5	60786	2.6
		TOTAL	477231	100.0	176705	100.0	2360442	100.0	1704779	100.0	73708	100.0	2377606	100.0
4	CRUDE PETR	RR	23433	98.0	7228	97.6	191717	90.1	113114	99.6	5539	90.7	192857	90.1
		HWY	471	2.0	181	2.4	21179	9.9	472	.4	566	9.3	21185	9.9
		TOTAL	23904	100.0	7409	100.0	212896	100.0	113585	100.0	6105	100.0	214042	100.0
5	METAL ORES	RR	77857	94.8	23510	92.8	467942	73.9	415581	98.9	14042	72.4	526145	76.1
		HWY	4244	5.2	1821	7.2	165033	26.1	4500	1.1	5341	27.6	165671	23.9
		TOTAL	82100	100.0	25332	100.0	632974	100.0	420081	100.0	19383	100.0	691816	100.0
6	MINERALS N	RR	136968	97.8	43243	99.8	823234	98.5	705277	99.9	25316	98.1	830327	98.5
		HWY	3047	2.2	100	.2	12790	1.5	1047	.1	482	1.9	12801	1.5
		TOTAL	140015	100.0	43343	100.0	836024	100.0	706324	100.0	25798	100.0	843128	100.0
7	FOOD+KINDR	RR	68476	100.0	82576	100.0	1267886	100.0	701827	100.0	61720	100.0	2657601	100.0
		TOTAL	68476	100.0	82576	100.0	1267886	100.0	701827	100.0	61720	100.0	2657601	100.0
8	TEXTILES+A	RR	997	100.0	2296	100.0	44760	100.0	16850	100.0	2652	100.0	106100	100.0
		TOTAL	997	100.0	2296	100.0	44760	100.0	16850	100.0	2652	100.0	106100	100.0
9	TOFC	RR	24550	90.6	20321	98.6	398256	95.9	32748	97.0	22504	96.4	447414	96.0
		HWY	2546	9.4	297	1.4	17000	4.1	1029	3.0	844	3.6	18545	4.0
		TOTAL	27095	100.0	20618	100.0	415256	100.0	33777	100.0	23348	100.0	465959	100.0
10	CHEMICALS	RR	113067	100.0	123269	100.0	1620702	100.0	1270572	100.0	73583	100.0	4009495	100.0
		TOTAL	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TRANSPORTATION NETWORK MODEL
1990 TOFC MINIMUM IMPEDANCE RUN

COMMODITY NO.	NAME	MODE	KTONS	PER-CENT	MTON-MILES	PER-CENT	COST($K)	PER-CENT	KTON DAYS	PER-CENT	ENERGY BBTU	PER-CENT	TOTAL DISUTILITY	PER-CENT
11	LUMBER+FUR	RR	43605	100.0	66631	100.0	812099	100.0	459997	100.0	46570	100.0	1902366	100.0
		TOTAL	43605	100.0	66631	100.0	812099	100.0	459997	100.0	46570	100.0	1902366	100.0
12	MACHINERY	RR	4574	100.0	8617	100.0	164083	100.0	62741	100.0	9517	100.0	282679	100.0
		TOTAL	4574	100.0	8617	100.0	164083	100.0	62741	100.0	9517	100.0	282679	100.0
13	ELEC MACHI	RR	3070	100.0	5906	100.0	149307	100.0	43494	100.0	[illegible]	100.0	193249	100.0
		TOTAL	3070	100.0	5906	100.0	149307	100.0	43494	100.0	[illegible]	100.0	193249	100.0
14	TRANSP EQU	RR	11938	100.0	11864	100.0	279150	100.0	120284	100.0	13033	100.0	354950	100.0
		TOTAL	11938	100.0	11864	100.0	279150	100.0	120284	100.0	13033	100.0	354950	100.0
15	UNID MANUF	RR	231069	100.0	194789	100.0	2682631	100.0	1923055	100.0	120980	100.0	6528932	100.0
		TOTAL	231069	100.0	194789	100.0	2682631	100.0	1923055	100.0	120980	100.0	6528932	100.0
16	PAPER+ALLI	RR	47557	100.0	46521	100.0	731781	100.0	424044	100.0	35324	100.0	1380623	100.0
		TOTAL	47557	100.0	46521	100.0	731781	100.0	424044	100.0	35324	100.0	1380623	100.0
17	PETRL PROD	RR	62081	83.9	30067	97.8	493538	87.5	391320	98.9	17646	87.2	783143	91.4
		HWY	11909	16.1	677	2.2	70213	12.5	4424	1.1	2583	12.8	73491	8.6
		TOTAL	73990	100.0	30744	100.0	563751	100.0	395744	100.0	20229	100.0	856634	100.0
18	PRMY METAL	RR	30481	100.0	28483	100.0	354132	100.0	291292	100.0	16690	100.0	826051	100.0
		TOTAL	30481	100.0	28483	100.0	354132	100.0	291292	100.0	16690	100.0	826051	100.0
19	FABR METAL	RR	9508	100.0	14031	100.0	215283	100.0	105941	100.0	11797	100.0	470618	100.0
		TOTAL	9508	100.0	14031	100.0	215283	100.0	105941	100.0	11797	100.0	470618	100.0
20	MISCELLANE	RR	41166	100.0	41704	100.0	498061	100.0	369619	100.0	24438	100.0	1706753	100.0
		TOTAL	41166	100.0	41704	100.0	498061	100.0	369619	100.0	24438	100.0	1706753	100.0
21	TF-FOOD	RR	107337	73.8	46427	91.7	1177042	83.0	90119	85.7	52169	81.3	1355560	83.4
		HWY	38104	26.2	4206	8.3	240855	17.0	15053	14.3	12000	18.7	270680	16.6
		TOTAL	145441	100.0	50633	100.0	1417898	100.0	105172	100.0	64169	100.0	1626240	100.0

TRANSPORTATION NETWORK MODEL
1990 TOFC MINIMUM IMPEDANCE RUN

COMMODITY NO.	NAME	MODE	KTONS	PER-CENT	MTON-MILES	PER-CENT	COST($K)	PER-CENT	KTON DAYS	PER-CENT	ENERGY BBTU	PER-CENT	TOTAL DISUTILITY	PER-CENT
22	TF-TEXTILE	RR	12573	75.6	8741	93.2	180014	85.0	14760	89.4	9410	85.0	233756	86.0
		HWY	4051	24.4	642	6.8	31704	15.0	1750	10.6	1663	15.0	38077	14.0
		TOTAL	16624	100.0	9383	100.0	211718	100.0	16510	100.0	11073	100.0	271833	100.0
23	TF-CHEMCLS	RR	70077	71.5	21177	87.8	662795	78.7	51088	82.1	25069	74.4	758880	79.2
		HWY	27956	28.5	2942	12.2	178876	21.3	11128	17.9	8640	25.6	199810	20.8
		TOTAL	98033	100.0	24119	100.0	841672	100.0	62215	100.0	33709	100.0	958690	100.0
24	TF-LUMBER	RR	23713	70.9	10594	89.6	266386	79.8	19562	83.0	11883	77.6	312766	80.3
		HWY	9736	29.1	1232	10.4	67346	20.2	3995	17.0	3435	22.4	76820	19.7
		TOTAL	33449	100.0	11826	100.0	333733	100.0	23557	100.0	15318	100.0	389586	100.0
25	TF-MCHNRY	RR	17563	89.6	11356	97.9	241759	94.7	20022	96.1	12265	94.7	279621	94.9
		HWY	2028	10.4	238	2.1	13611	5.3	823	3.9	680	5.3	15168	5.1
		TOTAL	19592	100.0	11594	100.0	255370	100.0	20845	100.0	12946	100.0	294788	100.0
26	TF-ELECTRC	RR	15377	88.4	10466	98.1	220381	94.6	20262	96.2	11334	94.9	240864	94.7
		HWY	2018	11.6	201	1.9	12638	5.4	794	3.8	606	5.1	13441	5.3
		TOTAL	17395	100.0	10667	100.0	233019	100.0	21056	100.0	11940	100.0	254304	100.0
27	TF-TRANSP	RR	9444	71.5	3808	89.4	103660	80.4	8448	84.7	4273	77.4	108989	80.6
		HWY	3771	28.5	453	10.6	25210	19.6	1526	15.3	1250	22.6	26174	19.4
		TOTAL	13215	100.0	4261	100.0	128870	100.0	9974	100.0	5523	100.0	135162	100.0
28	TF-UNID	RR	131257	58.2	54259	82.4	1421505	68.4	103208	72.7	61040	65.6	1628018	68.9
		HWY	94247	41.8	11590	17.6	656205	31.6	38758	27.3	32005	34.4	733773	31.1
		TOTAL	225504	100.0	65849	100.0	2077710	100.0	141967	100.0	93045	100.0	2361791	100.0
29	TF-PAPER	RR	26694	70.7	11812	89.6	297705	79.6	21845	82.9	13088	77.6	331149	80.0
		HWY	11063	29.3	1377	10.4	76067	20.4	4515	17.1	3784	22.4	82980	20.0
		TOTAL	37757	100.0	13188	100.0	373772	100.0	26360	100.0	16871	100.0	414129	100.0
30	TF-PR MTL	RR	60188	80.8	21152	93.5	600550	86.8	41444	88.0	23854	84.5	667727	86.9
		HWY	14306	19.2	1472	6.5	91062	13.2	5649	12.0	4364	15.5	100219	13.1
		TOTAL	74494	100.0	22623	100.0	691612	100.0	47092	100.0	28218	100.0	767946	100.0
31	TF-FAB MTL	RR	34643	85.7	17631	96.4	407760	91.6	30370	92.9	19317	91.1	480981	91.8
		HWY	5798	14.3	653	3.6	37288	8.4	2305	7.1	1886	8.9	42847	8.2
		TOTAL	40441	100.0	18284	100.0	445048	100.0	32675	100.0	21203	100.0	523828	100.0

TRANSPORTATION NETWORK MODEL
1990 TOFC MINIMUM IMPEDANCE RUN

COMMODITY NO.	NAME	MODE	KTONS	PER-CENT	MTON-MILES	PER-CENT	COST($K)	PER-CENT	KTON DAYS	PER-CENT	ENERGY BBTU	PER-CENT	TOTAL DISUTILITY	PER-CENT
32	TF-MISC	RR	84517	66.8	31501	86.2	861724	75.6	59257	77.8	35714	71.9	1055552	76.0
		HWY	42067	33.2	5039	13.8	277369	24.4	16899	22.2	13951	28.1	332650	24.0
		TOTAL	126583	100.0	36539	100.0	1139093	100.0	76156	100.0	49665	100.0	1388202	100.0
TOTAL, ALL COMMODITIES-														
		RR	2096141	86.0	1251743	96.4	20898569	88.6	10400843	98.6	904854	87.7	35060005	92.2
		HWY	341327	14.0	46462	3.6	2680464	11.4	145495	1.4	126960	12.3	2953267	7.8
		XFR	0	0.	0	0.	0	0.	0	0.	0	0.	0	0.
TOTAL, ALL MODES=			2437468	100.0	1298205	100.0	23579033	100.0	10546337	100.0	1031813	100.0	38013271	100.0

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         MM  MMMM    MM     MODEL
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01/23/78

1990 DOUBLE TRAILER MINIMUM IMPEDANCE RUN

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     NN      NNN
     NN       NN

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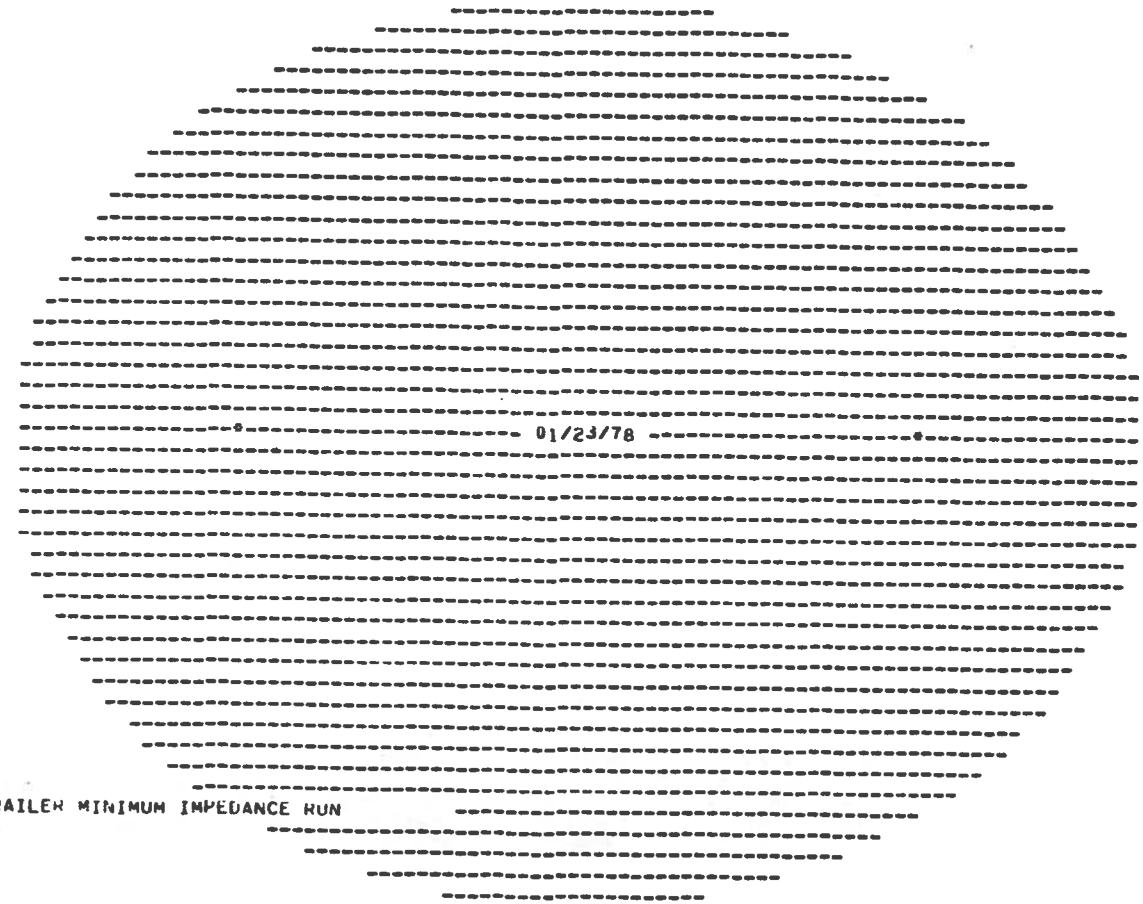


1990 DOUBLE TRAILER MINIMUM IMPEDANCE RUN

TRANSPORTATION NETWORK MODEL
1990 DOUBLE TRAILER MINIMUM IMPEDANCE RUN

S-Y-S-T-E-M P-A-R-A-M-E-T-E-R-S

MAXIMUM NUMBER OF ITERATIONS	LINK, NODE VOLUME CONVERGENCE CRITERION TO STOP ITERATION	VOLUME VS. ESTIMATION ERROR TOLERANCE	INCLUSION ELLIPSE ECCENTRICITY	BACKUP ELLIPSE ECCENTRICITY	VOLUME ESTIMATE % CHANGE	ENERGY UNITS
1	80.0 %	15.0 %	.60000	.40000	75.0%	BTU

171 REGIONS.

1014 NODES.

1837 LINEHAUL LINKS.

368 ACCESS LINKS.

152 TRANSFER LINKS.

10 NODE CLASSES.
15 LINK CLASSES.
6 ACCESS CLASSES.
2 TRANSFER CLASSES.

20 COMMODITIES.

OUTPUTS SELECTED

INPUT ECHO	NO
PLAYBACK REPORTS	
REGIONS	NO
NODES	NO
LINEHAUL LINKS	NO
ACCESS LINKS	NO
TRANSFER LINKS	NO
COMMODITIES	NO
CLASSES/FUNCTIONS	NO
SHIPMENTS	NO
CONTINUE AFTER PLAYBACK ?	YES
NODE VOLUME ESTIMATE CHANGES	NO
LINK VOLUME ESTIMATE CHANGES	NO
NETWORK FLOW REPORT	NO
NETWORK FILE	YES
NETWORK FLOW FILE	YES
PATH FILE	YES

```
--- LARGE ELLIPSE USED FOR FARM PROD. FROM  47        TO  48         (   222.8 KTONS)
--- LARGE ELLIPSE USED FOR TEXTILES+A FROM  28        TO  27         (    46.5 KTONS)
--- LARGE ELLIPSE USED FOR CHEMICALS  FROM  47        TO  48         (   438.0 KTONS)
--- LARGE ELLIPSE USED FOR LUMBER+FUR FROM  48        TO  47         (    97.7 KTONS)
```

TRANSPORTATION NETWORK MODEL
1990 DOUBLE TRAILER MINIMUM IMPEDANCE RUN

ITERATION # 1   PERCENT CONVERGENCE = 23.77

TRANSPORTATION NETWORK MODEL
1990 DOUBLE TRAILER MINIMUM IMPEDANCE RUN

MODAL SUMMARY REPORT - HWY

NODES

CLASS NO.	NAME	TOTAL NODES	% USED	KILOTONS CAPACITY	KILOTONS AVG. FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
1	PEN00	514	47.5	900000.0	2164.0	0.	0.	0.	0.	0.	0.	0.
2	PEN05	30	70.0	900000.0	3854.1	167.64	.08	4884.31	13568.0	280.9	395.3	14098.3
3	PEN07	23	65.2	900000.0	1793.0	240.04	.12	6992.06	6455.9	131.1	188.1	6738.3
4	PEN11	12	58.3	900000.0	3147.3	369.46	.18	10730.51	8139.8	168.0	236.4	8462.7
5	PEN18	3	33.3	900000.0	4319.7	582.09	.30	16979.24	2514.5	54.0	73.3	2612.6
SUBTOTALS		582	49.5	900000.0	2299.3	46.33	.02	1348.74	30678.1	634.0	893.1	31912.0

LINEHAUL LINKS

CLASS NO.	NAME	TOTAL LINKS	TOTAL MILES	% USED MILES	KILOTONS CAPACITY	KILOTONS AVG FLOW	MTON-MILES	AVG SPEED (MPH)	AVG PER TON/MILE COST MILLS	AVG PER TON/MILE TIME (MIN.)	AVG PER TON/MILE ENERGY BTU	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
1	D.L.FREE	247	17090	39.1	75000.	1136.8	7591	64.5	30.12	.930	2133.	228673.0	4904.	16193.	238790.
2	D.R.FREE	129	9063	22.5	48000.	445.5	909	54.6	35.71	1.100	2517.	32475.2	694.	2288.	33894.
3	D.M.FREE	81	7413	6.0	28000.	707.2	313	39.8	49.16	1.508	2495.	15401.7	328.	782.	15593.
4	D.L.TOLL	40	2998	26.3	75000.	523.5	413	64.7	32.44	.927	2070.	13401.0	266.	855.	13844.
5	D.R.TOLL	33	2031	6.9	48000.	750.6	106	54.2	39.79	1.107	2471.	4211.3	81.	262.	4374.
6	D.M.TOLL	15	749	10.9	28000.	282.0	23	41.8	55.77	1.435	2717.	1289.6	23.	63.	1332.
7	U.LEVEL	443	34384	41.2	15200.	1444.6	20461	45.5	43.39	1.319	1458.	887742.7	18747.	29832.	926470.
8	U.ROLLING	165	14320	13.4	9500.	579.6	1109	41.8	47.57	1.434	1974.	52742.0	1104.	2169.	55103.
9	U.MOUNT	139	15530	5.1	5000.	1442.0	1138	17.3	131.27	3.463	2831.	149355.6	2736.	3221.	150505.
SUBTOTALS		1292	103578	26.1	33908.	1185.8	32063	46.3	43.20	1.297	1737.	1385292.3	28884.	55684.	1439906.

ACCESS LINKS

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
1	HA25	134	76.1	900000.	2513.	2064.17	6.80	39997.12	529065.7	72661.	10252.	681813.
2	HA50	55	50.9	900000.	1029.	3181.97	6.83	80008.17	91640.7	8199.	2304.	106773.
3	HA75	5	80.0	900000.	822.	4748.03	8.86	120002.19	15606.8	1213.	394.	17976.

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	DISUTILITY WEIGHTED SUM(000)
SUBTOTALS		194	69.1	900000.	2152.	2206.39	6.83	44904.59	636313.2	82073.	12950.	806562.
MODE TOTALS		(TOTAL KTONS =		171096.)					2052283.6	111591.	69528.	2278360.

TRANSPORTATION NETWORK MODEL
1990 DOUBLE TRAILER MINIMUM IMPEDANCE RUN

MODAL SUMMARY REPORT - DBL

NODES

CLASS NO.	NAME	TOTAL NODES	% USED	KILOTONS CAPACITY	KILOTONS AVG. FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
6	PEN00D	364	70.6	900000.0	10885.0	0.	0.	0.	0.	0.	0.	0.
7	PEN05D	30	96.7	900000.0	22112.3	89.66	.08	3698.46	57494.7	2225.7	2371.7	62276.5
8	PEN07D	23	100.0	900000.0	25203.1	127.70	.12	5107.95	74023.4	2825.9	2960.9	79895.0
9	PEN11D	12	100.0	900000.0	37113.8	200.22	.18	8008.62	89169.1	3395.9	3566.8	96345.1
10	PEN18D	3	100.0	900000.0	69831.7	327.63	.30	12886.75	68636.7	2618.7	2699.7	73811.2
SUBTOTALS		432	75.0	900000.0	14423.5	61.91	.06	2482.03	289323.9	11066.2	11599.1	312329.9

LINEHAUL LINKS

CLASS NO.	NAME	TOTAL LINKS	TOTAL MILES	% USED MILES	KILOTONS CAPACITY	KILOTONS AVG FLOW	MTON-MILES	AVG SPEED (MPH)	AVG PER TON/MILE COST MILLS	AVG PER TON/MILE TIME (MIN.)	AVG PER TON/MILE ENERGY BTU	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
10	D.L.FREED	247	17090	82.8	75000.	10628.1	150430	60.5	18.69	.992	1197.	2812016.4	103662.	180032.	3027779.
11	D.R.FREED	129	9063	70.9	48000.	7746.8	49804	47.7	24.92	1.257	1789.	1240925.9	43481.	89105.	1334653.
12	D.M.FREED	81	7413	38.2	28000.	1789.3	5071	37.2	32.61	1.613	2284.	165336.1	5679.	11580.	174664.
13	D.L.TOLLD	40	2998	83.6	75000.	10271.0	25729	60.5	21.96	.991	1190.	565103.5	17715.	30623.	602013.
14	D.R.TOLLD	33	2031	79.1	48000.	8930.2	14342	46.1	28.81	1.302	1754.	413157.1	12972.	25161.	440337.
15	D.M.TOLLD	15	749	78.1	28000.	5394.6	3156	32.1	41.91	1.868	2348.	132276.0	4093.	7411.	141396.
SUBTOTALS		545	39344	71.5	61567.	8840.4	248531	55.2	21.44	1.087	1384.	5328814.9	187600.	343911.	5720844.

ACCESS LINKS

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
4	HA25D	119	97.5	900000.	11992.	2108.06	7.54	39999.62	2932370.4	437010.	55641.	3884155.
5	HA50D	50	74.0	900000.	4672.	3435.22	8.22	80386.15	593784.0	59217.	13895.	719155.
6	HA75D	5	80.0	900000.	3020.	4270.73	7.40	119988.18	51599.0	3724.	1450.	57710.
SUBTOTALS		174	90.2	900000.	10038.	2270.20	7.61	45042.46	3577753.4	499950.	70985.	4661020.

MODE TOTALS	(TOTAL KTONS = 809812.)	9195892.2	698617.	426495.	10694194.

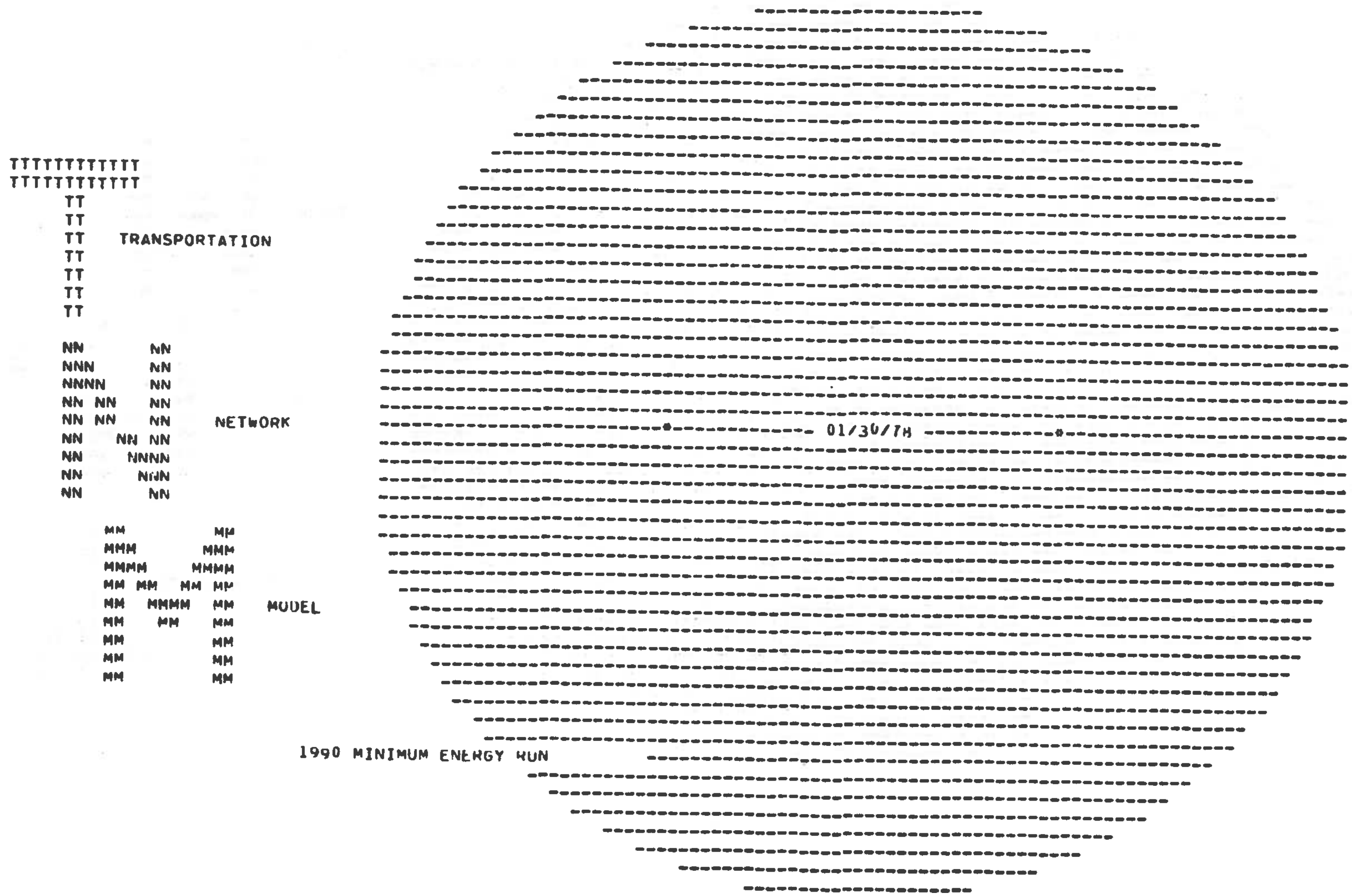
TRANSPORTATION NETWORK MODEL
1990 DOUBLE TRAILER MINIMUM IMPEDANCE RUN

MODAL SUMMARY REPORT - INTERMODAL TRANSFERS

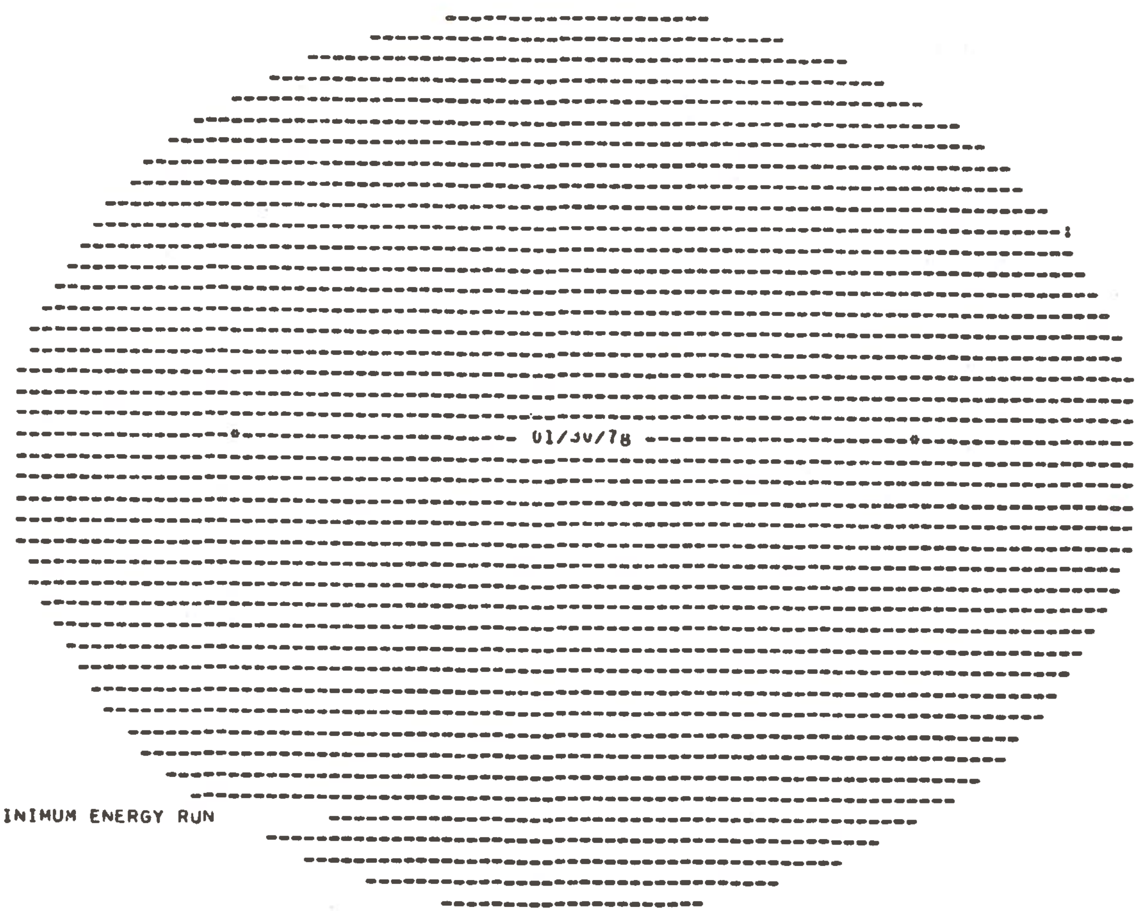
CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	AVG FLOW	AVG DISUTILITY PER KTON COST($)	TIME(HR)	ENERGY (KBTU)	TOTAL COST ($K)	KTON DAYS	DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
1	DB.TO.HWY	76	30.3	900000.	933.	1339.85	4.30	39995.53	28753.2	3844.	858.	36524.
2	HWY.TO.DB	76	27.6	900000.	1540.	1340.15	4.30	40004.46	43353.9	5797.	1294.	53486.
SUBTOTALS		152	28.9	1800000.	1223.	1340.03	4.30	40000.90	72107.1	9641.	2152.	90010.
NETWORK TOTALS	(TOTAL KTONS = 932165.)								11320282.8	819849.	498175.	13062584.

TRANSPORTATION NETWORK MODEL
1990 DOUBLE TRAILER MINIMUM IMPEDANCE RUN

COMMODITY NO.	NAME	MODE	KTONS	PER-CENT	MTON-MILES	PER-CENT	COST($K)	PER-CENT	KTON DAYS	PER-CENT	ENERGY HBTU	PER-CENT	TOTAL DISUTILITY	PER-CENT
19	FABR METAL	HWY	970	2.4	208	1.2	11784	2.0	639	1.7	436	1.5	13324	2.0
		DBL	38558	95.3	15825	94.8	547331	94.0	35293	95.0	27304	94.7	632431	94.1
		XFR	913	2.3	665	4.0	23066	4.0	1232	3.3	1103	3.8	26036	3.9
		TOTAL	40441	100.0	16698	100.0	582180	100.0	37164	100.0	28842	100.0	671790	100.0
20	MISCELLANE	HWY	12619	10.0	2660	7.8	177006	10.5	10410	8.3	5996	8.4	211055	10.1
		DBL	109530	86.5	28948	84.6	1391376	82.6	108585	86.7	60759	84.8	1746546	83.4
		XFR	4434	3.5	2608	7.6	115983	6.9	6202	5.0	4865	6.8	136270	6.5
		TOTAL	126583	100.0	34217	100.0	1684365	100.0	125197	100.0	71621	100.0	2093871	100.0
TOTAL, ALL COMMODITIES-		HWY	122353	13.1	23495	8.4	1433459	12.7	88933	10.8	52689	10.6	1618508	12.4
		DBL	761069	81.6	230189	82.0	8663455	76.5	666838	81.3	397725	79.8	10099282	77.3
		XFR	48743	5.2	26910	9.6	1223369	10.8	64078	7.8	47761	9.6	1344794	10.3
TOTAL, ALL MODES=			932165	100.0	280595	100.0	11320283	100.0	819849	100.0	498175	100.0	13062584	100.0


TRANSPORTATION
NETWORK
MODEL
1990 MINIMUM ENERGY RUN
01/30/78

TNM TRANSPORTATION NETWORK MODEL



1990 MINIMUM ENERGY RUN

TRANSPORTATION NETWORK MODEL
1990 MINIMUM ENERGY RUN

S-Y-S-T-E-M P-A-R-A-M-E-T-E-R-S

MAXIMUM NUMBER OF ITERATIONS	LINK, NODE VOLUME CONVERGENCE CRITERION TO STOP ITERATION	VOLUME VS. ESTIMATION ERROR TOLERANCE	INCLUSION ELLIPSE ECCENTRICITY	BACKUP ELLIPSE ECCENTRICITY	VOLUME ESTIMATE % CHANGE	ENERGY UNITS
1	80.0 %	15.0 %	.60000	.40000	75.0%	BTU

171 REGIONS.

1795 NODES.

3404 LINEHAUL LINKS.

662 ACCESS LINKS.

0 TRANSFER LINKS.

28 NODE CLASSES.
84 LINK CLASSES.
29 ACCESS CLASSES.
0 TRANSFER CLASSES.

20 COMMODITIES.

OUTPUTS SELECTED

INPUT ECHO	NO
PLAYBACK REPORTS	
REGIONS	NO
NODES	NO
LINEHAUL LINKS	NO
ACCESS LINKS	NO
TRANSFER LINKS	NO
COMMODITIES	NO
CLASSES/FUNCTIONS	NO
SHIPMENTS	NO
CONTINUE AFTER PLAYBACK ?	YES
NODE VOLUME ESTIMATE CHANGES	NO
LINK VOLUME ESTIMATE CHANGES	NO
NETWORK FLOW REPORT	NO
NETWORK FILE	YES
NETWORK FLOW FILE	YES
PATH FILE	YES

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--- LARGE ELLIPSE USED FOR FARM PROD. FROM  47      TO  48      (  222.8 KTONS)
--- LARGE ELLIPSE USED FOR TEXTILES+A FROM  28      TO  27      (   46.5 KTONS)
--- LARGE ELLIPSE USED FOR TOFC       FROM 167      TO 171      (   23.5 KTONS)
--- LARGE ELLIPSE USED FOR TOFC       FROM 171      TO 167      (   52.7 KTONS)
--- LARGE ELLIPSE USED FOR CHEMICALS  FROM  47      TO  48      (  438.0 KTONS)
--- LARGE ELLIPSE USED FOR LUMBER+FUR FROM  48      TO  47      (   97.7 KTONS)
--- LARGE ELLIPSE USED FOR UNID MANUF FROM  47      TO  48      (  573.6 KTONS)
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TRANSPORTATION NETWORK MODEL
1990 MINIMUM ENERGY RUN

ITERATION # 1   PERCENT CONVERGENCE = 13.33

TRANSPORTATION NETWORK MODEL
1990 MINIMUM ENERGY RUN

MODAL SUMMARY REPORT - RR

NODES

CLASS NO.	NAME	TOTAL NODES	% USED	KILOTONS CAPACITY	KILOTONS AVG. FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
1	R.EAST	309	92.6	900000.0	37526.9	204.53	10.69	2559.10	2195197.1	4781143.1	27466.1	43.6
2	R.SOUTH	180	95.6	900000.0	23885.4	187.21	11.05	2269.02	769119.1	1890844.7	9321.8	14.8
3	R.WEST	406	96.8	900000.0	16863.1	216.73	11.62	2842.53	1623228.5	3655706.1	21094.6	33.5
SUBTOTALS		895	95.1	900000.0	26159.9	206.07	11.13	2600.05	4587544.7	1.0E+07	57882.5	91.8

LINEHAUL LINKS

CLASS NO.	NAME	TOTAL LINKS	TOTAL MILES	% USED MILES	KILOTONS CAPACITY	KILOTONS AVG FLOW	MTON-MILES	AVG SPEED (MPH)	AVG PER TON/MILE COST MILLS	AVG PER TON/MILE TIME (MIN.)	AVG PER TON/MILE ENERGY BTU	TOTAL DISUTILITY COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
2	EF125	10	567	86.8	62000.	9084.1	4469	40.9	7.58	1.467	542.	33865.7	4552.	2421.	4.
3	EF120	93	3828	80.2	62000.	9960.3	30588	36.8	6.16	1.631	481.	188301.9	34653.	14713.	23.
4	EF117	214	8376	70.5	58000.	16291.1	96215	29.1	6.08	2.063	487.	584809.1	137832.	46871.	74.
5	EF225	4	274	68.2	186000.	5450.9	1019	42.6	9.66	1.409	490.	9842.5	997.	499.	1.
6	EF220	26	930	83.5	186000.	16418.1	14311	41.3	7.33	1.452	535.	104878.0	14431.	7652.	12.
7	EF217	129	5015	88.4	174000.	24195.4	107307	38.6	6.10	1.554	490.	654291.7	115770.	52594.	83.
8	EF320	3	157	53.5	310000.	4597.4	386	42.9	9.35	1.400	524.	3611.4	375.	202.	.
9	EF317	65	2434	94.5	290000.	39766.3	91462	39.3	6.38	1.528	516.	583822.9	97045.	47174.	75.
10	EH125	4	154	100.0	58000.	6157.3	948	40.2	8.39	1.493	674.	7957.7	983.	639.	1.
11	EH120	31	1660	66.7	58000.	8562.6	9487	37.3	6.43	1.608	579.	61017.1	10595.	5491.	9.
12	EH117	6	632	91.3	45000.	5321.6	3071	24.8	5.19	2.416	426.	15939.4	5152.	1309.	2.
13	EH220	12	633	85.2	174000.	18559.0	10003	38.4	6.93	1.560	582.	69315.7	10840.	5819.	9.
14	EH217	6	505	77.4	135000.	19618.7	7671	28.3	5.87	2.118	462.	45034.4	11283.	3543.	6.
15	EH320	6	393	100.0	290000.	48199.2	18942	38.4	5.82	1.562	534.	110255.8	20548.	10111.	16.
16	SF125	4	249	100.0	60000.	8303.1	2067	37.9	6.84	1.583	511.	14139.0	2273.	1057.	2.
17	SF120	291	17643	79.2	60000.	10883.0	152145	34.5	6.54	1.741	514.	995314.5	183985.	78150.	124.
18	SF117	7	450	100.0	60000.	8312.5	3741	37.2	5.60	1.615	457.	20935.8	4195.	1711.	3.
19	SF220	41	1867	96.2	180000.	16360.0	29383	38.3	7.19	1.565	516.	211359.3	31939.	15174.	24.
20	SF217	2	156	80.8	180000.	14004.5	1765	38.2	6.48	1.570	425.	11430.2	1924.	750.	1.
21	SF320	4	125	100.0	300000.	33166.5	4146	38.7	7.46	1.551	554.	30930.4	4466.	2295.	4.
22	SH125	1	130	100.0	45000.	22976.0	2987	25.2	5.51	2.378	491.	16445.8	4933.	1467.	2.
23	SH120	12	1014	78.6	45000.	13227.6	10542	25.4	5.91	2.366	525.	62295.5	17320.	5537.	9.
24	SH117	10	621	91.8	45000.	24255.1	13825	19.5	4.94	3.075	406.	68253.3	29525.	5615.	9.
25	SH225	1	60	100.0	135000.	27124.6	1627	29.6	6.61	2.027	581.	10760.7	2291.	946.	2.
26	SH220	1	42	100.0	135000.	37569.0	1578	28.8	6.01	2.082	549.	9481.0	2282.	866.	1.
27	WF130	1	61	100.0	70000.	4137.8	252	49.0	9.25	1.224	585.	2334.2	215.	148.	.

CLASS NO.	NAME	TOTAL LINKS	TOTAL MILES	% USED MILES	KILOTONS CAPACITY	KILOTONS AVG FLOW	MTON-MILES	AVG SPEED (MPH)	AVG PER TON/MILE COST MILLS	AVG PER TON/MILE TIME (MIN.)	AVG PER TON/MILE ENERGY BTU	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
28	WF125	67	4903	75.6	70000.	11160.8	41351	35.5	7.87	1.689	605.	325354.4	48498.	24998.	40.
29	WF120	399	28661	64.7	70000.	9559.0	232149	43.5	6.50	1.380	558.	1509987.5	222488.	129486.	205.
30	WF117	108	6549	77.9	70000.	9616.5	49034	43.9	6.03	1.367	534.	295730.2	46555.	26200.	42.
31	WF225	12	930	100.0	210000.	34006.9	31626	45.7	7.47	1.313	613.	236265.5	28832.	19387.	31.
32	WF220	103	4897	93.5	210000.	15882.6	72726	47.7	7.14	1.257	556.	519147.9	63493.	40446.	64.
33	WF217	3	113	100.0	210000.	21033.9	2377	48.1	6.43	1.246	548.	15279.2	2057.	1303.	2.
34	WF320	17	749	86.0	350000.	28264.9	18203	47.6	7.12	1.261	566.	129654.1	15935.	10301.	16.
35	WH130	47	6337	80.9	62000.	8623.9	44206	40.9	8.92	1.465	803.	394439.4	44988.	35508.	56.
36	WH230	13	1468	94.5	186000.	16528.5	22925	43.8	9.36	1.371	813.	214535.9	21826.	18642.	30.
SUBTOTALS		1754	102709	82.4	97024.	13399.7	1134536	38.0	6.67	1.580	546.	7567016.9	1245074.	619026.	982.

ACCESS LINKS

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
1	EAR25	59	100.0	900000.	36491.	1861.89	19.95	15871.45	4008562.5	1790017.	34171.	54.
3	SOR25	39	100.0	900000.	23366.	1742.57	20.44	13442.01	1587952.5	776123.	12249.	19.
5	WSR25	80	98.8	900000.	17652.	1904.65	21.92	17130.01	2656012.6	1273810.	23888.	38.
6	WSR50	17	88.2	900000.	5250.	2033.55	22.60	22966.66	160129.6	74164.	1808.	3.
SUBTOTALS		195	98.5	900000.	23633.	1854.04	20.70	15893.46	8412657.2	3914114.	72116.	114.

MODE TOTALS (TOTAL KTONS = 2268731.) 20567218.8 15466882. 749025. 1188.

TRANSPORTATION NETWORK MODEL
1990 MINIMUM ENERGY RUN

MODAL SUMMARY REPORT - HWY

NODES

CLASS NO.	NAME	TOTAL NODES	% USED	KILOTONS CAPACITY	KILOTONS AVG. FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
4	PEN00	514	8.0	900000.0	884.8	0.	0.	0.	0.	0.	0.	0.
5	PEN05	30	16.7	900000.0	1569.5	160.23	.08	4657.77	1257.4	27.2	36.6	.1
6	PEN07	23	21.7	900000.0	161.4	233.38	.12	6996.03	188.3	3.9	5.6	.0
7	PEN11	12	41.7	900000.0	2200.3	389.63	.18	10914.68	4286.4	83.9	120.1	.2
SUBTOTALS		582	9.6	900000.0	998.8	102.48	.05	2901.28	5732.1	115.1	162.3	.3

LINEHAUL LINKS

CLASS NO.	NAME	TOTAL LINKS	TOTAL MILES	% USED MILES	KILOTONS CAPACITY	KILOTONS AVG FLOW	MTON-MILES	AVG SPEED (MPH)	AVG PER TON/MILE COST MILLS	AVG PER TON/MILE TIME (MIN.)	AVG PER TON/MILE ENERGY BTU	TOTAL COST ($K)	TOTAL DISUTILITY KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
37	D.L.FREE	247	17090	2.8	75000.	245.4	118	64.9	32.03	.925	2323.	3781.5	76.	274.	.
38	D.R.FREE	129	9063	1.8	48000.	1163.0	194	54.6	37.35	1.099	2485.	7253.7	148.	483.	1.
39	D.M.FREE	81	7413	5.2	28000.	5003.2	1911	37.7	51.72	1.590	2430.	98850.2	2111.	4645.	7.
41	D.R.TOLL	33	2031	2.3	48000.	37.3	2	55.3	35.41	1.085	2524.	60.7	1.	4.	.
42	D.M.TOLL	15	749	3.9	28000.	5366.1	156	38.6	59.64	1.554	2590.	9281.1	168.	403.	1.
43	U.LEVEL	443	34384	3.2	15200.	112.4	122	53.7	32.13	1.117	1627.	3920.6	95.	199.	.
44	U.ROLLING	165	14320	4.5	9500.	130.0	84	43.3	48.54	1.384	2093.	4088.5	81.	176.	.
45	U.MOUNT	139	15530	5.9	5000.	1182.3	1091	17.1	133.20	3.509	2837.	145347.4	2659.	3096.	5.
SUBTOTALS		1292	103578	3.6	22617.	977.8	3678	28.7	74.11	2.090	2523.	272583.7	5338.	9280.	15.

ACCESS LINKS

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
7	HA25	134	17.2	900000.	676.	2014.70	6.60	40012.69	31346.7	4276.	623.	1.
8	HA50	55	14.5	900000.	1992.	2801.90	5.23	80007.41	44659.5	3471.	1275.	2.
9	HA75	5	40.0	900000.	69.	4738.97	8.85	119706.96	654.0	51.	17.	.
SUBTOTALS		194	17.0	900000.	959.	2423.19	5.92	60510.66	76660.2	7797.	1914.	3.

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	DISUTILITY WEIGHTED SUM(000)
MODE TOTALS		(TOTAL KTONS =		15821.)					354976.0	13251.	11357.	18.

TRANSPORTATION NETWORK MODEL
1990 MINIMUM ENERGY RUN

MODAL SUMMARY REPORT - WTR

NODES

CLASS NO.	NAME	TOTAL NODES	% USED	KILOTONS CAPACITY	KILOTONS AVG. FLOW	AVG DISUTILITY PER KTON COST($)	TIME(HR)	ENERGY (KBTU)	TOTAL DISUTILITY COST ($K)	KTON DAYS	ENERGY BBTU	WEIGHTED SUM(000)
9	MAJR.FLEET	7	100.0	900000.0	102078.8	225.00	24.00	2700.00	160774.1	714551.7	1929.3	3.1
10	INMD.FLEET	3	100.0	900000.0	84132.1	150.00	16.00	1800.00	37859.4	168264.2	454.3	.7
11	MINR.FLEET	5	100.0	900000.0	52201.6	75.00	8.00	900.00	19575.6	87002.7	234.9	.4
12	THRU+ACCES	97	97.9	900000.0	38007.3	0.	0.	0.	0.	0.	0.	0.
13	UM600.110	23	100.0	50000.0	21953.2	29.84	1.73	1714.81	15067.7	36338.3	865.8	1.4
14	UM.LD26	1	100.0	90000.0	88904.7	296.10	17.49	16296.00	26324.7	64804.1	1448.8	2.3
15	IL600.110	12	100.0	50000.0	37791.8	157.92	9.38	6650.81	71618.0	177337.6	3016.2	4.8
16	AK600.110	42	95.2	45000.0	19125.7	39.74	2.41	1681.52	30402.1	76921.2	1286.4	2.0
17	OH12+6.110	16	100.0	120000.0	58066.9	19.65	1.26	883.34	18253.5	48774.2	820.7	1.3
18	OH.NAVPASS	2	100.0	195000.0	104729.3	19.60	1.05	934.80	4105.7	9196.8	195.8	.3
19	OH.GALLPLS	1	100.0	80000.0	46162.3	32.15	2.08	1731.51	1484.2	3992.2	79.9	.1
20	OH600+360	7	100.0	60000.0	28024.1	60.12	3.53	3410.33	11793.3	28852.1	669.0	1.1
21	MN360.56	12	83.3	40000.0	3235.4	26.77	1.06	921.00	866.2	1432.2	29.8	.0
22	MN720.XX+	4	100.0	100000.0	6907.0	9.49	.66	548.23	262.1	760.0	15.1	.0
23	TNUM.360+	4	100.0	30000.0	5964.7	42.82	1.94	1963.69	1021.7	1928.0	46.9	.1
24	XX400+.75+	5	100.0	35000.0	9592.0	163.31	5.13	5774.43	7832.3	10246.9	276.9	.4
25	KW2X360.56	4	100.0	60000.0	4693.7	26.02	1.54	949.02	488.6	1207.0	17.8	.0
26	GIWW.XXXX	7	100.0	55000.0	36471.4	85.66	5.01	1606.27	21869.5	53245.6	410.1	.7
27	KY145.XX	6	100.0	4500.0	798.9	48.23	1.04	2697.75	231.2	208.3	12.9	.0
SUBTOTALS		258	97.7	4253884.9	33502.1	50.91	4.22	1398.95	429830.0	1485063.0	11810.7	16.7

LINEHAUL LINKS

CLASS NO.	NAME	TOTAL LINKS	TOTAL MILES	% USED MILES	KILOTONS CAPACITY	KILOTONS AVG FLOW	MTON-MILES	AVG SPEED (MPH)	AVG PER TON/MILE COST MILLS	TIME (MIN.)	ENERGY BTU	TOTAL DISUTILITY COST ($K)	KTON DAYS	ENERGY BBTU	WEIGHTED SUM(000)
46	LWR.MISS.R	9	665	100.0	900000.	91523.4	60863	7.4	3.32	8.119	302.	202191.8	343158.	18382.	29.
47	UPR.MISS.R	46	733	100.0	900000.	35745.2	26201	7.2	3.67	8.299	299.	96269.5	151011.	7843.	12.
48	ARKANSAS.R	25	440	100.0	900000.	11893.8	5233	5.6	4.46	10.637	223.	23344.5	38658.	1167.	2.
49	OHIO.RIVEP	43	997	100.0	900000.	60528.0	60346	7.7	2.75	7.769	191.	165952.7	325565.	11526.	18.
50	L.MONONGHL	3	42	100.0	900000.	6907.0	290	7.6	3.15	7.920	187.	913.8	1596.	54.	.
51	U.MONONGHL	8	82	100.0	900000.	5825.5	478	7.6	3.15	7.920	187.	1504.7	2627.	89.	.
52	ALLEGHENY	10	68	100.0	900000.	2334.3	159	7.2	2.75	8.340	198.	436.5	919.	31.	.
53	TENNESSEE	17	553	100.0	900000.	16795.3	9268	8.3	3.15	7.272	203.	29256.6	46905.	1889.	3.
54	CLINCH/EMY	2	51	100.0	900000.	1473.0	75	7.8	3.00	7.680	223.	225.4	401.	17.	.
55	CUMBERLAND	4	91	100.0	900000.	19623.0	1786	7.8	3.00	7.680	223.	5357.1	9524.	398.	1.

CLASS NO.	NAME	TOTAL LINKS	TOTAL MILES	% USED MILES	KILOTONS CAPACITY	KILOTONS AVG FLOW	MTON-MILES	AVG SPEED (MPH)	AVG PER TON/MILE COST MILLS	AVG PER TON/MILE TIME (MIN.)	AVG PER TON/MILE ENERGY BTU	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
56	KANAWHA.R	4	86	100.0	900000.	906.3	78	6.8	3.00	8.760	187.	243.8	474.	15.	.
57	KENTUCKY.R	7	108	100.0	900000.	796.9	86	7.2	5.50	8.340	719.	474.6	500.	62.	.
58	ILLINOIS.R	13	326	100.0	900000.	47230.0	15397	7.4	3.15	8.100	248.	48500.5	86608.	3818.	6.
59	GIWW.WEST	15	549	100.0	900000.	42162.7	23147	6.5	3.60	9.300	175.	83330.4	149493.	4051.	6.
60	GIWW.EAST	4	245	100.0	900000.	36641.9	8977	6.1	4.71	9.821	203.	42300.9	61225.	1826.	3.
61	BW/TOMB/MO	11	375	100.0	900000.	30266.5	11350	6.5	3.15	9.300	164.	35752.3	73302.	1861.	3.
62	ALABA/COOS	4	275	100.0	900000.	137.4	38	6.8	5.00	8.761	527.	188.9	230.	20.	.
63	MISSOURI.R	3	224	100.0	900000.	21770.7	4877	6.9	7.21	8.655	413.	35171.1	29309.	2014.	3.
64	AP/CHAT/FL	7	287	100.0	900000.	4418.2	1268	5.6	14.83	10.794	598.	16809.6	9505.	758.	1.
65	ATCHAF/OLD	4	121	100.0	900000.	63434.4	7676	7.3	9.73	8.253	227.	74704.6	43993.	1743.	3.
66	RED.RIVER	2	69	100.0	900000.	7498.8	517	7.4	6.30	8.100	514.	3259.7	2910.	266.	.
68	P.ALLEN.RT	3	64	100.0	900000.	11756.1	752	7.4	3.60	8.100	293.	2708.6	4232.	220.	.
84	TENN.TOM	12	265	100.0	900000.	35498.8	9407	6.5	3.15	9.300	164.	29632.7	60755.	1543.	2.
SUBTOTALS		262	7075	94.9	900000.	36969.9	248290	7.2	3.63	8.368	240.	900520.1	1442899.	59595.	95.

ACCESS LINKS

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
10	WA025	50	94.0	900000.	13723.	1933.70	40.83	29363.08	1247175.0	1097142.	18938.	30.
11	WA050	15	93.3	900000.	3284.	2593.37	52.46	42742.38	119235.4	100503.	1965.	3.
12	WA075	17	94.1	900000.	4199.	3254.29	61.24	61850.92	218619.8	171407.	4155.	7.
13	WA100	15	93.3	900000.	1651.	5906.23	50.39	113521.43	136498.8	48527.	2624.	4.
14	WA125	12	91.7	900000.	2065.	6801.71	49.62	133388.41	154480.4	46958.	3030.	5.
15	WA150	9	77.8	900000.	639.	8950.12	53.11	179356.86	40016.0	9893.	802.	1.
16	WA175	9	100.0	900000.	1254.	11005.19	45.94	222788.34	124226.6	21607.	2515.	4.
17	WA200	2	100.0	900000.	2640.	10455.54	65.54	215707.52	55215.7	14421.	1139.	2.
SUBTOTALS		129	93.0	900000.	6875.	2540.00	43.94	42627.93	2095467.7	1510457.	35168.	56.

MODE TOTALS (TOTAL KTONS = 412516.)

	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
MODE TOTALS	3425817.9	4438419.	106573.	169.

TRANSPORTATION NETWORK MODEL
1990 MINIMUM ENERGY RUN

MODAL SUMMARY REPORT - PPL

NODES

CLASS NO.	NAME	TOTAL NODES	% USED	KILOTONS CAPACITY	KILOTONS AVG. FLOW	AVG DISUTILITY PER KTON COST($)	TIME(HR)	ENERGY (KBTU)	TOTAL DISUTILITY COST ($K)	KTON DAYS	ENERGY BBTU	WEIGHTED SUM(000)
28	PIPELINE	60	76.7	900000.0	24563.6	0.	0.	0.	0.	0.	0.	0.
SUBTOTALS		60	76.7	900000.0	24563.6	0.	0.	0.	0.	0.	0.	0.

LINEHAUL LINKS

CLASS NO.	NAME	TOTAL LINKS	TOTAL MILES	% USED MILES	KILOTONS CAPACITY	KILOTONS AVG FLOW	MTON-MILES	AVG SPEED (MPH)	AVG PER TON/MILE COST MILLS	TIME (MIN.)	ENERGY BTU	TOTAL DISUTILITY COST ($K)	KTON DAYS	ENERGY BBTU	WEIGHTED SUM(000)
70	P10	5	1763	71.6	4000.	1182.2	1492	2.2	2.58	26.806	331.	3848.8	27772.	494.	1.
71	P14	5	1631	36.7	8000.	3539.1	2120	2.4	2.96	24.920	335.	6285.1	36687.	711.	1.
72	P16	5	1236	34.7	11000.	2070.4	888	1.5	2.73	40.716	138.	2427.8	25114.	123.	.
73	P18	18	4284	75.7	14000.	4464.5	14483	2.4	4.20	25.146	494.	60814.6	252908.	7160.	11.
74	P20	6	1772	69.2	18000.	5328.2	6532	3.2	4.47	18.487	550.	29199.5	86130.	3590.	6.
75	P22	5	1123	50.8	24000.	11861.9	6761	3.3	2.46	18.279	312.	16626.1	85828.	2112.	3.
76	P24	8	2634	70.8	30000.	8393.7	15654	1.9	2.47	32.275	196.	38701.2	350861.	3067.	5.
77	P28	11	2313	86.6	44000.	11091.5	22227	2.4	2.06	24.847	165.	45788.9	383533.	3668.	6.
78	P32	12	3118	87.5	61000.	17048.9	46509	2.6	2.58	23.482	304.	120116.5	758434.	14146.	22.
79	P34	7	1615	70.8	71000.	24588.1	28104	2.8	1.90	21.231	185.	53521.5	414369.	5203.	8.
80	P36	5	2159	78.1	82000.	38075.4	64195	4.8	2.00	12.557	484.	128154.6	559779.	31101.	49.
81	P40	3	995	100.0	106000.	27201.3	27065	2.3	2.48	26.067	112.	67192.6	489936.	3023.	5.
83	P48	2	573	21.8	168000.	1631.4	204	.7	5.09	87.338	3.	1038.4	12368.	1.	.
SUBTOTALS		96	25983	68.8	42075.	13215.3	236236	2.8	2.43	21.235	315.	573715.7	3483718.	74397.	118.

ACCESS LINKS

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	TIME(HR)	ENERGY (KBTU)	TOTAL COST ($K)	KTON DAYS	DISUTILITY ENERGY BBTU	WEIGHTED SUM(000)
18	PA010	7	85.7	900000.	12492.	11.00	4.00	620.02	824.5	12493.	46.	.
19	PA025	41	75.6	900000.	10304.	27.00	9.00	1550.00	8624.5	119785.	495.	1.
20	PA050	17	70.6	900000.	8119.	54.00	19.00	3100.01	5261.2	77132.	302.	.

CLASS NO.	CLASS NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL COST ($K)	TOTAL KTON DAYS	DISUTILITY ENERGY BBTU	DISUTILITY WEIGHTED SUM(000)
21	PA075	11	81.8	900000.	8859.	81.00	28.00	4649.91	6458.2	93020.	371.	1.
22	PA100	26	57.7	900000.	2442.	108.01	37.00	6200.31	3955.5	56463.	227.	.
23	PA125	8	50.0	900000.	6571.	135.01	46.00	7750.50	3548.8	50385.	204.	.
24	PA150	13	61.5	900000.	863.	162.00	55.00	9300.16	1118.1	15817.	64.	.
26	PA200	13	46.2	900000.	1754.	215.99	74.00	12399.22	2272.8	32444.	130.	.
27	PA250	4	25.0	900000.	4081.	269.98	91.99	15499.05	1101.8	15643.	63.	.
28	PA300	1	100.0	900000.	2276.	323.96	109.98	18597.45	737.3	10430.	42.	.
SUBTOTALS		144	64.6	900000.	7078.	51.51	17.63	2955.51	33902.9	483612.	1945.	3.
MODE TOTALS		(TOTAL KTONS = 329118.)							607618.6	3967330.	76342.	121.

TRANSPORTATION NETWORK MODEL
1990 MINIMUM ENERGY RUN

MODAL SUMMARY REPORT - INTERMODAL TRANSFERS

CLASS NO.	NAME	TOTAL LINKS	% USED	KILOTONS CAPACITY	KILOTONS AVG FLOW	AVG DISUTILITY PER KTON COST($)	AVG DISUTILITY PER KTON TIME(HR)	AVG DISUTILITY PER KTON ENERGY (KBTU)	TOTAL COST ($K)	TOTAL KTON DAYS	TOTAL DISUTILITY ENERGY BBTU	TOTAL DISUTILITY WEIGHTED SUM(000)
NETWORK TOTALS		(TOTAL KTONS = 3026186.)							24955631.	223905881.	943297.	1496.

TRANSPORTATION NETWORK MODEL
1990 MINIMUM ENERGY RUN

COMMODITY SUMMARY REPORT

COMMODITY NO.	NAME	MODE	KTONS	PER-CENT	MTON-MILES	PER-CENT	COST($K)	PER-CENT	KTON DAYS	PER-CENT	ENERGY BBTU	PER-CENT	TOTAL DISUTILITY	PER-CENT
1	FARM PROD.	RR	134618	72.9	66124	59.0	1065547	65.9	919911	57.0	39967	68.6	63	68.6
		WTR	50152	27.1	45920	41.0	552498	34.1	694409	43.0	18323	31.4	29	31.4
		TOTAL	184771	100.0	112044	100.0	1618046	100.0	1614320	100.0	58290	100.0	92	100.0
2	FOREST+MAR	RR	483	5.2	365	19.3	5501	13.5	4598	9.2	227	19.1	0	19.1
		WTR	8883	94.8	1529	80.7	35385	86.5	45572	90.8	964	80.9	2	80.9
		TOTAL	9366	100.0	1893	100.0	40886	100.0	50170	100.0	1191	100.0	2	100.0
3	COAL	RR	512972	98.6	178813	96.8	2407575	95.9	1843875	96.0	72480	95.4	115	95.4
		HWY	1522	.3	604	.3	60582	2.4	1565	.1	1830	2.4	3	2.4
		WTR	5911	1.1	5301	2.9	42088	1.7	74517	3.9	1643	2.2	3	2.2
		TOTAL	520405	100.0	184718	100.0	2510245	100.0	1919957	100.0	75953	100.0	120	100.0
4	CRUDE PETR	RR	45574	10.9	11836	4.6	339264	30.8	201958	4.5	9372	10.5	15	10.5
		HWY	450	.1	179	.1	20984	1.9	463	.0	559	.6	1	.6
		WTR	42077	10.1	11363	4.4	132538	12.0	336351	7.5	3200	3.6	5	3.6
		PPL	329118	78.9	236236	91.0	607619	55.2	3967330	88.0	76342	85.3	121	85.3
		TOTAL	417219	100.0	259614	100.0	1100405	100.0	4506102	100.0	89473	100.0	142	100.0
5	METAL ORES	RR	69217	72.7	19240	43.7	402643	51.9	367511	53.1	11609	48.6	18	48.6
		HWY	4244	4.5	1821	4.1	164717	21.2	4495	.6	5339	22.3	8	22.3
		WTR	21745	22.8	22965	52.2	208751	26.9	320377	46.3	6942	29.1	11	29.1
		TOTAL	95205	100.0	44027	100.0	776110	100.0	692383	100.0	23890	100.0	38	100.0
6	MINERALS N	RR	120984	78.0	34471	67.8	702048	69.9	623068	67.2	20484	72.3	32	72.3
		HWY	346	.2	10	.0	1714	.2	123	.0	59	.2	0	.2
		WTR	33732	21.8	16386	32.2	300038	29.9	304560	32.8	7781	27.5	12	27.5
		TOTAL	155063	100.0	50867	100.0	1003800	100.0	927752	100.0	28324	100.0	45	100.0
7	FOOD+KINDR	RR	165505	75.2	103709	79.6	2222266	80.5	1403717	74.6	82754	85.3	131	85.3
		HWY	1474	.7	55	.0	10502	.4	1034	.1	271	.3	0	.3
		WTR	52972	24.1	26538	20.4	526158	19.1	476429	25.3	14033	14.5	22	14.5
		TOTAL	219951	100.0	130302	100.0	2758926	100.0	1881180	100.0	97059	100.0	154	100.0
8	TEXTILES+A	RR	15103	85.7	9642	83.5	280988	88.8	136843	81.6	11339	91.2	18	91.2
		HWY	225	1.3	47	.4	3055	1.0	183	.1	131	1.1	0	1.1
		WTR	2293	13.0	1861	16.1	32323	10.2	30636	18.3	967	7.8	2	7.8
		TOTAL	17621	100.0	11551	100.0	316366	100.0	167662	100.0	12437	100.0	20	100.0

TRANSPORTATION NETWORK MODEL
1990 MINIMUM ENERGY RUN

COMMODITY NO.	NAME	MODE	KTONS	PER-CENT	MTON-MILES	PER-CENT	COST($K)	PER-CENT	KTON DAYS	PER-CENT	ENERGY HBTU	PER-CENT	TOTAL DISUTILITY	PER-CENT
9	TOFC	RR	27095	100.0	19614	100.0	502688	100.0	223409	100.0	22959	100.0	36	100.0
		TOTAL	27095	100.0	19614	100.0	502688	100.0	223409	100.0	22959	100.0	36	100.0
10	CHEMICALS	RR	176581	79.2	112466	74.5	1846796	81.7	1593925	72.1	69046	81.4	110	81.4
		HWY	1200	.5	112	.1	9192	.4	490	.0	411	.5	1	.5
		WTR	45195	20.3	38432	25.4	403133	17.8	616024	27.9	15368	18.1	24	18.1
		TOTAL	222977	100.0	151009	100.0	2259120	100.0	2210439	100.0	84825	100.0	135	100.0
11	LUMBER+FUR	RR	69787	89.9	69174	92.8	1015462	92.4	679852	88.1	48749	94.7	77	94.7
		HWY	166	.2	5	.0	1167	.1	115	.0	31	.1	0	.1
		WTR	7674	9.9	5373	7.2	82087	7.5	91358	11.8	2692	5.2	4	5.2
		TOTAL	77626	100.0	74552	100.0	1098716	100.0	771326	100.0	51472	100.0	82	100.0
12	MACHINERY	RR	18663	75.5	16259	82.2	433912	85.9	206699	76.4	18412	89.9	29	89.9
		WTR	6071	24.5	3528	17.8	71253	14.1	63885	23.6	2076	10.1	3	10.1
		TOTAL	24733	100.0	19787	100.0	505166	100.0	270584	100.0	20488	100.0	32	100.0
13	ELEC MACHI	RR	19773	96.6	15432	99.3	577480	98.9	207597	99.8	22378	98.8	35	98.8
		HWY	693	3.4	114	.7	6605	1.1	431	.2	279	1.2	0	1.2
		TOTAL	20465	100.0	15546	100.0	584084	100.0	208028	100.0	22657	100.0	36	100.0
14	TRANSP EQU	RR	25152	100.0	14912	100.0	465488	100.0	222587	100.0	17126	100.0	27	100.0
		TOTAL	25152	100.0	14912	100.0	465488	100.0	222587	100.0	17126	100.0	27	100.0
15	UNID MANUF	RR	409412	88.3	226539	90.4	3905899	88.6	3224867	87.4	144061	91.1	228	91.1
		HWY	2507	.5	592	.2	54398	1.2	2484	.1	1788	1.1	3	1.1
		WTR	51780	11.2	23398	9.3	446552	10.1	462450	12.5	12221	7.7	19	7.7
		TOTAL	463698	100.0	250529	100.0	4406849	100.0	3689801	100.0	158071	100.0	251	100.0
16	PAPER+ALLI	RR	74201	81.9	49748	81.6	967580	83.2	652901	77.5	38524	86.4	61	86.4
		HWY	106	.1	3	.0	718	.1	74	.0	18	.0	0	.0
		WTR	16292	18.0	11216	18.4	194032	16.7	189748	22.5	6065	13.6	10	13.6
		TOTAL	90599	100.0	60968	100.0	1162330	100.0	842723	100.0	44607	100.0	71	100.0
17	PETRL PROD	RR	79322	62.3	42347	67.0	685232	76.4	637347	55.1	24227	73.8	38	73.8
		HWY	526	.4	15	.0	2843	.3	187	.0	91	.3	0	.3
		WTR	47435	37.3	20870	33.0	208732	23.3	518508	44.9	8507	25.9	13	25.9
		TOTAL	127284	100.0	63232	100.0	896806	100.0	1156042	100.0	32825	100.0	52	100.0

TRANSPORTATION NETWORK MODEL
1990 MINIMUM ENERGY RUN

COMMODITY NO.	NAME	MODE	KTONS	PER-CENT	MTON-MILES	PER-CENT	COST($K)	PER-CENT	KTON DAYS	PER-CENT	ENERGY BBTU	PER-CENT	TOTAL DISUTILITY	PER-CENT
18	PRMY METAL	RR	101129	92.8	45844	88.3	836229	93.0	808505	90.0	28381	92.6	45	92.6
		WTR	7904	7.2	6086	11.7	62496	7.0	90067	10.0	2260	7.4	4	7.4
		TOTAL	109033	100.0	51930	100.0	898725	100.0	898572	100.0	30641	100.0	49	100.0
19	FARM METAL	RR	44410	88.9	27606	88.9	638857	90.9	392146	87.7	23877	93.1	38	93.1
		HWY	426	.9	12	.0	2541	.4	222	.0	74	.3	0	.3
		WTR	5113	10.2	3426	11.0	61118	8.7	54864	12.3	1693	6.6	3	6.6
		TOTAL	49949	100.0	31044	100.0	702517	100.0	447233	100.0	25645	100.0	41	100.0
20	MISCELLANE	RR	158749	94.5	70395	94.4	1265565	93.9	1135567	94.2	43054	94.9	68	94.9
		HWY	1937	1.2	108	.1	15958	1.2	1384	.1	474	1.0	1	1.0
		WTR	7288	4.3	4098	5.5	66637	4.9	68664	5.7	1838	4.1	3	4.1
		TOTAL	167974	100.0	74601	100.0	1348159	100.0	1205616	100.0	45365	100.0	72	100.0
TOTAL, ALL COMMODITIES-		RR	2268731	75.0	1134536	69.9	20567219	82.4	15486883	64.8	749025	79.4	1188	79.4
		HWY	15821	.5	3678	.2	354976	1.4	13251	.1	11357	1.2	18	1.2
		WTR	412516	13.6	248290	15.3	3425818	13.7	4438419	18.6	106573	11.3	169	11.3
		PPL	329118	10.9	236236	14.6	607619	2.4	3967330	16.6	76342	8.1	121	8.1
		XFR	0	0.	0	0.	0	0.	0	0.	0	0.	0	0.
TOTAL, ALL MODES=			3026186	100.0	1622740	100.0	24955631	100.0	23905881	100.0	943297	100.0	1496	100.0

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