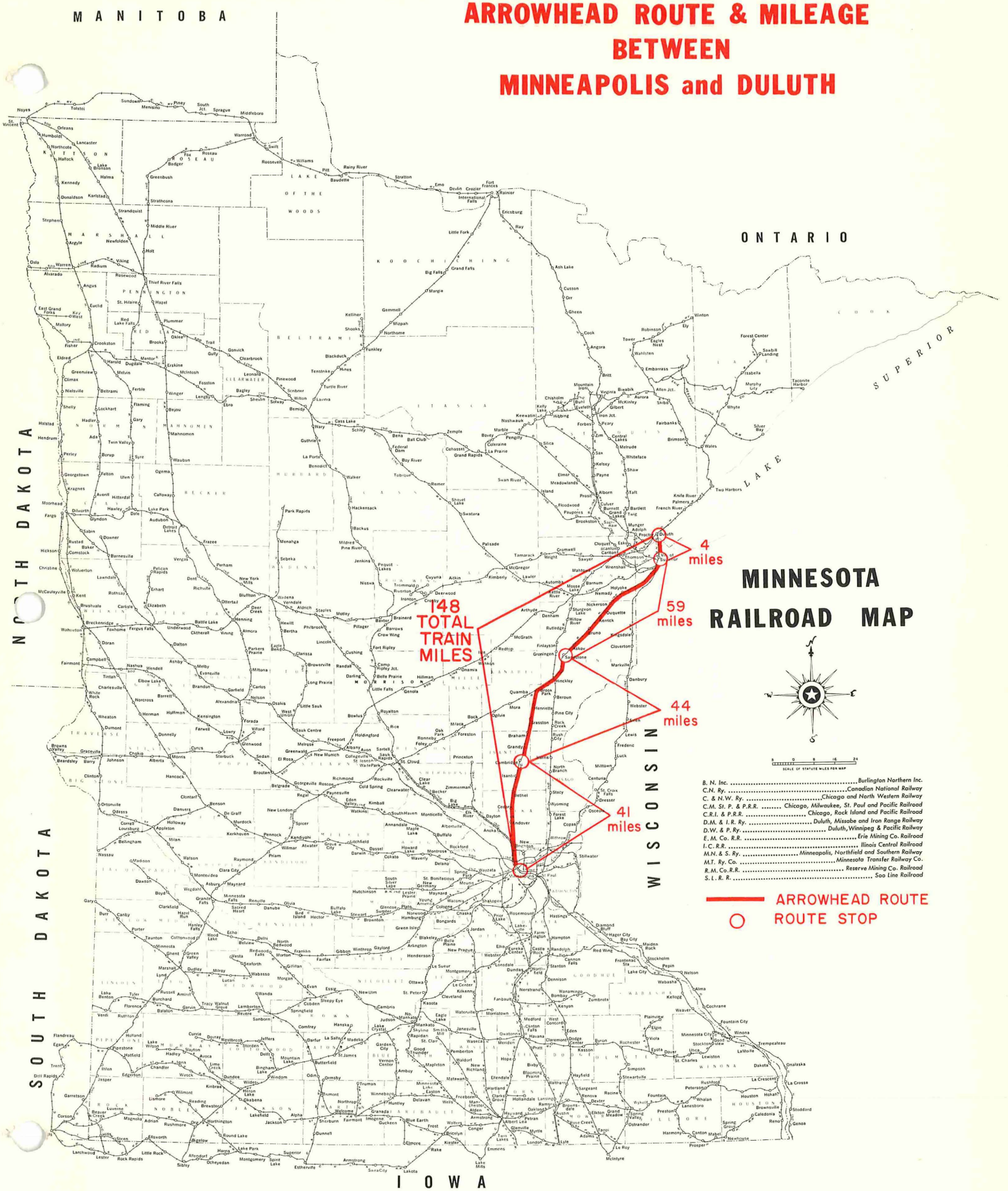
SUPPLEMENTAL REPORT TO THE LEGISLATURE ON AMTRAK RAIL SERVICE BETWEEN THE TWIN CITIES AND DULUTH

TABLE OF CONTENTS

ARROWHEAD ROUTE & MILEAGE BETWEEN MINNEAPOLIS and DULUTH



MAP PREPARED BY TRANSPORTATION PLANNING AND PROGRAMMING DIVISION
MINNESOTA DEPARTMENT OF HIGHWAYS JANUARY 1976

Section I

ARROWHEAD TRAIN
30-Month Summary
April 15 - September, 1979
Cost Revenue Data

Operating Cost			$2,693,554
Operating Revenues		(36%)	974,629
Subsidy-State [1]	$1,002,177	(37%)	
Federal	716,748	(27%)	
Total Deficit			$1,718,925

Cost Share Per Passenger	
Revenue	$ 7.03
State Subsidy	$ 7.23
Federal Subsidy	$ 5.17
Total Cost	$19.43

Total Passengers - 138,573
Pass Passengers - 19,350
Value of Passes - $142,089.07

[1] State Share of Operating Deficit:

April 15, 1975 thru September, 1976	66.67%
Beginning October, 1976	50.00%

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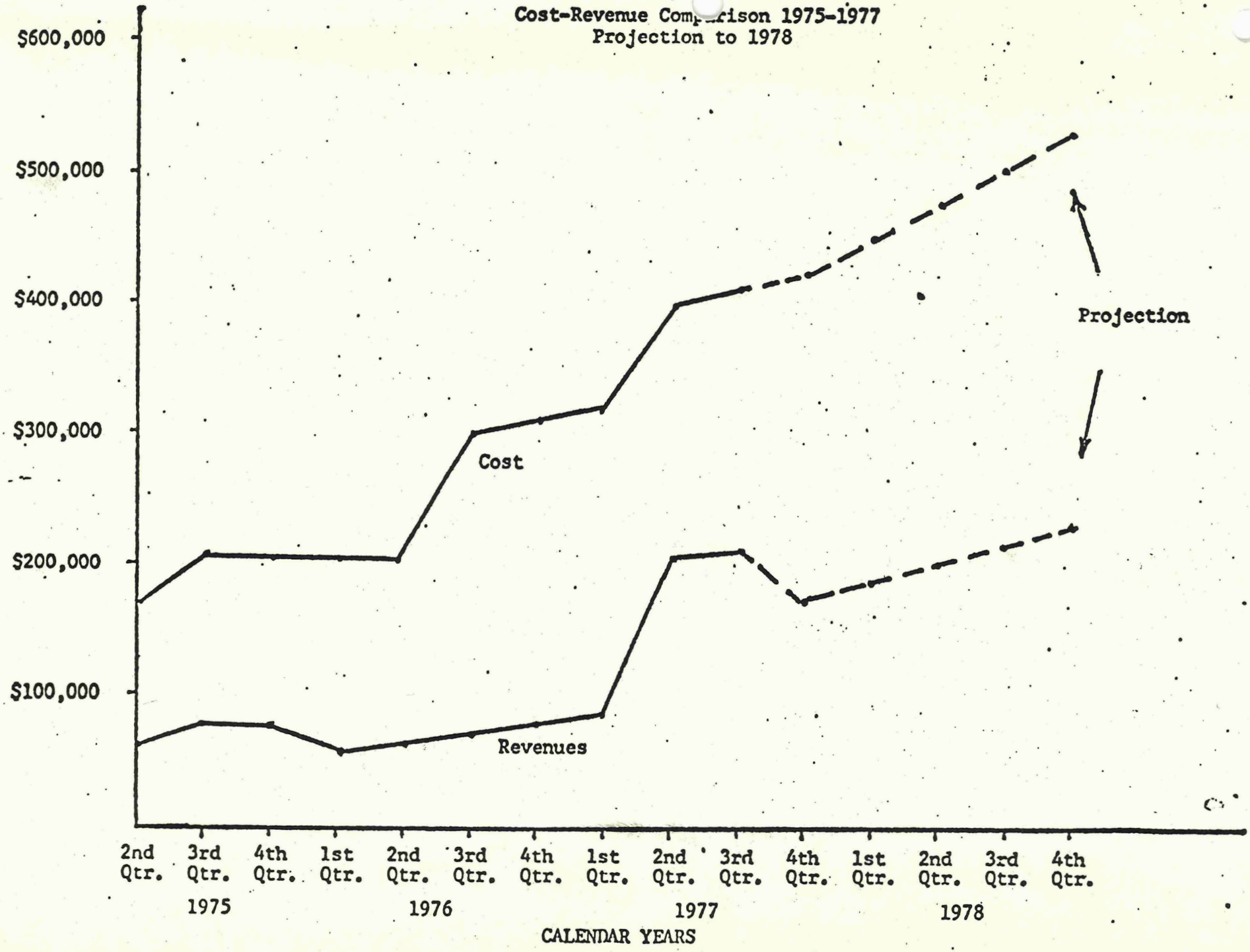
Cost-Revenue Comparison 1975-1977
Projection to 1978



National Railroad Passenger Corporation
"Arrowhead Route"
Statement of Operations - Summary
April 15, 1975 thru September 1977

Calendar Year	Month	Number of Ridership	Quarter Total	Operating Revenue	Quarter Total	Operating Expenses	Quarter Total	Net Operating Deficit	Quarter Total	State Share of Operating Deficit	Quarter Total
1975	April	1,628		$13,100	$	$ 33,001	$	$19,901	$	$13,268	$
	May	3,349		21,654		65,219		43,565		29,045	
	June	3,949	8,926	27,004	61,758	65,124	163,344	38,120	(101,586)	25,415	67,728
	July	3,885		25,590		67,072		41,482		27,656	
	August	5,665		29,641		67,916		38,275		25,518	
	September	2,974	12,524	22,794	78,025	67,242	202,230	44,448	(124,205)	29,634	82,808
	October	2,912		20,181		67,651		47,470		31,648	
	November	3,743		25,590		67,722		42,132		28,089	
	December	4,176	10,831	29,920	75,691	69,977	205,350	40,057	(129,659)	26,706	86,443
1976	January	2,646		19,205		68,195		48,990		32,662	
	February	2,537		17,456		67,899		50,443		33,630	
	March	3,079	8,262	20,007	56,668	67,673	203,767	47,666	(147,099)	31,779	98,071
	April	4,242		29,537		68,059		38,522		25,683	
	May	2,914		20,645		67,847		47,202		31,470	
	June	2,811	9,967	20,090	70,272	66,998	202,904	46,908	(132,632)	31,274	88,427
	July	3,321		25,709		96,111		70,402		46,937	
	August	3,971		27,803		96,217		68,414		45,612	
	September	2,504	9,796	18,668	72,180	100,776	293,104	82,108	(220,924)	54,741	147,290
	October	2,591		18,693		110,239		91,546		45,773	
	November	3,257		24,849		101,907		77,058		38,529	
	December	4,113	9,961	30,798	74,340	100,230	312,376	69,432	(238,036)	34,716	119,018
1977	January	2,392		18,513		94,907		76,394		38,197	
	February	4,134		21,459		109,269		87,810		43,905	
	March	5,193	11,719	39,760	79,732	108,764	312,940	69,004	(233,208)	34,502	116,604
	April	5,990		42,781		132,733		89,952		44,976	
	May	10,203		74,691		128,182		53,490		26,745	
	June	11,356	27,549	82,740	200,213	130,708	391,623	47,968	(191,410)	23,984	95,705
	July	10,522		74,693		124,973		50,280		25,140	
	August	10,789		75,549		131,411		55,862		27,931	
	September	7,727	29,038	55,508	205,750	149,532	405,916	94,024	(200,166)	47,012	100,083
GRAND TOTALS			138,573		$974,629		$2,693,554		$(1,718,925)		$1,002,177

NATIONAL RAILROAD PASSENGER CORPORATION
"ARROWHEAD TRAIN"
PASSENGER SERVICE BETWEEN MPLS.-ST. PAUL AND DULUTH-SUPERIOR

STATEMENT OF OPERATIONS
2ND QUARTER - CALENDAR YEAR 1975

	APRIL[1]	MAY	JUNE	TOTALS	%
Operating Revenue					
Passenger	$12,324	$21,601	$25,492	$ 59,417	96.2
Dining-Buffet	773	53	1,508	2,334	3.7
Mail	-	-	-	-	-
Other	3	-	4	7	.0
TOTAL OPERATING REVENUE	$13,100	$21,654	$27,004	$ 61,758	100.0
Operating Expenses					
Railroad Costs - BN*	$26,449	$52,898	$52,898	$132,245	80.9
Dining-Buffet	464	32	905	1,401	.8
On-Board Service Attendant	1,993	4,119	3,987	10,099	6.1
Facilities	2,356	4,882	4,368	11,606	7.1
Depreciation	1,221	1,992	1,959	5,172	3.1
Administration	300	600	600	1,500	.9
Interest	-	-	-	-	-
Claims Liability	218	310	407	935	.5
Other	-	386	-	386	.2
TOTAL OPERATING EXPENSE	$33,001	$65,219	$65,124	$163,344	100.0
NET OPERATING (DEFICIT)	(19,901)	(43,565)	(38,120)	(101,586)	
STATE SHARE - 66.67%	13,268	29,045	25,415	67,728	66.6
FEDERAL SHARE - 33.33%	6,633	14,520	12,705	33,858	33.3
STATISTICAL DATA:					
PASSENGERS (INCLUDES PASSES)	1,628	3,349	3,949	8,926	
COST PER PASSENGER	20.27	19.47	16.49	18.30	
Operating Revenue Produced Per Passenger	8.05	6.47	6.84	6.92	
LOSS PER PASSENGER	12.22	13.01	9.65	11.38	
STATE SUBSIDY	8.15	8.67	6.43	7.59	
FEDERAL SUBSIDY	4.07	4.34	3.22	3.79	

* Billed to NRPC By Burlington Northern.
1 Train service started April 15th.

NATIONAL RAILROAD PASSENGER CORPORATION
"ARROWHEAD TRAIN"
PASSENGER SERVICE BETWEEN MPLS.-ST. PAUL AND DULUTH-SUPERIOR

STATEMENT OF OPERATIONS
3RD QUARTER - CALENDAR YEAR 1975

	JULY	AUG.	SEPT.	TOTALS	%
Operating Revenue					
Passenger	$22,133	$25,716	$19,198	$ 67,047	85.93
Dining-Buffet	3,446	3,915	3,581	10,942	14.02
Mail	-	-	-	-	-
Other	11	10	15	36	.05
TOTAL OPERATING REVENUE	$25,590	$29,641	$22,794	$ 78,025	100.00
Operating Expenses					
Railroad Costs - BN*	$52,898	$52,898	$52,898	$158,694	78.47
Dining-Buffet	2,068	2,349	2,149	6,560	3.25
On-Board Service Attendant	4,119	4,119	3,987	12,225	6.05
Facilities	5,020	5,142	5,190	15,352	7.59
Depreciation	2,026	2,339	2,026	6,391	3.16
Administration	600	600	600	1,800	.89
Interest	-	-	-	-	-
Claims Liability	341	469	392	1,202	.59
Other	-	-	-	-	-
TOTAL OPERATING EXPENSE	$67,072	$67,916	$67,242	$202,230	100.00
NET OPERATING (DEFICIT)	(41,482)	(38,275)	(44,448)	(124,205)	
STATE SHARE - 66.67%	27,656	25,518	29,634	82,808	66.67
FEDERAL SHARE - 33.33%	13,826	12,757	14,814	41,397	33.33
	-				
STATISTICAL DATA:					
PASSENGERS (INCLUDES PASSES)	3,885	5,665	2,974	12,524	
COST PER PASSENGER	17.26	11.99	22.61	16.15	
Operating Revenue Produced Per Passenger	6.59	5.23	7.66	6.23	
LOSS PER PASSENGER	10.67	6.76	14.95	9.92	
STATE SUBSIDY	7.11	4.51	9.97	6.61	
FEDERAL SUBSIDY	3.56	2.25	4.98	3.31	

* Billed to NRPC By Burlington Northern.
Train service started April 15th.

NATIONAL RAILROAD PASSENGER CORPORATION
"ARROWHEAD TRAIN"
PASSENGER SERVICE BETWEEN MPLS.-ST. PAUL AND DULUTH-SUPERIOR

STATEMENT OF OPERATIONS
4TH QUARTER - CALENDAR YEAR 1975

	OCT.	NOV.	DEC.	TOTALS	%
Operating Revenue					
Passenger	$18,372	$23,590	$26,259	$ 68,221	90.13
Dining-Buffet	1,816	2,000	3,661	7,477	9.88
Mail	-	-	-	-	-
Other	(7)	-	-	(7)	- .01
TOTAL OPERATING REVENUE	$20,181	$25,590	$29,920	$ 75,691	100.00
Operating Expenses					
Railroad Costs - BN*	$52,898	$52,898	$52,898	$158,694	77.28
Dining-Buffet	1,090	1,200	2,197	4,487	2.19
On-Board Service Attendant	4,288	4,150	4,268	12,706	6.19
Facilities	6,337	5,675	6,500	18,512	9.01
Depreciation	1,993	2,299	2,453	6,745	3.28
Administration	600	600	600	1,800	.88
Interest	-	-	-	-	-
Claims Liability	280	409	1,061	1,750	.85
Other	165.28	491	-	656	.32
TOTAL OPERATING EXPENSE	$67,651	$67,722	$69,977	$205,350	100.00
NET OPERATING (DEFICIT)	(47,470)	(42,132)	(40,057)	(129,659)	
STATE SHARE - 66.67%	$31,648	$28,089	$26,706	$ 86,443	66.67
FEDERAL SHARE - 33.33%	15,822	14,043	13,351	43,216	33.33
STATISTICAL DATA:					
PASSENGERS (INCLUDES PASSES)	2,912	3,743	4,176	10,831	
COST PER PASSENGER	23.23	18.09	16.76	18.96	
Operating Revenue Produced Per Passenger	6.93	6.84	7.16	6.99	
LOSS PER PASSENGER	16.30	11.25	9.60	11.97	
STATE SUBSIDY	10.87	7.50	6.40	7.98	
FEDERAL SUBSIDY	5.43	3.75	3.20	3.99	

* Billed to NRPC By Burlington Northern.
Train service started April 15th.

NATIONAL RAILROAD PASSENGER CORPORATION
"ARROWHEAD TRAIN"
PASSENGER SERVICE BETWEEN MPLS.-ST. PAUL AND DULUTH-SUPERIOR

STATEMENT OF OPERATIONS
SUMMARY - April 15 - December 31, 1975

	TOTALS	%
Operating Revenue		
Passenger	$194,685	90.35
Dining-Buffet	20,753	9.63
Mail	-	-
Other	36	.02
TOTAL OPERATING REVENUE	$215,474	100.00
Operating Expenses		
Railroad Costs - BN*	$449,633	78.75
Dining-Buffet	12,454	2.19
On-Board Service Attendant	35,030	6.14
Facilities	45,470	7.96
Depreciation	18,308	3.21
Administration	5,100	.89
Interest	-	-
Claims Liability	3,887	.68
Other	1,042	.18
TOTAL OPERATING EXPENSE	$570,924	100.00
NET OPERATING (DEFICIT)	(355,450)	
STATE SHARE - 66.67%	$236,979	66.67
FEDERAL SHARE - 33.33%	118,471	33.33
STATISTICAL DATA:		
PASSENGERS (INCLUDES PASSES)	32,281	
COST PER PASSENGER	17.69	
Operating Revenue Produced Per Passenger	6.67	
LOSS PER PASSENGER	11.01	
STATE SUBSIDY	7.34	
FEDERAL SUBSIDY	3.67	

* Billed to NRPC By Burlington Northern.
Train service started April 15th.

NATIONAL RAILROAD PASSENGER CORPORATION
"ARROWHEAD TRAIN"
PASSENGER SERVICE BETWEEN MPLS.-ST. PAUL AND DULUTH-SUPERIOR

STATEMENT OF OPERATIONS
1ST QUARTER - CALENDAR YEAR 1976

	JAN.	FEB.	MAR.	TOTALS	%
Operating Revenue					
Passenger	$17,437	$15,537	$17,891	$ 50,865	89.76
Dining-Buffet	1,768	1,900	2,113	5,781	10.20
Mail	-	-	-	-	-
Other	-	19	3	22	.04
TOTAL OPERATING REVENUE	$19,205	$17,456	$20,007	$ 56,668	100.00
Operating Expenses					
Railroad Costs - BN*	$52,898	$52,898	$52,898	$158,694	77.90
Dining-Buffet	1,061	1,140	1,268	3,469	1.70
On-Board Service Attendant	4,278	4,002	4,278	12,558	6.16
Facilities	6,334	6,346	5,605	18,285	8.97
Depreciation	2,361	2,130	2,140	6,631	3.25
Administration	600	600	600	1,800	.88
Interest	-	-	-	-	-
Claims Liability	663	783	884	2,330	1.14
Other	-	-	-	-	-
TOTAL OPERATING EXPENSE	$68,195	$67,899	$67,673	$203,767	100.00
NET OPERATING (DEFICIT)	(48,990)	(50,443)	(47,666)	(147,099)	
STATE SHARE - 66.67%	$32,662	$33,630	$31,779	$ 98,071	66.67
FEDERAL SHARE - 33.33%	$16,328	$16,813	$15,887	$ 49,028	33.33
STATISTICAL DATA:					
PASSENGERS (INCLUDES PASSES)	2,646	2,537	3,079	8,262	
COST PER PASSENGER	25.77	26.76	21.98	24.66	
Operating Revenue Produced Per Passenger	7.26	6.88	6.50	6.86	
LOSS PER PASSENGER	18.51	19.88	15.48	17.80	
STATE SUBSIDY	12.34	13.25	10.32	11.87	
FEDERAL SUBSIDY	6.17	6.63	5.16	5.93	

* Billed to NRPC By Burlington Northern.
Train service started April 15th.

NATIONAL RAILROAD PASSENGER CORPORATION
"ARROWHEAD TRAIN"
PASSENGER SERVICE BETWEEN MPLS.-ST. PAUL AND DULUTH-SUPERIOR

STATEMENT OF OPERATIONS
2ND QUARTER - CALENDAR YEAR 1976

	APR.	MAY	JUNE	TOTALS	%
Operating Revenue					
Passenger	$25,187	$17,482	$17,410	$ 60,079	85.50
Dining-Buffet	1,914	1,859	1,522	5,295	7.53
Mail	2,436	1,298	1,158	4,892	6.96
Other	-	6	-	6	.01
TOTAL OPERATING REVENUE	$29,537	$20,645	$20,090	$ 70,272	100.00
Operating Expenses					
Railroad Costs - BN*	$52,898	$52,898	$52,898	$158,694	78.21
Dining-Buffet	1,148	1,115	913	3,176	1.57
On-Board Service Attendant	4,140	4,278	4,140	12,558	6.19
Facilities	5,954	6,012	5,654	17,620	8.68
Depreciation	2,258	2,173	2,188	6,619	3.26
Administration	600	600	600	1,800	.89
Interest	-	-	-	-	-
Claims Liability	1,061	771	605	2,437	1.20
Other	-	-	-	-	-
TOTAL OPERATING EXPENSE	$68,059	$67,847	$66,998	$202,904	100.00
NET OPERATING (DEFICIT)	(38,522)	(47,202)	(46,908)	(132,632)	
STATE SHARE - 66.67%	$25,683	$31,470	$31,274	$ 88,427	66.67
FEDERAL SHARE - 33.33%	12,839	15,732	15,634	44,205	33.33
STATISTICAL DATA:					
PASSENGERS (INCLUDES PASSES)	4,242	2,914	2,811	9,967	
COST PER PASSENGER	16.04	23.28	23.83	20.36	
Operating Revenue Produced Per Passenger	6.96	7.08	7.15	7.05	
LOSS PER PASSENGER	9.08	16.20	16.68	13.31	
STATE SUBSIDY	6.05	10.80	11.12	8.87	
FEDERAL SUBSIDY	3.03	5.40	5.56	4.44	

* Billed to NRPC By Burlington Northern.
Train service started April 15th.

NATIONAL RAILROAD PASSENGER CORPORATION
"ARROWHEAD TRAIN"
PASSENGER SERVICE BETWEEN MPLS.-ST. PAUL AND DULUTH-SUPERIOR

STATEMENT OF OPERATIONS
3RD QUARTER - CALENDAR YEAR 1976

	JULY	AUG.	SEPT.	TOTALS	%
Operating Revenue					
Passenger	$20,750	$24,902	$15,129	$ 60,781	84.21
Dining-Buffet	2,785	1,742	1,690	6,217	8.61
Mail	1,264	1,156	1,112	3,532	4.89
Other	910	3	737	1,650	2.29
TOTAL OPERATING REVENUE	$25,709	$27,803	$18,668	$ 72,180	100.00
Operating Expenses					
Railroad Costs - BN*	$80,732	$81,561	$86,326	$248,619	84.82
Dining-Buffet	1,671	1,045	1,014	3,730	1.27
On-Board Service Attendant	4,278	4,278	4,140	12,696	4.34
Facilities	6,090	5,824	5,674	17,588	6.00
Depreciation	2,359	2,437	2,551	7,347	2.51
Administration	600	600	600	1,800	.61
Interest	-	-	-	-	-
Claims Liability	381	472	471	1,324	.45
Other	-	-	-	-	-
TOTAL OPERATING EXPENSE	$96,111	$96,217	$100,776	$293,104	100.00
NET OPERATING (DEFICIT)	(70,402)	(68,414)	(82,108)	(220,924)	
STATE SHARE - 66.67%	$46,937	$45,612	$54,741	$147,290	66.67
FEDERAL SHARE - 33.33%	23,465	22,802	27,367	73,634	33.33
STATISTICAL DATA:					
PASSENGERS (INCLUDES PASSES)	3,321	3,971	2,504	9,796	
COST PER PASSENGER	28.94	24.23	40.24	22.55	
Operating Revenue Produced Per Passenger	7.74	7.00	7.46	7.37	
LOSS PER PASSENGER	21.20	17.23	32.79	22.55	
STATE SUBSIDY	14.13	11.49	21.86	15.04	
FEDERAL SUBSIDY	7.07	5.74	10.93	7.52	

* Billed to NRPC By Burlington Northern.
Train service started April 15th.

NATIONAL RAILROAD PASSENGER CORPORATION
"ARROWHEAD TRAIN"
PASSENGER SERVICE BETWEEN MPLS.-ST. PAUL AND DULUTH-SUPERIOR

STATEMENT OF OPERATIONS
4TH QUARTER - CALENDAR YEAR 1976

	OCT.	NOV.	DEC.	TOTALS	%
Operating Revenue					
Passenger	$ 14,889	$ 20,615	$ 25,792	$ 61,296	82.45
Dining-Buffet	1,649	2,288	2,586	6,523	8.78
Mail	1,221	1,029	1,358	3,608	4.85
Other	934	917	1,062	2,913	3.92
TOTAL OPERATING REVENUE	$ 18,693	$ 24,849	$ 30,798	$ 74,340	100.00
Operating Expenses					
Railroad Costs - BN*	$ 85,681	$ 85,135	$ 83,546	$254,362	81.43
Dining-Buffet	989	1,373	1,552	3,914	1.25
On-Board Service Attendant	4,412	4,270	4,412	13,094	4.19
Facilities	6,013	5,084	4,657	15,754	5.04
Depreciation	11,818**	4,582	4,599	20,999	6.72
Administration	600	600	600	1,800	.58
Interest	-	-	-	-	-
Claims Liability	726	863	864	2,453	.79
Other	-	-	-	-	-
TOTAL OPERATING EXPENSE	$110,239	$101,907	$100,230	$312,376	100.00
NET OPERATING (DEFICIT)	(91,546)	(77,058)	(69,432)	(238,036)	
				State Share 50%	
STATE SHARE - 50%	$ 45,773	$ 38,529	$ 34,716	$119,018	50.00
				Federal Share 50%	
FEDERAL SHARE - 50%	45,773	38,529	34,716	119,018	50.00
STATISTICAL DATA:					
PASSENGERS (INCLUDES PASSES)	2,591	3,257	4,113	9,961	
COST PER PASSENGER	42.55	31.29	24.37	31.36	
Operating Revenue Produced Per Passenger	7.21	7.63	7.49	7.46	
LOSS PER PASSENGER	35.34	23.66	16.88	23.90	
STATE SUBSIDY	17.67	11.83	8.44	11.95	
FEDERAL SUBSIDY	17.67	11.83	8.44	11.95	

** Depreciation Adjustment
July $2,359
Aug. 2,437
Sept. 2,551 $7,347

* Billed to NRPC By Burlington Northern.
Train service started April 15th.

State Share of Operating Deficit:
April, 1975 thru Sept., 1976 66.67%
Beginning October, 1976 50 %

NATIONAL RAILROAD PASSENGER CORPORATION
"ARROWHEAD TRAIN"
PASSENGER SERVICE BETWEEN MPLS.-ST. PAUL AND DULUTH-SUPERIOR

STATEMENT OF OPERATIONS
SUMMARY- CALENDAR YEAR 1976

	TOTALS	%
Operating Revenue		
Passenger	$ 233,021	85.21
Dining-Buffet	23,816	8.71
Mail	12,032	4.40
Other	4,591	1.68
TOTAL OPERATING REVENUE	$ 273,460	100.00
Operating Expenses		
Railroad Costs - BN*	$ 820,369	81.05
Dining-Buffet	14,289	1.41
On-Board Service Attendant	50,906	5.03
Facilities	69,247	6.84
Depreciation	41,596	4.11
Administration	7,200	.71
Interest	-	-
Claims Liability	8,544	.85
Other	-	-
TOTAL OPERATING EXPENSE	$1,012,151	100.00
NET OPERATING (DEFICIT)	(738,691)	
STATE SHARE - 50%	$ 452,806	61.30
FEDERAL SHARE - 50%	285,885	38.70
STATISTICAL DATA:		
PASSENGERS (INCLUDES PASSES)	37,986	
COST PER PASSENGER	26.65	
Operating Revenue Produced Per Passenger	7.20	
LOSS PER PASSENGER	19.44	
STATE SUBSIDY	11.92	
FEDERAL SUBSIDY	7.53	

* Billed to NRPC By Burlington Northern.
Train service started April 15th.

NATIONAL RAILROAD PASSENGER CORPORATION
"ARROWHEAD TRAIN"
PASSENGER SERVICE BETWEEN MPLS.-ST. PAUL AND DULUTH-SUPERIOR

STATEMENT OF OPERATIONS
1ST QUARTER - CALENDAR YEAR 1977

	JAN.	FEB.	MAR.	TOTALS	%
Operating Revenue					
Passenger	$15,048	$17,742	$33,353	$ 66,143	82.96
Dining-Buffet	1,744	3,075	5,490	10,309	12.93
Mail	1,002	606	894	2,502	3.13
Other	719	36	23	778	.98
TOTAL OPERATING REVENUE	$18,513	$21,459	$39,760	$ 79,732	100.00
Operating Expenses					
Railroad Costs - BN*	$78,542	$90,899	$86,695	$256,136	81.85
Dining-Buffet	1,046	1,845	3,294	6,185	1.97
On-Board Service Attendant	4,620	4,173	4,620	13,413	4.28
Facilities	4,370	4,053	5,990	14,413	4.61
Depreciation	5,053	6,741	6,091	17,885	5.72
Administration	600	600	600	1,800	.58
Interest	-	-	-	-	-
Claims Liability	676	958	1,474	3,108	.99
Other	-	-	-	-	-
TOTAL OPERATING EXPENSE	$94,907	$109,269	$108,764	$312,940	100.00
NET OPERATING (DEFICIT)	(76,394)	(87,810)	(69,004)	(233,208)	
STATE SHARE - 66.67%	$38,197	$43,905	$ 34,502	$116,604	
FEDERAL SHARE - 33.33%	$38,197	$43,905	$ 34,502	$116,604	
STATISTICAL DATA:					
PASSENGERS (INCLUDES PASSES)	2,392	4,134	5,193	11,719	
COST PER PASSENGER	39.68	26.43	20.94	26.70	
Operating Revenue Produced Per Passenger	7.74	5.19	7.66	6.80	
LOSS PER PASSENGER	31.94	21.24	13.28	1.98	
STATE SUBSIDY	15.97	10.62	6.64	9.95	
FEDERAL SUBSIDY	15.97	10.62	6.64	9.95	

* Billed to NRPC By Burlington Northern.
Train service started April 15th.

Time Schedule Flip Flopped
February 15, 1977.

NATIONAL RAILROAD PASSENGER CORPORATION
"ARROWHEAD TRAIN"
PASSENGER SERVICE BETWEEN MPLS.-ST. PAUL AND DULUTH-SUPERIOR

STATEMENT OF OPERATIONS
2ND QUARTER - CALENDAR YEAR 1977

	APR.	MAY	JUNE	TOTALS
Operating Revenue				
Passenger	$ 38,594	$ 69,473	$ 77,571	$185,638
Dining-Buffet	4,956	5,146	5,156	15,258
Mail	802	-	-	(802)
Other	33	73	13	119
TOTAL OPERATING REVENUE	$ 42,781	$ 74,692	$ 82,740	$200,213
Operating Expenses				
Railroad Costs - BN*	$ 92,902	$ 99,163	$105,639	$297,704
Dining-Buffet	2,974	3,088	3,094	9,156
On-Board Service Attendant	4,471	4,620	4,471	13,562
Facilities	15,703	9,346	8,764	33,813
Depreciation	4,635	8,667	4,861	18,163
Administration	600	600	600	1,800
Interest	-	-	-	-
Claims Liability	1,448	2,698	3,279	7,425
Other	10,000			10,000
TOTAL OPERATING EXPENSE	$132,733	$128,182	$130,708	$391,623
NET OPERATING (DEFICIT)	(89,952)	(53,490)	(47,968)	(191,410)
STATE SHARE - 66.67%	$ 44,976	$ 26,745	$ 23,984	$ 95,705
FEDERAL SHARE - 33.33%	44,976	26,745	23,984	95,705
STATISTICAL DATA:				
PASSENGERS (INCLUDES PASSES)	5,990	10,203	11,356	27,549
COST PER PASSENGER	22.16	12.56	11.51	14.22
Operating Revenue Produced Per Passenger	7.14	7.32	7.29	7.27
LOSS PER PASSENGER	15.02	5.24	4.22	6.95
STATE SUBSIDY	7.51	2.62	2.11	3.47
FEDERAL SUBSIDY	7.51	2.62	3.47	3.47

* Billed to NRPC By Burlington Northern.
Train service started April 15th.

NATIONAL RAILROAD PASSENGER CORPORATION
"ARROWHEAD TRAIN"
PASSENGER SERVICE BETWEEN MPLS.-ST. PAUL AND DULUTH-SUPERIOR

STATEMENT OF OPERATIONS
3RD QUARTER - CALENDAR YEAR 1977

	JULY	AUG.	SEPT.	TOTAL	%
Operating Revenue					
Transportation	$ 71,341	$ 72,249	$ 53,583	$197,173	95.83
Food & Beverage	3,352	3,300	1,925	8,577	4.17
Mail-Express & Other	-	-	-	-	-
TOTAL OPERATING REVENUE	$ 74,693	$ 75,549	$ 55,508	$205,750	100.00
Operating Expenses					
Direct Expenses:					
Train & Engineer Crews	$ 21,338	$ 21,154	$ 18,208	$ 60,700	14.95
Train Fuel & Power	7,722	7,062	9,568	24,352	6.00
Onboard Service-Labor	2,148	1,982	2,438	6,568	1.62
Onboard Service-Supplies	4,998	5,740	14,765	25,503	6.28
Other-Direct	46	196	26	268	.07
TOTAL DIRECT EXPENSES	$ 36,252	$ 36,134	$ 45,005	$117,391	
Common Expenses:					
Station Services	$ 23,594	$ 26,012	$ 25,938	$ 75,544	18.61
Transportation	4,352	4,824	2,142	11,318	2.79
Locomotive Maintenance	8,762	10,596	13,804	33,162	8.17
Car Maintenance	11,114	12,797	14,357	38,268	9.43
Maintenance of Way	1,104	1,166	1,728	3,998	.98
Joint Facilities	-	-	-	-	-
Other Common-AMTRAK	7,392	6,076	-	13,468	3.32
Other Common-Railroad	3,758	3,534	-	7,292	1.80
TOTAL COMMON EXPENSES	$ 60,076	$ 65,005	$ 57,969	$183,050	
Other Expenses					
Railroad Performance Paymts.	$ -	$ -	$ -	$ -	
Other Railroad Expenses	278	302	12,988	13,568	3.34
Operating Support	15,017	16,593	19,694	51,304	12.64
Administration	670	670	670	2,010	.50
Depreciation	5,542	5,618	5,618	16,778	4.13
Interest	4,928	4,905	5,204	15,037	3.70
Taxes & Insurance	2,210	2,184	2,384	6,778	1.67
TOTAL OTHER EXPENSES	$ 28,645	$ 30,272	$ 46,558	$105,475	
TOTAL OPERATING EXPENSES	$124,973	$131,411	$149,532	$405,916	100.00
NET OPERATING (DEFICIT)	(50,280)	(55,862)	(94,024)	(200,166)	
STATE SHARE - 50%	$ 25,140	$ 27,931	$ 47,012	$100,083	50.00
FEDERAL SHARE - 50%	$ 26,140	$ 27,931	$ 47,012	$100,083	50.00
STATISTICAL DATA:					
PASSENGERS (INCLUDES PASSES)	10,522	10,789	7,727	29,038	
COST PER PASSENGER	11.88	12.18	19.35	13.98	
Operating Revenue Produced Per Passenger	7.10	7.00	7.18	7.08	
LOSS PER PASSENGER	4.78	5.18	12.17	6.90	
STATE SUBSIDY	2.39	2.59	6.08	3.45	
FEDERAL SUBSIDY	2.39	2.59	6.08	3.45	

Section II

BY CALENDAR YEAR AND QUARTER
ARROWHEAD RIDERSHIP

		Number of Ridership	Passenger Per Trip	Revenue Passengers	Pass Riders	% of Rev. Passengers	% Pass Riders
1975	April	1,628		1,390	238	85	15
	May	3,349		2,805	544	84	16
	June	3,949		3,373	576	85	15
		8,936	60			84.78	15.21
	July	3,885		3,358	527	86	14
	August	5,665		4,703	962	83	17
	Sept.	2,974		2,452	522	82	18
		12,524	69			83.94	16.00
	Oct.	2,912		2,329	583	80	20
	Nov.	3,743		3,102	641	83	17
	Dec.	4,176		3,401	775	81	19
		10,831	60			81.54	18.46
1976	Jan.	2,646		2,209	437	83	17
	Feb.	2,537		1,963	574	77	23
	March	3,079		2,271	808	74	26
		8,262	45			77.98	22.00
	April	4,242		3,461	781	82	18
	May	2,914		2,345	569	80	20
	June	2,811		2,278	533	81	19
		9,967	55			81.10	18.89
	July	3,321		2,776	545	84	16
	August	3,971		3,226	745	81	19
	Sept.	2,504		1,954	550	78	22
		9,796	54			81.21	18.78
	Oct.	2,591		1,959	632	76	24
	Nov.	3,257		2,639	618	81	19
	Dec.	4,113		3,338	775	81	19
		9,961	55			79.67	20.33
1977	Jan.	2,392		1,888	505	79	21
	Feb.	4,134		3,407	727	82	18
	March	5,193		4,625	568	89	11
		11,719	64			84.64	15.35
	April	5,990		5,329	661	89	11
	May	10,203		9,566	637	94	6
	June	11,356		10,442	914	92	8
		27,549	151			91.97	8.03
	July	10,522		9,643	879	92	8
	Aug.	10,789		9,914	875	92	8
	Sept.	7,727		7,077	650	92	8
		29,033	160			91.72	8.28
1977	Oct.	4,777		4,262	515	89	10
Cont.	Nov.*	3,773		3,460	310	91.7	8
	Dec.**	3,500		3,000	500	85.7	14
		12,050	66			88.93	11.1
	TOTALS	150,623	75	129,945	20,675	86.27	13.73

* Unofficial Information
** Projection

ARROWHEAD ROUTE
REVENUE PRODUCED PER PAYING PASSENGER
APRIL 15, 1975 THRU SEPTEMBER 30, 1977

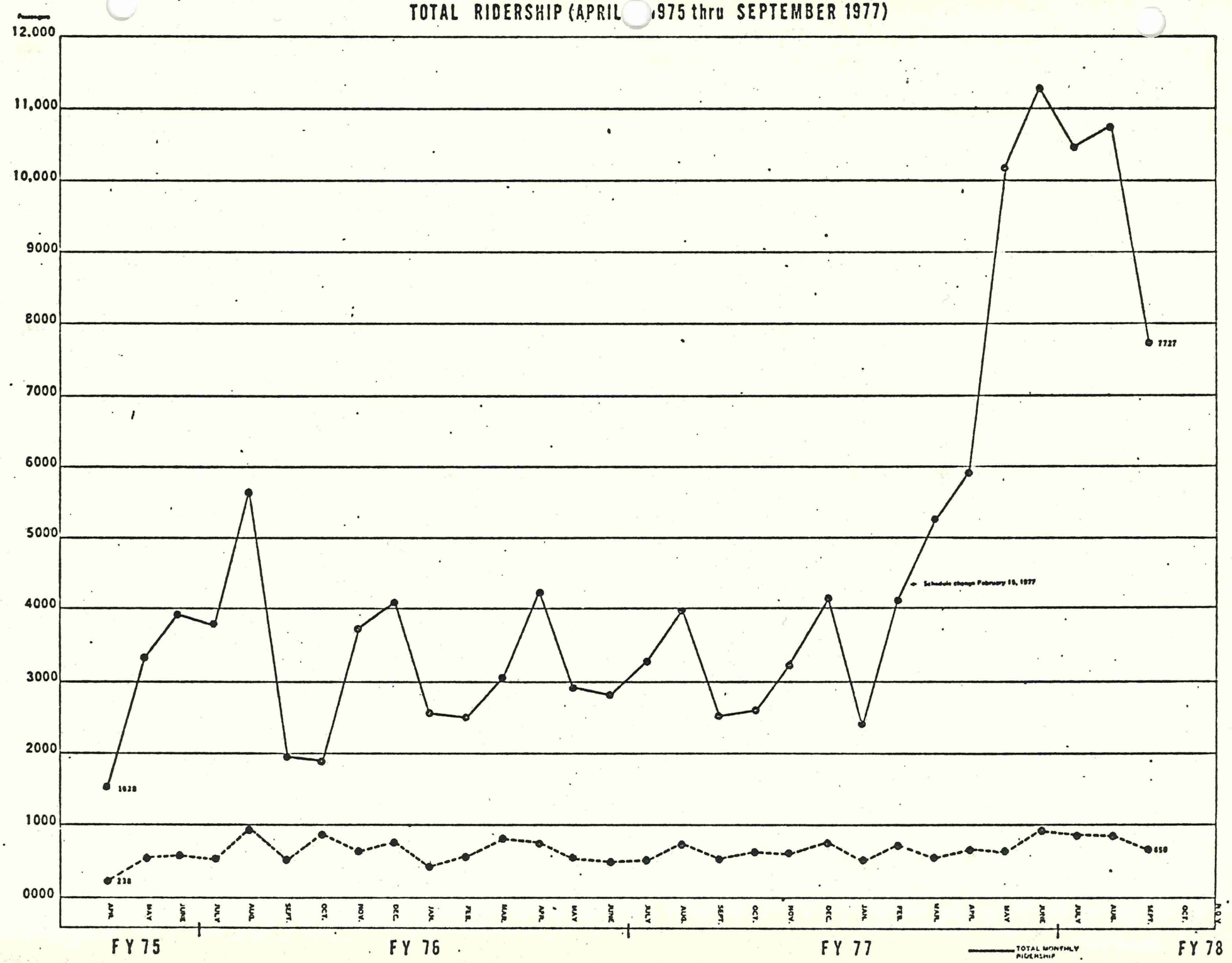
CALENDER YEAR	MONTH	PASSENGER REVENUE	QUARTER TOTALS	NUMBER OF REVENUE PASSENGERS	QUARTER TOTALS	REVENUE PRODUCED PER PAYING PASSENGERS	QUARTER
1975	April	$ 12,324	$	1,390		$8.87	$
	May	21,601		2,805		7.70	
	June	25,492	59,417	3,373	7,568	7.56	7.85
	July	22,133		3,358		6.59	
	August	25,716		4,703		5.47	
	September	19,198	67,047	2,452	10,513	7.83	6.38
	October	18,372		2,329		7.89	
	November	23,590		3,102		7.60	
	December	26,259	68,221	3,401	8,832	7.72	7.72
1976	January	17,437		2,209		7.89	
	February	15,537		1,963		7.31	
	March	17,891	50,865	2,271	6,443	7.88	7.87
	April	25,187		3,461		7.28	
	May	17,482		2,345		7.46	
	June	17,410	60,079	2,278	8,084	7.64	7.43
	July	20,750		2,776		7.47	
	August	24,902		3,226		7.72	
	September	15,129	60,781	1,954	7,956	7.74	7.64
	October	14,889		1,959		7.60	
	November	20,615		2,639		7.81	
	December	25,792	61,296	3,338	7,936	7.73	7.72
1977	January	15,048		1,888		7.97	
	February	17,742		3,407		5.21	
	March	33,353	66,143	4,625	9,920	7.21	6.67
	April	38,594		5,329		7.24	
	May	69,473		9,566		7.26	
	June	77,571	185,638	10,442	25,337	7.43	7.33
	July	71,341		9,643		7.40	
	August	72,249		9,914		7.29	
	September	53,583	197,173	7,077	26,634	7.57	7.40
GRAND TOTAL		$876,660		119,223		$7.35	

ARROWHEAD TRAIN
PASS RIDER REVENUE NOT COLLECTED
APRIL 15, 1975 THROUTH SEPTEMBER 30, 1977

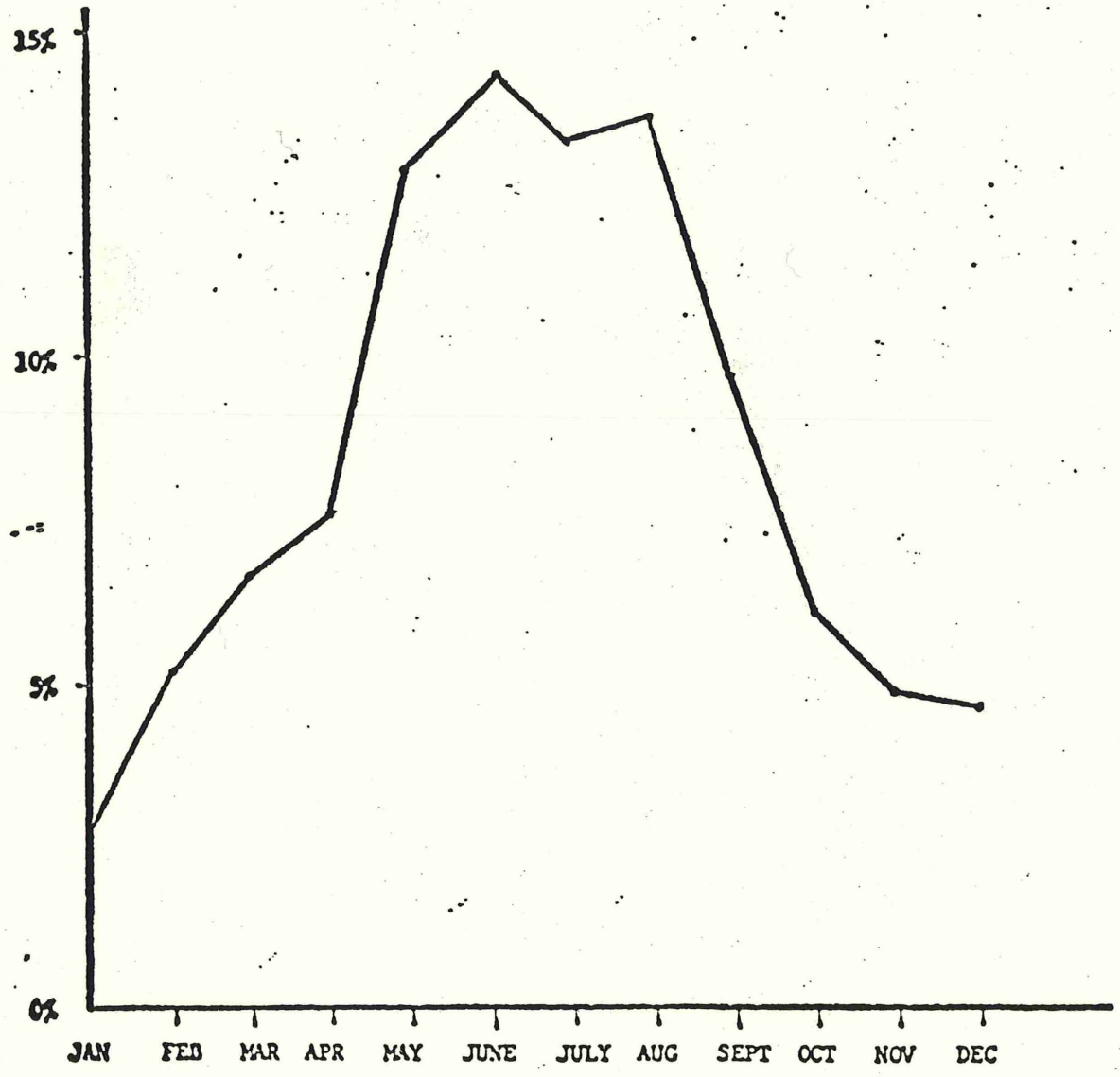
CALENDER YEAR	QUARTERS	NUMBER OF PASS RIDERS	PAYING PASSENGERS AVERAGE FARE COLLECTED	PASS RIDER REVENUE NOT COLLECTED
1975	2nd Quarter	1,358	$7.85	$ 10,660.30
	3rd Quarter	2,011	6.38	12,830.18
	4th Quarter	1,999	7.72	15,432.28
1976	1st Quarter	1,819	7.87	14,315.53
	2nd Quarter	1,883	7.43	13,990.69
	3rd Quarter	1,840	7.64	14,057.60
	4th Quarter	2,025	7.72	15,633.00
1977	1st Quarter	1,799	6.67	11,999.33
	2nd Quarter	2,212	7.33	16,213.96
	3rd Quarter	2,404	7.40	17,789.60
GRAND TOTAL		19,350		$142,922.47

ARROWHEAD TRAIN

TOTAL RIDERSHIP (APRIL 1975 thru SEPTEMBER 1977)



Arrowhead Ridership
Monthly % of Yearly Total
1977



DAILY PERCENT OF TOTAL WEEKLY
RIDERSHIP OF THE ARROWHEAD TRAIN
FROM FEBRUARY 15, 1977 TO JANUARY 11, 1978

Passengers Entraining and Detraining
Between Minneapolis - St. Paul & Duluth - Superior

Train 766 2nd Quarter, Calendar Year 1975, April 15 - June 30

Passengers Entraining	Passengers Detraining					
	Cambridge	Sandstone	Superior	Duluth	Unknown	Total
Minneapolis			4685			4685
Cambridge						
Sandstone						
Superior						
Unknown						
Total			4685			4685

Train 761 & 763

Passengers Entraining	Passengers Detraining					
	Superior	Sandstone	Cambridge	Minneapolis	Unknown	Total.
Duluth						
Superior				4241		4241
Sandstone						
Cambridge						
Unknown						
Total				4241		4241

Passengers Entraining and Detraining
Between Minneapolis - St. Paul & Duluth - Superior

Train 766 - 3rd Quarter, Calendar Year 1975, July-September

Passengers Entraining	Passengers Detraining					
	Cambridge	Sandstone	Superior	Duluth	Unknown	Total
Minneapolis			6493			6493
Cambridge						
Sandstone						
Superior						
Unknown						
Total			6493			6493

Train 761 & 763

Passengers Entraining	Passengers Detraining					
	Superior	Sandstone	Cambridge	Minneapolis	Unknown	Total
Duluth						
Superior				6031		6031
Sandstone						
Cambridge						
Unknown						
Total				6031		6031

Passengers Entraining and Detraining
Between Minneapolis - St. Paul & Duluth - Superior

Train 766 - 4th Quarter, Calender Year 1975, October - December

Passengers Entraining	Passengers Detraining					
	Cambridge	Sandstone	Superior	Duluth	Unknown	Total
Minneapolis			5635			5635
Cambridge						
Sandstone						
Superior						
Unknown						
Total			5635			5635

Train 761 & 763

Passengers Entraining	Passengers Detraining					
	Superior	Sandstone	Cambridge	Minneapolis	Unknown	Total
Duluth						
Superior				5196		5196
Sandstone						
Cambridge						
Unknown						
Total				5196.		5196

Passengers Entraining and Detraining
Between Minneapolis - St. Paul & Duluth - Superior

Train 766 - 1st Quarter, Calendar Year 1976, January - March

Passengers Entraining	Passengers Detraining					
	Cambridge	Sandstone	Superior	Duluth	Unknown	Total
Minneapolis			4396			4396
Cambridge						
Sandstone						
Superior						
Unknown						
Total			4396			4396

Train 761 & 763

Passengers Entraining	Passengers Detraining					
	Superior	Sandstone	Cambridge	Minneapolis	Unknown	Total
Duluth						
Superior				3866		3866
Sandstone						
Cambridge						
Unknown						
Total				3866		3866

Passengers Entraining and Detraining
Between Minneapolis - St. Paul & Duluth - Superior

Train 766 - 2nd Quarter, Calendar Year 1976, April - June

Passengers Entraining	Passengers Detraining					
	Cambridge	Sandstone	Superior	Duluth	Unknown	Total
Minneapolis	37	98	4835			4970
Cambridge		6	33			39
Sandstone			2			2
Superior						
Unknown					3	3
Total					3	5014

Train 761 & 763

Passengers Entraining	Passengers Detraining					
	Superior	Sandstone	Cambridge	Minneapolis	Unknown	Total
Duluth						
Superior		5	29	4774		4808
Sandstone				70		70
Cambridge				75		75
Unknown						
Total						4953

Passengers Entraining and Detraining
Between Minneapolis - St. Paul & Duluth - Superior

Train 766 3rd Quarter, Calendar Year 1976, July. - Sept.

Passengers Entraining	Passengers Detraining					
	Cambridge	Sandstone	Superior	Duluth	Unknown	Total
Minneapolis	267	267	4311			4845
Cambridge		29	78			107
Sandstone			6			6
Superior						
Unknown					19	19
Total	267	267	4395		19	4977

Train 761 & 763

Passengers Entraining	Passengers Detraining					
	Superior	Sandstone	Cambridge	Minneapolis	Unknown	Total
Duluth						
Superior		56	58	4014		4128
Sandstone			84	242		326
Cambridge				343		343
Unknown					22	22
Total		56	142	4599	22	4819

Passengers Entraining and Detraining
Between Minneapolis - St. Paul & Duluth - Superior

Train 766 4th Quarter, Calendar Year 1976, October - December

Passengers Entraining	Passengers Detraining					
	Cambridge	Sandstone	Superior	Duluth	Unknown	Total
Minneapolis	328	331	4304			4963
Cambridge		34	65			99
Sandstone			22			22
Superior						
Unknown					21	21
Total	328	365	4391		21	5105

Train 761 & 763

Passengers Entraining	Passengers Detraining					
	Superior	Sandstone	Cambridge	Minneapolis	Unknown	Total
Duluth						
Superior		11	50	4071		4132
Sandstone			20	286		306
Cambridge				416		416
Unknown					2	2
Total		11	70	4773	2	4856

Passengers Entraining and Detraining
Between Minneapolis - St. Paul & Duluth - Superior

Train 760 & 766 1st Quarter, Calendar Year 1977, January - March

Passengers Entraining	Passengers Detraining					
	Cambridge	Sandstone	Superior	Duluth	Unknown	Total
Minneapolis	190	183	2019	3065		5457
Cambridge		16	33	114		163
Sandstone			14	88		102
Superior				103		103
Unknown						
Total	190	199	2066	3370		5825

Train 761 & 763

Passengers Entraining	Passengers Detraining					
	Superior	Sandstone	Cambridge	Minneapolis	Unknown	Total
Duluth	23	38	153	3215		3429
Superior		13	35	2020		2068
Sandstone			10	177		187
Cambridge				210		210
Unknown						
Total	23	51	198	5622		5894

Passengers Entraining and Detraining
Between Minneapolis - St. Paul & Duluth - Superior

Train 760 2nd Quarter, Calendar Year 1977, April - June

Passengers Entraining	Passengers Detraining					
	Cambridge	Sandstone	Superior	Duluth	Unknown	Total
Minneapolis	153	208	713	11497		12571
Cambridge		205	21	640		866
Sandstone			9	195		204
Superior				533		533
Unknown					2	2
Total	153	413	742	12865	2	14176

Train 761

Passengers Entraining	Passengers Detraining					
	Superior	Sandstone	Cambridge	Minneapolis	Unknown	Total
Duluth	53	173	596	11229		12051
Superior		9	21	942		972
Sandstone			9	182		191
Cambridge				159		159
Unknown						
Total	53	182	626	12512		13373

Between Minneapolis - St. Paul & Duluth - Superior

Train 760 3rd Quarter, Calendar Year 1977, July - August

Passengers Entraining	Passengers Detraining					
	Cambridge	Sandstone	Superior	Duluth	Unknown	Total
Minneapolis	194	187	770	11774		12925
Cambridge		39	116	904		1059
Sandstone			51	358		409
Superior				253		253
Unknown					240	240
Total	194	226	937	13289	240	14886

Train 761

Passengers Detraining	Passengers Detraining					
	Superior	Sandstone	Cambridge	Minneapolis	Unknown	Total
Duluth	65	235	806	11260		12366
Superior		84	121	1000		1205
Sandstone			16	201		217
Cambridge				174		174
Unknown					190	190
Total	65	319	942	12635	190	14152

Special Ski Train
December 23, 1977

ORIGIN

Mpls.	LV. 8:05	Cambridge	Sandstone	Superior	Duluth	Totals ON	Totals OFF
Rev.	59	1	1			61	
Pass	2	0	0			2	
Subtotal On	61	1	1			63	
Rev.		1	5	13	42		61
Pass		0	0	0	2		2
Subtotal Off		1	5	13	44		63

Duluth	LV. 12:45	Superior	Sandstone	Cambridge	Mpls.	ON	OFF
Rev.	14	3				17	
Pass	5	0				5	
Subtotal On	19	3				22	
Rev.		0		1	16		17
Pass		1		0	4		5
Subtotal Off		1		1	20		22

Mpls.	LV. 5:30	Cambridge	Sandstone	Superior	Duluth	ON	OFF
Rev.	33					33	
Pass	6					6	
Subtotal On	39					39	
Rev.		1	0	2	30		33
Pass		0	1	3	2		6
Subtotal Off		1	1	5	32		39

Duluth	LV. 10:10	Superior	Sandstone	Cambridge	Mpls.	ON	OFF
Rev.	19	3	3			25	
Pass	1	11	0			12	
Subtotal On	20	14	3			37	
Rev.				1	24		25
Pass				1	11		12
Subtotal Off				2	35		37

TOTAL: 161 136 REVENUE, 25 PASS

Special Ski Train
December 30, 1977

ORIGIN

Mpls.	LV. 8:05	Cambridge	Sandstone	Superior	Duluth	Totals ON	Totals OFF
Rev.	91	4		4		99	
Pass	5	0		0		5	
Subtotal On	96	4		4		104	
Rev.					99		99
Pass					5		5
Subtotal Off					104		104

Duluth	LV. 12:45	Superior	Sandstone	Cambridge	Mpls.	ON	OFF
Rev.	194	8				202	
Pass	3	1				4	
Subtotal On	197	9				206	
Rev.					202		202
Pass					4		4
Subtotal Off					206		206

Mpls.	LV. 5:30	Cambridge	Sandstone	Superior	Duluth	ON	OFF
Rev.	33					33	
Pass	7					7	
Subtotal On	40					40	
Rev.					33		33
Pass					7		7
Subtotal Off					40		40

Duluth	LV. 10:10	Superior	Sandstone	Cambridge	Mpls.	ON	OFF
Rev.	18	5		1		24	
Pass	0	0		0		0	
Subtotal On	18	5		1		24	
Rev.					24		24
Pass					0		0
Subtotal Off					24		24

TOTAL: 374 358 REVENUE, 16 PASS

Special Ski Train
January 6, 1978

ORIGIN

Mpls.	LV. 8:05	Cambridge	Sandstone	Superior	Duluth	Totals ON	Totals OFF
Rev.	37	2				39	
Pass	6	0				6	
Subtotal On	43	2				45	
Rev.			1	0	38		39
Pass			0	1	5		6
Subtotal Off			1	1	43		43

Duluth	LV. 12:45	Superior	Sandstone	Cambridge	Mpls.	ON	OFF
Rev.	15	6				21	
Pass	0	0				0	
Subtotal On	15	6				21	
Rev.					21		21
Pass					0		0
Subtotal Off					21		21

Mpls.	LV. 5:30	Cambridge	Sandstone	Superior	Duluth	ON	OFF
Rev.	37					37	
Pass	2					2	
Subtotal On	39					39	
Rev.		1	1	3	32		37
Pass		0	0	1	1		2
Subtotal Off		1	1	4	33		39

Duluth	LV. 10:10	Superior	Sandstone	Cambridge	Mpls.	ON	OFF
Rev.	16	8	2	2		28	
Pass	0	3	0	0		3	
Subtotal On	16	11	2	2		31	
Rev.			2		26		28
Pass			0		3		3
Subtotal Off			2		29		31

TOTAL: 136 125 REVENUE, 11 PASS

Special Ski Train
January 13, 1978

ORIGIN

Mpls.	LV. 8:05	Cambridge	Sandstone	Superior	Duluth	Totals ON	Totals OFF
Rev.	27	2				29	
Pass	4	0				4	
Subtotal On	31	2				33	
Rev.		1	3	4	21		29
Pass		0	0	1	3		4
Subtotal Off		1	3	5	24		33

Duluth	LV. 12:45	Superior	Sandstone	Cambridge	Mpls.	ON	OFF
Rev.	16	1				17	
Pass	0	1				1	
Subtotal On	16	2				18	
Rev.				1	16		17
Pass				0	1		1
Subtotal Off				1	17		18

Mpls.	LV. 5:30	Cambridge	Sandstone	Superior	Duluth	ON	OFF
Rev.	35	1				36	
Pass	2	0				2	
Subtotal On	37	1				38	
Rev.			2	2	32		36
Pass			0	1	1		2
Subtotal Off			2	3	33		38

Duluth	LV. 10:10	Superior	Sandstone	Cambridge	Mpls.	ON	OFF
Rev.	17	3		1		21	
Pass	3	5		0		8	
Subtotal On	20	8		1		29	
Rev.			1	1	19		21
Pass			0	0	8		8
Subtotal Off			1	1	27		29

TOTAL: 118 103 REVENUE, 15 PASS

Special Ski Train
January 20, 1978

ORIGIN

Mpls.	LV. 8:05	Cambridge	Sandstone	Superior	Duluth	Totals ON	Totals OFF
Rev.	50	3				53	
Pass	3	0				3	
Subtotal On	53	3				56	
Rev.		3		9	41		53
Pass		0		1	2		3
Subtotal Off		3		10	43		56

Duluth	LV. 12:45	Superior	Sandstone	Cambridge	Mpls.	ON	OFF
Rev.	21	0				21	
Pass	0	2				2	
Subtotal On	21	2				23	
Rev.				1	20		21
Pass				0	2		2
Subtotal Off				1	22		23

Mpls.	LV. 5:30	Cambridge	Sandstone	Superior	Duluth	ON	OFF
Rev.	51	5				56	
Pass	1	0				1	
Subtotal On	52	5				57	
Rev.			2	4	50		56
Pass			0	0	1		1
Subtotal Off			2	4	51		57

Duluth	LV. 10:10	Superior	Sandstone	Cambridge	Mpls.	ON	OFF
Rev.	7	4	2	3		16	
Pass	0	3	0	0		3	
Subtotal On	7	7	2	3		19	
Rev.			1	1	14		16
Pass			0	0	3		3
Subtotal Off			1	1	17		19

TOTAL: 155 146 REVENUE, 9 PASS

Special Ski Train
January 27, 1978

ORIGIN

Mpls.	LV. 8:05	Cambridge	Sandstone	Superior	Duluth	Totals ON	Totals OFF
Rev.	114	15				129	
Pass	3	0				3	
Subtotal On	117	15				132	
Rev.			2	4	123		129
Pass			0	1	2		3
Subtotal Off			2	5	125		132

Duluth	LV. 12:45	Superior	Sandstone	Cambridge	Mpls.	ON	OFF
Rev.	25					25	
Pass	1					1	
Subtotal On	26					26	
Rev.				14	11		25
Pass				0	1		1
Subtotal Off				14	12		26

Mpls.	LV. 5:30	Cambridge	Sandstone	Superior	Duluth	ON	OFF
Rev.	80	1	0			81	
Pass	1	0	1			2	
Subtotal On	81	1	1			83	
Rev.		2	3	5	71		81
Pass		0	0	0	2		2
Subtotal Off		2	3	5	73		83

Duluth	LV. 10:10	Superior	Sandstone	Cambridge	Mpls.	ON	OFF
Rev.	27	10	1	1		39	
Pass	2	2	0	0		4	
Subtotal On	29	12	1	1		43	
Rev.				1	38		39
Pass				0	4		4
Subtotal Off				1	42		43

TOTAL: 284 274 REVENUE, 10 PASS

Special Ski Train
February 3, 1978

ORIGIN

Mpls.	LV. 8:05	Cambridge	Sandstone	Superior	Duluth	Totals ON	Totals OFF
Rev.	20	1				21	
Pass	2	0				2	
Subtotal On	22	1				23	
Rev.				3	18		21
Pass				2	0		2
Subtotal Off				5	18		23

Duluth	LV. 12:45	Superior	Sandstone	Cambridge	Mpls.	ON	OFF
Rev.	8	1				9	
Pass	0	0				0	
Subtotal On	8	1				9	
Rev.					9		9
Pass					0		0
Subtotal Off					9		9

Mpls.	LV. 5:30	Cambridge	Sandstone	Superior	Duluth	ON	OFF
Rev.	50	2	1			53	
Pass	2	0	0			2	
Subtotal On	52	2	1			55	
Rev.			1	5	47		53
Pass			0	0	2		2
Subtotal Off			1	5	49		55

Duluth	LV. 10:10	Superior	Sandstone	Cambridge	Mpls.	ON	OFF
Rev.	22	5	1	2		30	
Pass	1	1	0	0		2	
Subtotal On	23	6	1	2		32	
Rev.				1	29		30
Pass				0	2		2
Subtotal Off				1	31		32

TOTAL: 119 113 REVENUE, 6 PASS

Special Ski Train
February 10, 1978

ORIGIN

Mpls.	LV. 8:05	Cambridge	Sandstone	Superior	Duluth	Totals ON	Totals OFF
Rev.	118	4				122	
Pass	6	0				6	
Subtotal On	124	4				128	
Rev.			3	0	119		122
Pass			0	1	5		6
Subtotal Off			3	1	124		128

Duluth	LV. 12:45	Superior	Sandstone	Cambridge	Mpls.	ON	OFF
Rev.	10					10	
Pass	1					1	
Subtotal On	11					11	
Rev.				1	9		10
Pass				0	1		1
Subtotal Off				1	10		11

Mpls.	LV. 5:30	Cambridge	Sandstone	Superior	Duluth	ON	OFF
Rev.	95	1	1			97	
Pass	5	0	0			5	
Subtotal On	100	1	1			102	
Rev.			1	7	89		97
Pass			0	4	1		5
Subtotal Off			1	11	90		102

Duluth	LV. 10:10	Superior	Sandstone	Cambridge	Mpls.	ON	OFF
Rev.	13	9	2	3		27	
Pass	0	2	2	0		4	
Subtotal On	13	11	4	3		31	
Rev.				1	26		27
Pass				0	4		4
Subtotal Off				1	30		31

TOTAL: 272 256 REVENUE, 16 PASS

Special Ski Train
February 17, 1978

ORIGIN

Mpls.	LV. 8:05	Cambridge	Sandstone	Superior	Duluth	Totals ON	Totals OFF
Rev.	50	5				55	
Pass	2	0				2	
Subtotal On	52	5				57	
Rev.		1		3	51		55
Pass		0		1	1		2
Subtotal Off		1		4	52		57

Duluth	LV. 12:45	Superior	Sandstone	Cambridge	Mpls.	ON	OFF
Rev.	17	3		2		22	
Pass	0	1		0		1	
Subtotal On	17	4		2		23	
Rev.				2	20		22
Pass				0	1		1
Subtotal Off				2	21		23

Mpls.	LV. 5:30	Cambridge	Sandstone	Superior	Duluth	ON	OFF
Rev.	88	1				89	
Pass	4	0				4	
Subtotal On	92	1				93	
Rev.		1		9	79		89
Pass		0		3	1		4
Subtotal Off		1		12	80		93

Duluth	LV. 10:10	Superior	Sandstone	Cambridge	Mpls.	ON	OFF
Rev.	46	13	2	3		64	
Pass	3	6	0	0		9	
Subtotal On	49	19	2	3		73	
Rev.				1	63		64
Pass				0	9		9
Subtotal Off				1	72		73

TOTAL: 246 230 REVENUE, 16 PASS

Amtrak Survey

The attachment summarizes the Amtrak Passenger Survey conducted this fall. Two significant findings are:

- Passengers are generally non-repeating travelers. Their trip is a one time experience for novelty or recreation. This makes it impossible to establish a set of "regulars" to support the system. Continuous incentives and a high level of advertising will be necessary to maintain moderate ridership levels.

- There is no correlation between ridership and any age or economic group. This makes promotional efforts difficult.

Section III

AMTRAK PASSENGER SURVEY

A survey of passengers on the Amtrak service from the Twin Cities to Duluth was conducted for 7 days, in September of 1977. There were 1,307 passengers surveyed. These passengers were asked questions to identify their trip origin, destination purpose for making the trip, frequency of making the trip, and characteristics of the traveler such as age group and income group. Opinions on the Amtrak service were also requested.

Origin and destination questions help identify market areas which are being served. This information should identify where techniques to increase ridership will be most effective. The number and percent of travelers by area are depicted in Figure 1 for the home end of the trip. This figure indicates travelers are primarily from the Twin Cities area and Duluth (81%) with small percentages from the travel corridor and southeastern Minnesota. Sixty-two percent of the patronage had either an origin or destination of home in the Twin Cities Metropolitan Area. Duluth-Superior was home for 8% of the originations and destinations. Southeastern Minnesota was home for 8%, with 6% of the patronage listing home as locations between Minneapolis, St. Paul and Duluth-Superior. Approximately 5% of the interviews were listed as address unknown.

The Twin Cities Metropolitan Area currently (1975) contains 49% of the population of the state. In 1980 and 2000 approximately 50% of the state's population will reside in the Twin Cities Metropolitan Area. This area is expected to grow by approximately 5% from 1975 to 1980 and by 20% from 1975 to 2000. Northeastern Minnesota is expected to decline in percent of the state's population and in absolute growth during the 1975 to 2000 time period. Southeastern Minnesota is expected to remain relatively stable both as a percent of the state's population and in absolute growth. The only Amtrak service area expected to have a measurable increase in population is the cities and counties in route between Minneapolis, St. Paul and Duluth-Superior. Since this area of Minnesota has a small share of the state's population, significant growth does not increase the areas share of the population substantially.

The growth patterns for the geographic areas of existing Amtrak riders homes does not provide any basis for a substantial increase in patronage. The percent of the population using Amtrak service is so small that traffic increases should be estimated for reasons other than population growth.

Trip purposes of the travelers were as follows:

Purpose	Number of Responses	Percent
Recreation	681	
Work	59	
Shopping	28	
Other	186	
	954* Total	

* 328 responses did not specify a purpose as specified "home" for both origin and destination. There were 25 multiple purpose responses.

The trip purpose response makes it apparent the trips being served are primarily non-repetitive recreation trips. Many of the purposes listed under the "other" category were tour related purposes such as student groups. Further insight can be gained from the answers to the question of why the train was chosen for the trip.

Reason for Choosing Train	Responses	Percent
Novelty	506	
More convenient	169	
More comfortable	141	
Less expensive	29	
Other	85	
Multiple response	220	
	1,150* Total	

* 157 did not respond.

Novelty is the overwhelming reason for choosing train. In response to the question, "How often have you made this trip in the last year?" only 11 persons indicated they had made the trip more than once by any mode, car, train, bus, or air in the past year. This again indicates the travelers are non-repetitive.

There was no indication that any particular age group or income group was more inclined to use the train. A slight majority of the riders were female (58%). These factors again indicate the diversity of persons taking the train and the difficulty in increasing ridership by catering to a particular market.

Most persons (83%) rated the service as good or excellent, with only 1% rating it as poor. Poor service does not, therefore, appear to be a deterrent to ridership.

Conclusions

Present ridership on the Amtrak service to Duluth from the Twin Cities are generally recreational travelers. They have diverse socio-economic characteristics and chose train primarily because it is a novelty. Since this type of ridership is generally non-repetitive, a constant promotional campaign will be necessary to maintain this ridership. Efforts to increase ridership will probably be most effective if they are directed toward recreational opportunities.

Minnesota Department of Transportation
Transportation Building, St. Paul, MN 55155

Phone _____

Dear Arrowhead Passenger:

Currently, the State of Minnesota pays 50% of the Arrowhead's annual losses due to the cost of operation. The Minnesota Department of Transportation is conducting a study to evaluate the effectiveness of passenger service to Minneapolis-St. Paul, Cambridge, Sandstone, Superior and Duluth.

The most accurate passenger information we can collect is from you, the passenger. Basically, we are interested in who uses the train, how often, and for what purpose.

Please take a few minutes to complete the attached questionnaire. Survey representatives will collect the form when you are finished and answer any questions you might have.

Your help will aid us in evaluating passenger service on the Arrowhead. Thank you.

Jim Harrington
Commissioner

RAIL PASSENGER SURVEY

(Number of Responses)

You boarded this train at?

_____

(City) (State)

6-40 2) "Start of trip" Address?

_____

(Street) (City) (State)

42 3) In order to get to the train you (check one)?

(125)* 1☐ Walked _____ blocks

(461) 2☐ Auto Passenger

(232) 3☐ Bus

4☐ Drove a Car (248)

5☐ Taxi-Limousine (64)

9☐ Other (please specify) (21) _____

Multiple Response (28)

* All but 6 walked less than 10 blocks

43 4) You came from (check one)?

(795) 1☐ Home

(9) 2☐ Shopping

3☐ Work (business) (28)

4☐ Recreation-Vacation (243)

5☐ Other (please specify) (65) _____

Multiple Response (10)

-58 5) You will be taking this train as far as?

_____

(City) (State)

-60 6) After leaving the train you will get to your destination by (check one)?

(176) *1☐ Walking _____ blocks

(374) 2☐ Auto Passenger

(278) 3☐ Bus

4☐ Driving Auto (155)

5☐ Taxi-Limousine (92)

9☐ Other (please specify) (47)

Multiple Response (50)

* All but 9 walked less than 10 blocks

61 7) Your destination, after leaving the train, will be (check one)?

4) 1☐ Home 3☐ Work (business) (31)

(19) 2☐ Shopping 4☐ Recreation-Vacation (438)

9☐ Other (please specify) (121) Multiple Response (15)

2-76 7A) Destination address _____
(Street) (City) (State)

77 8) Are you a licensed driver?

(943) 1☐ Yes 2☐ No (212)

78 9) How many autos are there in your household? (check one)

☐ 1 (469) ☐ 2 (412) ☐ 3 (102) ☐ 4 or more (39)

0 Cars (225)

79 10) Was an auto available to you for this trip?

1☐ Yes (863) 2☐ No (270)

80 11) Why did you choose the train for this trip?

(169) 1☐ More convenient 4☐ Novelty (506)

(29) 2☐ Less expensive 9☐ Other (please specify) (85)

(141) 3☐ More comfortable Multiple Responses (220)

81 12) How would you make this trip if train service were not available?

(551) 1☐ Car 4☐ Airplane (3)

(204) 2☐ Bus 9☐ Other (please specify) (345)

5☐ Wouldn't go (210)

Multiple Responses (297)

82 13) If this is only part of a longer trip, what other means of travel did you use for the first portion of this trip?

(210) 1☐ Car
(105) 2☐ Bus
(55) 3☐ Train
4☐ Airplane (26)
9☐ Other (please specify)_____ (25)
Multiple Response (40)

83 13A) What other means of travel will you use for the remainder of this trip? ?

(290) 1☐ Car
(180) 2☐ Bus
(85) 3☐ Train
4☐ Airplane (34)
9☐ Other (please specify)_____ (69)
Multiple Response (52)

84-87 14) How often have you made this trip in the last year; by -

	No. of times
1☐ Car	_____
2☐ Bus	_____
3☐ Train	_____
4☐ Airplane	_____
9☐ Other (please specify)_____	

See page 5

88-90 15) If you are traveling in a group, how many persons are in your group?

_____ not tabulated

91 16) Your sex is?

1☐ Male (479) 2☐ Female (659)

92 17) What is your age? (check one)

1☐ Under 16 (133) 2☐ 16 - 21 (113) 3☐ 22 - 34 (325)
4☐ 35 - 54 (174) 5☐ 55 - 65 (191) 6☐ 65 + (210)

93 18) Your yearly family income falls between? (check one)

(155) 1☐ 0 - $ 4999
(121) 2☐ $ 5000 - $ 7999
(73) 3☐ $ 8000 - $ 9999
(90) 4☐ $10000 - $11999
5☐ $12000 - $14999 (114)
6☐ $15000 - $19999 (173)
7☐ $20000 - $24999 (110)
8☐ Over $25000 (133)

94 19) How did you learn about this AMTRAK service? (check one)

(320) 1☐ Newspaper
(77) 2☐ Television
(262) 3☐ Friend
4☐ Travel service (54)
5☐ Rail Terminal Information (109)
9☐ Other (182)
Multiple Response (119)

95 20) How would you rate the existing rail service? (check one)

(297) 1☐ Excellent
(619) 2☐ Good
3☐ Fair (174)
4☐ Poor (15)

21) What improvements or changes would you like to see in rail passenger service?

QUESTION 14

No. of times trip made	1	2	3	4	5	6 (or more)
MODE						
Bus	1	0	1	1	0	0
Car	1	0	0	0	0	3
Train	1	1	0	0	0	1
Airplane	0	2	0	0	0	1

TOTAL 13 of 1,150 Surveyed

These are the railroad survey trips

Column cities are: MPLS, DUL, CA, SA, SU

Row cities are: MPLS, DUL, CA, SA, SU

	MPLS	DUL	CA	SA	SU
MPLS	0	448	4	2	62
DUL	526	0	40	2	1
CA	3	36	0	1	1
SA	5	6	1	0	1
SU	45	0	4	0	0

This is the number of refused interviews - 55

Tabulation of comments from Arrowhead On-board survey.

Total Surveys Distributed	1077	
Total People Represented	1217	
Refusals	88	7.2%
Total Responses	1129	
Questionaires With Comments	641	56.8%

*Comments with an asterik were observations of Mn/DOT Staff.

Comments are sometimes quotes but generally have been shortened for clarity etc. An attempt has been made to retain the intent and character of the comments.

PHYSICAL CONDITIONS ON TRAIN AND IN DEPOTS

Clean Windows	-87	
Improve Tracks, Faster Smoother, Quieter	-97	
More Capacity In Snack Car	-34	
More Dome Cars	-38	
Better Ventilation In Dome Car	-15	*
Better Parking Mpls.	-10	
Dul.	-3	
CA.	-1	
Nicer Bathrooms	-13	*
Movies, Music, TV, Stereo, Etc.	-17	
Equipment Good	-7	

Equipment Bad	-5	
Cars Clean	-3	
Cars Dirty	-8	
No Trash Baskets	-5	*
Minneapolis Depot Unsatisfactory	-17	
Duluth Depot Unsatisfactory	-6	

SMOKING - NO SMOKING

Non Enough Area For Smokers	-24	
Prohibit Smoking	-3	
Confusing As To What Is A Smoking Area	-2	*
Prohibit Smoking In Dome Car	-8	
Poor Enforcement Of No Smoking Areas	-12	
Good Enforcement	-1	

OTHER PASSENGERS

Too Many Screaming Kids	-22	
A Party of Drunks Has Overrun The Observation Car, Will Not Let Anyone Else In And Are Highly Obnoxious	-17	(all on one day) *

SERVICE EXPANSIONS

Additional Service Mpls. - Dul.	-110	
Additional Service General	-50	
International Falls	-6	

Virginia	-5
Winnipeg	-3
Des Moines	-3
Saint Cloud	-2
Alexandria	-3
Brainerd	-2
Moorhead	-1
Ely	-1
South Dakota	-1
St. Louis	-1
Omaha	-1
Fergus Falls	-1
"Out East"	-1
Commuter Service	-7
From North To Mpls.	-2
From South To Mpls.	-1
More Stops	-7
Hinckley	-1
Isanti	-1
Pine City	-3
Stillwater	-1
Fewer Stops	-4
Use a St. Paul Depot	-11
Better Connections	-4
Reverse Schedule	-11
Keep Schedule As Is	-6

The Service Is Prompt	-4	
Leave Mpls. At 9:00 A.M.	-5	
FOOD		
Bad, Poor Selection, No Hot, Food, Etc.	-86	*
Too Expensive	-11	
Fair Price	-1	
No Food Available	-10	(All On One Specific Run)
FARES, SUBSIDY ETC.		
Keep It Running	-37	
Good, Fine, Excellent, Etc.	-37	
Unsatisfactory	-2	
Fares		
Senior Citizen Discount	-4	
Family Discount	-1	
Large Group Discount	-1	
One Day Excursion Fares	-1	
Reduced Fares For Frequent Travellers	-1	
Ticket Should Be Valid For More Than 10 Days	-1	
Reasonable Fare	-3	
Fare Is Too High	-7	
Dont Raise Fares	-1	
Do Not Subsidize	-8	
50% Subsidy Sounds Too High	-3	

MARKETING - AMTRAK STAFF

Not Enough Information -21

Ticketing Took Too Long -7

Should Be Able To Make Reservations -8

Run More Tours -9

Staff On Train

Helpful -11

Unhelpful -2 (Survey # 240, 958)

Too Many With Nothing To Do -2

Dining Car Staff; Negative Comments -2

No One Helped Us Board -5

No Assistance With Bags -10

Rude & Unsupervised At Mpls. Depot -7

SURVEY CONDUCT

Too Many Surveys -6

Survey Staff
Positive Comments -5
Negative Comments -3

LISTING OF ALL OTHER COMMENTS MADE

More Time Before & After Duluth City Tour Before Train Departs -1

Run An Extra Car On Weekends -1

Make Possible To Check Bags More Than 1/2 hour before Departure -1

Reversable seats	-1
Move heat	-3
No water	-5
Loudspeakers for tour groups	-2
Haul mail	-2
Bigger water cups	-2
Easier opening doors	1
Foot Rests	2
Blankets & pillows	-3
No facilities for E&H	-1
Bring back the dining car in use earlier in the year	-1
Clean the snack counter	-1
Food was readily available	-1
The man behind the snack counter tries to give me too little change; I ride frequently and my friends say the same thing (survey 1077)	-1
Woman asnwering phone at Mpls. depot was unhelpful	-1
Too many personnel at Mpls. depot	-2
Not enough personnel at Dul. depot	-2
People loading my bicycle (for a $3 fee) were unpleasant	-1

Get rid of Train Unions	-1	
This train is much superior to North Coast Hiawatha, cleaner, friendlier crew, better run	-1	
Run a turbotrain on the Empire Builder	-1	
Faster service to Chicago	-4	
Overnight service to Chicago	-2	
Open Waiting Rooms earlier	-1	
Reading Material and Gift Shop is needed	1	
Play area on train for children	3	
Separate tour groups	3	
Why is everbody for Duluth (95% of passengers) herded into one car when Cambridge & Sandstone passengers are given 3 coaches?	3	***
Cambridge Depot is very hard to find, no clear marking	-1	
No Checking facilities at Duluth	-1	
Make outstate rail transportation a priority in the Mn/DOT Plan	-1	
I'd rather ride train than bus	-4	
I'd ride bus than train	-1	
This service is a necessity, not a luxury	-2	

Provide a level of service equal to European trains -4

Nationalize the trains. 1

Since when do Hiways operate at a profit? .4

Return to former RR standards. 1

A study by German Federal Railways shows that it takes 4 years to build clientele for a train service -1

Native Americans should ride free because the Iron Horse is the symbol of the distruction of the Native American lifestyle -1

Section IV

Auto travel between Minneapolis/St. Paul and Duluth has been studied many times. The three most frequently used studies are the statewide origin destination study of 1966, the 1964 origin destination study on I-35 West of Duluth, and the 1970 Travel Behavior Inventory for the Twin Cities.

Using these studies, the following is an estimate of average daily vehicle trips and person trips between the Twin Cities and Duluth (person trips were computed using the occupancy factor of 2.10 determined from the I-35 study West of Duluth).

Calendar Year	Two Way Vehicle Trips Per day	Person Trips Per Day	Person Trips Per Year
1970	1,900	4,000	1,460,000
1975	2,200	4,600	1,679,000
1976	2,250	4,700	1,715,500
1977	2,300	4,800	1,752,000
2000	4,000	8,400	3,066,000

The percentage of these trips for different trip purposes as determined from the 1970 Travel Behavior Inventory are as follows:

		Percent
A.	Non Home Based	23.9
B.	Home Based Work	13.6
C.	Home Based Shop	.4
D.	Home Based School	.9
E.	Home Based Medical	.2
F.	Home Based Outdoor Recreation	9.5
G.	Home Based Other Social/Recreation	30.0
H.	Home Based Personal Business	15.7
I.	Home Based Serve Passenger	5.8

These estimates basically point out that auto travel between Duluth and the Twin Cities will about double between now and the year 2000. These trips are of three major types:

Home Based Recreation (F + G)	39.5%
Home Based Work or Business (B + H)	29.3%
Non Home Based (A)	23.9%

The large percentage of recreation and non-home based trips is significant but not surprising. Duluth is a reacreational center and a gateway to other recreational areas. The non-home based trips are those which do not originate or end at what the traveler considers to be his home. The two main types of such trips are going from an office or a place of business to another office or place of business, and going from one stop to the next in a multiple stop journey like a vacation trip.

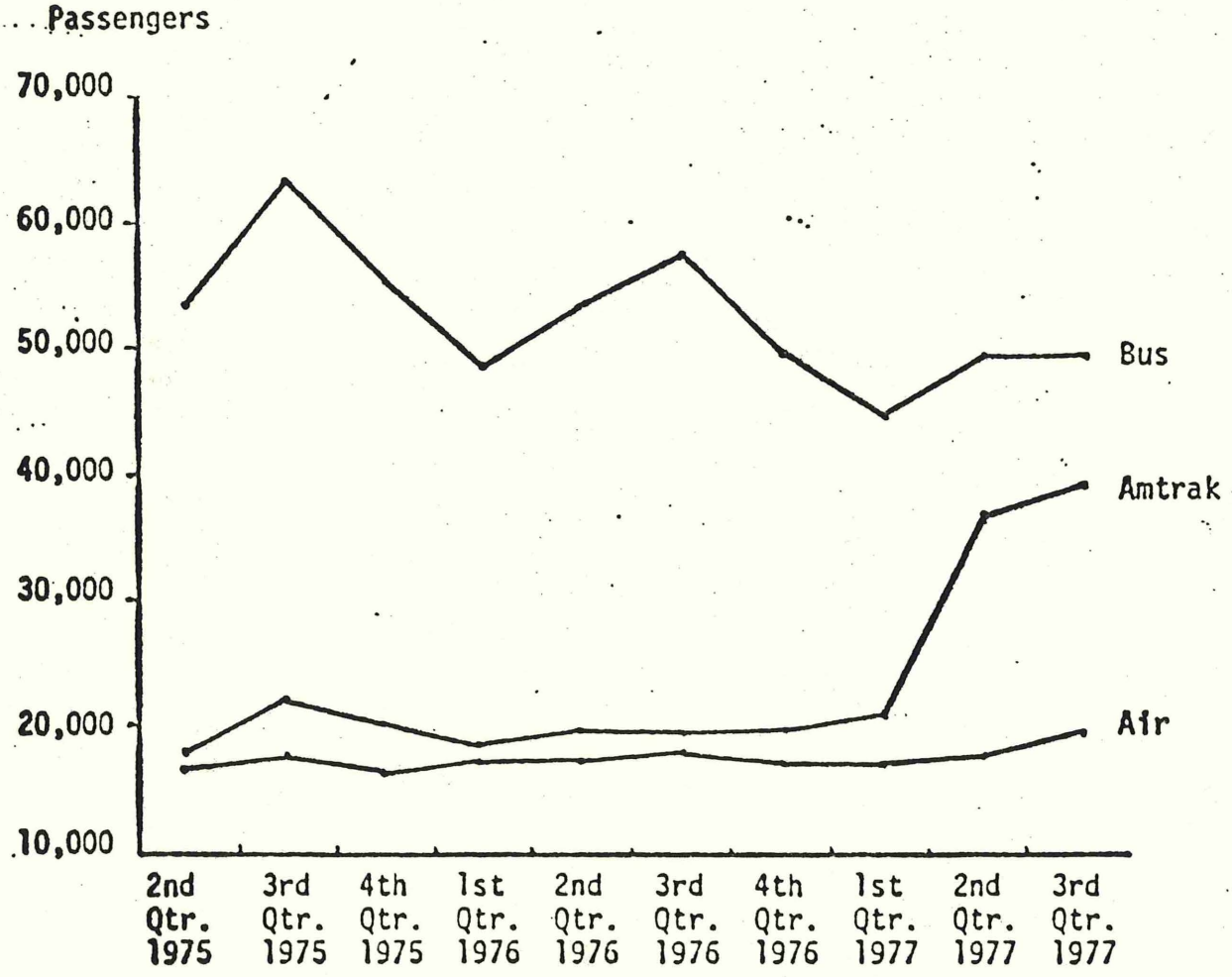
The high vehicle occupancy is not surprising either considering the length of the trip and the trip purposes. Long trips have a greater tendency to carpool when using auto. Recreation trips tend to be family or group oriented.

Thus auto travel between Duluth and the Twin Cities has a fairly high occupancy for business or recreational travel.

On a calendar year basis, following is a tabulation showing Total Person Trips by Mode between Minneapolis-St. Paul and Duluth-Superior from April 15, 1975 through September 30, 1977.

Calendar Year	AMTRAK	Bus	Air	Auto	Total Person Trips Per Year
1975-8-1/2 mo.	32,281	145,597	21,422	1,200,600	1,399,900
1976	37,986	170,514	30,938	1,715,500	1,954,938
1977-9 mo.	68,306	119,190	25,083	1,310,400	1,522,979
30-Month Period	138,573	435,301	77,443	4,226,500	4,877,817
Percentage	2.8	8.9	1.6	86.7	100

PASSENGER RIDERSHIP BETWEEN TWIN CITIES AND DULUTH
BY AMTRAK, GREYHOUND BUS AND
NORTH CENTRAL AIRLINES
APRIL, 1975 - SEPTEMBER, 1977



RIDERSHIP BY COMMERCIAL TRANSPORTATION MODE
TICKETED PASSENGERS BETWEEN
MINNEAPOLIS - ST. PAUL AND DULUTH - SUPERIOR
APRIL 15, 1975 THRU SEPTEMBER, 1977

C.Y.		AMTRAK		% OF TOTAL	BUS		% OF TOTAL	AIR		% OF TOTAL	ALL MODES GRAND TOTALS	
1975	Apr.	1,628			13,106			2,364			17,098	
	May	3,349			14,379			2,321			20,049	
	June	3,949	8,926	14.75%	16,862	44,347	73.31%	2,536	7,221	11.94%	23,347	60,494
	July	3,885			19,353			2,709			25,947	
	Aug.	5,665			20,992			2,601			29,258	
	Sept.	2,974	12,524	16.77%	14,246	54,591	73.10%	2,250	7,560	10.12%	19,470	74,675
	Oct.	2,912			15,287			2,435			20,634	
	Nov.	3,743			14,428			1,831			20,002	
	Dec.	4,176	10,831	16.89%	16,944	46,659	72.76%	2,375	6,641	10.36%	23,495	64,131
1976	Jan.	2,646			13,368			2,361			18,375	
	Feb.	2,537			12,713			2,185			17,435	
	Mar.	3,079	8,262	15.04%	13,478	39,559	71.99%	2,582	7,128	12.97%	19,139	54,949
	Apr.	4,242			13,526			2,436			20,204	
	May	2,914			13,268			2,405			18,587	
	June	2,811	9,967	16.55%	15,889	42,683	70.87%	2,732	7,573	12.57%	21,432	60,223
	July	3,321			17,839			3,114			24,274	
	Aug.	3,971			17,730			3,041			24,742	
	Sept.	2,504	9,796	14.71%	12,440	48,009	72.08%	2,641	8,796	13.21%	17,585	66,601
	Oct.	2,591			13,149			2,522			18,262	
	Nov.	3,257			12,639			2,227			18,123	
	Dec.	4,113	9,961	17.27%	14,475	40,263	69.82%	2,692	7,441	12.90%	21,280	57,665
1977	Jan.	2,392			12,069			2,646			17,107	
	Feb. 15	4,134			11,135			2,399			17,668	
	Mar.	5,193	11,719	21.19%	12,608	35,812	64.75%	2,729	7,774	14.06%	20,530	55,305
	Apr.	5,990			13,602			2,541			22,133	
	May	10,203			12,594			2,627			25,424	
	June	11,356	27,549	36.21%	14,123	40,319	52.99%	3,051	8,219	10.80%	28,530	76,087
	July	10,522			15,139			3,169			28,830	
	Aug.	10,789			15,521			3,295			29,605	
	Sept.	7,727	29,038	35.76%	12,399	43,059	53.04%	2,626	9,090	11.20%	22,752	81,187
GRAND TOTALS			138,573			435,301			77,443			651,317
PERCENTAGE				21.28%			66.83%			11.89%		

	AMTRAK	BUS	AIR	AUTOMOBILE
Cost				
One-way	$10.50	$ 8.05	$35.79	$23.84 - 149 mi.@ 0.16/mi.
Round trip	16.00	15.30	70.38	47.68 - 298 mi.@ 0.16/mi.
Travel Time	200 min.	185-280 min.*	35-40 min.	163 minutes at 55 mph
Frequency of Service per Day	1	6	9	Upon demand
Number of Towns Served	5	41	2	Unlimited
Share Ridership between Twin Cities & Duluth	2.8%	8.9%	1.6%	86.7%

* Express and Local Service

FARES BY COMMERCIAL TRANSPORTATION, MODE

TICKETED PASSENGERS BETWEEN

MINNEAPOLIS / ST. PAUL — DULUTH – SUPERIOR

	CURRENT FARE	PERCENTAGE COMPARISON TO AMTRAK	
		HIGHER	LOWER
		%	%
ONE WAY			
ARROWHEAD TRAIN	$ 10.50		
BUS	8.05		23.33
AIRLINE	35.19	335.14	
ROUND TRIP			
ARROWHEAD TRAIN	$16.00		
BUS	15.30		4.37
AIRLINE	70.38	439.87	
ARROWHEAD TRAIN = 100%			

NUMBER OF COMMUNITIES SERVED

COMMERCIAL TRANSPORTATION - TICKETED PASSENGERS

BETWEEN MPLS. - ST.PAUL - - - DULUTH - SUPERIOR

ARROWHEAD TRAIN

MPLS. - ST. PAUL
CAMBRIDGE
SANDSTONE
SUPERIOR
DULUTH

BUS

MINNEAPOLIS
ST. PAUL
WHITE BEAR LAKE
HUGO
WESTON
FOREST LAKE
WYOMING
STACY
NORTH BRANCH
HARRIS
RUSH CITY
ROCK CREEK
PINE CITY
BEROUN
HINCKLEY
SANDSTONE
*ASKOV
*BRUNO
*KERRICK
*DUQUETTE
*NICKERSON
*HOLYOKE
*WRENSHALL
*FOND Du Lac
*NEW DULUTH
*MORGAN PARK
RUTLEDGE
WILLOW RIVER
STURGEON LAKE
MOOSE LAKE
BARNUM
MAHTOWA
ATKINSON
CARLTON
SCANLON
CLOQUET
ESKO
NOPEMING
W. DULUTH
DULUTH, MN
SUPERIOR, WISC.

AIRLINE

MPLS. - ST. PAUL
DULUTH - SUPERIOR

The express schedules operate over Interstate T.H. 35 and the local schedules operate over T.H. 61 and, in one instance, over T.H. 23 between Sandstone and Duluth.

* Local schedule over T.H. 23 between Sandstone and Duluth

COMPARATIVE SCHEDULE & FREQUENCY

COMMERCIAL TRANSPORTATION - TICKETED PASSENGERS

BETWEEN MPLS.-ST. PAUL & DULUTH-SUPERIOR

Time Schedule	Arrowhead Train	Bus	Airline
7:45 a.m.		Express	
8:05 a.m.	X		
8:35 a.m.			X
8:45 a.m.		Local	
10:15 a.m.(Ex. Sat.)			X
11:15 a.m.			X
11:45 a.m.		Express	
1:45 p.m.		Express	
2:05 p.m.			X
3:00 p.m.(Ex. Sat.)			X
4:55 p.m.			X
5:00 p.m.		Local-Fri. Only	
5:00 p.m.		Express	
8:10 p.m.		Local	
8:40 p.m.			X
10:25 p.m.			X

BETWEEN DULUTH-SUPERIOR & MPLS.-ST. PAUL

6:40 a.m.			X
7:30 a.m.		Express	
7:30 a.m.		Local	X
10:45 a.m.		Express	
12:25 p.m.			X
12:45 p.m.		Express	
1:50 p.m.(Ex. Sat.)			X
3:15 p.m.			X
3:55 p.m.			X
4:30 p.m.(Sundays, Holidays)		Local	
4:30 p.m.		Express	
5:30 p.m.	X	Local	
6:55 p.m.			X
8:25 p.m.			X
11:25 p.m.			X

TRAVEL TIME BY COMMERCIAL TRANSPORTATION MODE

MINNEAPOLIS / ST. PAUL — DULUTH – SUPERIOR

	TRAVEL TIME IN MINUTES	PERCENTAGE OF TIME COMPARISON TO AMTRAK FASTER OR SLOWER	
		%	%
ARROWHEAD TRAIN	200		
BUS: EXPRESS	185	7.5	
	195	2.5	
LOCAL	270		35
	280		40
AIRLINE	35	82.5	
ARROWHEAD TRAIN = 100%	40	80	

Section V

ENERGY EFFICIENCY OF CURRENT INTERCITY PASSENGER TRANSPORTATION MODES

1.0 INTRODUCTION

The 1973-1974 oil embargo created a great interest in the petroleum product consumption and utilization efficiency of the various sectors of the U.S. economy. Many papers were published on modal efficiencies of the transportation sector. One outstanding aspect of their results was the apparent lack of agreement of the data produced.[1]

Our objective here is to present the results of a study[2] initiated in the Spring of 1974 and to draw particular attention to the *difficulties of making fair comparisons*.

The study was limited to Intercity Passenger Transportation in the 48 contiguous United States. Only trip energy was to be considered.

First, recent trends of fuel consumption in transportation and some of its sectors are discussed. Then the main ground-rules of the study are presented, and the subject of circuity is discussed. Source data and factors important to the analysis are described for the four transportation modes: airplanes, automobiles, buses, and trains. Modal energy efficiency comparisons are presented, first for a few interesting city pairs and then in a generalized form as a function of city pair distance. The difficulties of making fair comparisons are discussed in some detail. Finally, some concluding remarks and recommendations are made.

2.0 TRANSPORTATION SECTOR ENERGY CONSUMPTION

As a prelude to modal efficiency discussions, many authors emphasize the importance of petroleum as a transportation fuel. This paper follows the general line except emphasis is also given to the growth *trends of the recent past*.

The transportation sector uses approximately 25% of the total U.S. energy consumption and has maintained this share despite an overall growth of 90% from 1950 to 1970[3]. However, the reduced use of coal has resulted in almost complete reliance on petroleum. Over 95% of the sector energy has been derived from petroleum since 1960.

The Bureau of Mines publishes statistics of the purchases of petroleum products by the Transportation sector.[3,4] Their records give insight into the major users and growth trends (figure 1). The data do not give exact modal consumption levels since small amounts of each fuel type may not be used in vehicles of the indicated mode. Also, spillage and evaporation are included

in the data. However, some general trends are apparent.

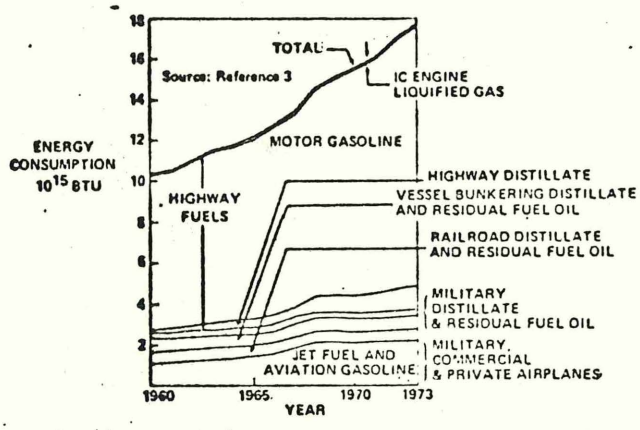


Figure 1.— Consumption of Petroleum Products in the U.S. Transportation Sector, 1960—1973

Purchases of highway related fuels dominate the sector. Since 1968, the increased use of such fuels accounts for 96% of the total increase in transportation consumption. Emission control devices for automobiles, growth of automobile population, and the continued growth of the truck fleet are factors which contribute to this situation. Some of these may be transitory, and therefore, recent trends do not necessarily provide a suitable basis for future predictions. Indeed, 1974* automobiles are already known to have better urban driving fuel efficiency than 1974 models.[5]

Purchases of distillate and residual fuels for railroads, vessels, and the military have been substantially constant in recent years. Clearly the associated modes are not pacing the growth in sector consumption.

Consumption of aviation fuels increased annually up to 1968 but was substantially constant thereafter. However, these total levels mask the trends of individual aviation fuels and users. As shown on figure 2, military naphtha purchases from the domestic distribution system have declined annually since 1968. This complements the growth of kerosene consumption by all users. Commercial consumption of kerosene is the dominant growth trend. However, the growth rates of the 1960's were not continued into the 1970's. Improved technology airplanes and reduced market growth rate are considered to be significant factors. Growth predictions based only on the data of the 1960's clearly require close inspection.

Finally, a breakdown of sector petroleum consumption is required, which identifies the part that supports intercity passenger transportation. In particular, the intercity part of automobile consumption is the pacing item. However, source data deficiencies preclude reasonable estimation. A frequently quoted study[6] makes a number of gross assumptions. We therefore consider its results questionable.

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* The 1976 average fuel energy level for new cars is 17.1 mpg; preliminary data.

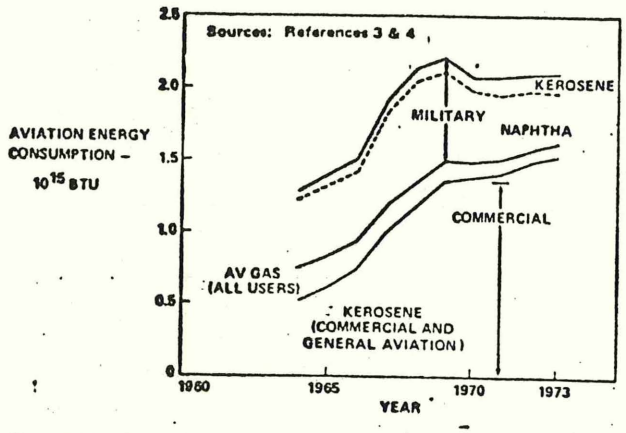


Figure 2.– User Consumption of Petroleum Products in the Aviation Sector, 1964–1973

3.0 STUDY GROUNDRULES

3.1 SPRING 1974 AND CITY PAIR ANALYSIS

The modal performance levels presented in this paper are governed by consideration of actual round trip city pair services for Spring 1974. Appropriate to this frame are the conservation procedures resulting from the 1973-1974 oil embargo. These include 55 mph highway speed limits and long range cruise airplane Mach numbers. As far as possible, equipment types, operational procedures, routes, and schedules reflect actual services. These rules were selected with the objective of providing a status for 1974 that will be widely accepted as a suitable base for improvement studies.

Ten city pairs were selected for detailed studies (figure 3). These city pairs were taken from a larger sample of 83 using the following criteria. Each city population exceeds one million. Also, passenger trains, bus, and air services exist between each city pair. Routes and cities cover the contiguous 48 states with trip distances ranging from *100 - 2400 great circle miles in reasonable increments*. New York to Washington, and Chicago to St. Louis were selected because they are serviced by advanced technology trains, the Metroliner and the Turbo-train, respectively.

The city pair method was adopted because the modes can be compared doing specific origin to destination transportation jobs. Also, issues such as equipment selection and route constraints are avoided since these are defined by actual services. Normally, the results of city pair analyses are not generally applicable to wider populations. To overcome this difficulty, modal route distance trends were developed for the wider population of 83 city pairs. These trends were adopted and used to extend the detailed results of the 10 city pairs (figure 4). Thereby

generalized fuel utilization efficiencies were obtained as a function of great circle trip distance for each transportation mode. These aspects are futher discussed later.

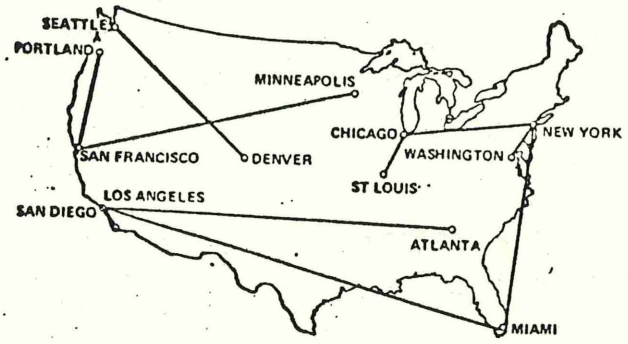


Figure 3.— City Pairs for Detailed Study

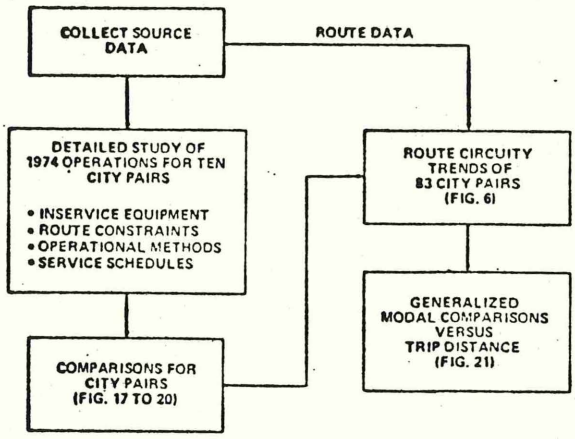


Figure 4.— General Analysis Method

3.2 COMPARISON UNITS

Fuel utilization is expressed in terms of passenger great circle miles per gallon. This parameter gives credit only for productive transportation since passenger great circle miles defines the job to be done between city pairs. Normally, modal route miles exceed the great circle distance even for the airplane which is subject to in-flight maneuvers. Such additional miles cause fuel to be burnt, and therefore, trip fuel was determined by route miles. Fastest service schedules were used to determine route distance for buses and trains. AAA Triptiks provided automobile route miles. Airplane maneuver and route allowances were taken from the Air Transport Association rules, which reflect airline operating experience. Only nonstop flights were considered, since on all city pairs the service frequencies of such flights were considerably greater than for the bus and train modes.

3.3 LOAD FACTOR

Load factor is a system characteristic which directly impacts fuel utilization efficiency. An initial study objective was to apply load factors specific to each mode on each city pair route. However, such data were not available for all public modes in the Spring of 1974. System average load factors for air are historically higher than for the other public modes (figure 5). Post embargo load factors for air and rail were significantly higher than previous levels at 60% and 53% respectively for Spring 1974. Bus system average load factors were 47%,

although higher levels are typical of regions where bus freight revenues are small. Pending availability of the correct data, results for individual city pairs were determined as a function of load factor. However, for summary comparison, the public modes were credited with 60%*.

Automobile statistics normally state occupancy levels rather than load factor, which is subject to the uncertainties of seating definitions. Occupancy levels based on survey data were adopted for summary comparisons. For individual city pairs, results were determined as a function of load factor up to 100% (five passengers).

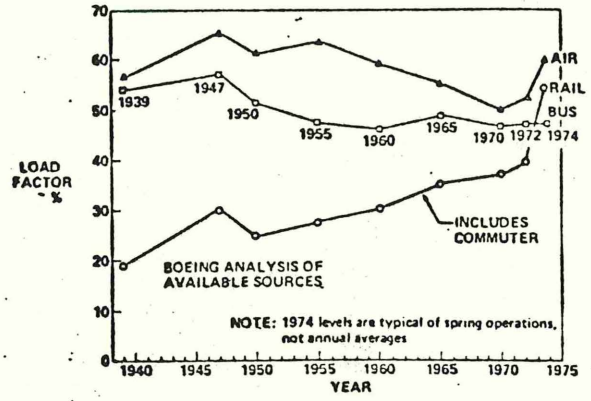


Figure 5.— Load Factor by Mode of Transportation, Selected Years 1939–1974

3.4 EXCLUSIONS

Energy consumption for system-related operations such as vehicle, terminal, and route maintenance were excluded. Also, the transportation energies of local travel to and from terminals were not considered. Complete assessment would require detailed examination of the travel population distribution relative to the modal terminals of each city. It could be assumed that the city center is the population centroid and that only the airplane performance should be corrected for local travel from the city center to the airport. Such corrections involve small fuel increments for short trips (6% Los Angeles to San Diego) but negligible amounts for long trips. However, the approach was considered to be invalid, particularly for the new cities that have not developed uniformly around the central business district.

4.0 CIRCUITY

The ratio of route to great circle miles is defined as circuity. High circuity is associated with geography, and indirect routing for ground modes. Air circuity is strongly dependent on traffic patterns around airports and enroute flight lanes.

* This number appears to be high for buses and rail.--MITTAL

The significance of circuity to fuel utilization comparisons is seen as follows. Conventionally, airplane performance data and CAB statistics include the trip fuel and distance penalties of circuity. Thus, airplane data give distance credit only for great circle miles traveled, yet fuel consumption reflects actual flown miles. This bookkeeping system is clearly different from that conventionally used for ground modes, where credit is normally given for all route miles. However, conversion to the airplane bookkeeping system is merely a matter of dividing route miles per gallon by route circuity. These differences in data bookkeeping are often overlooked.

A comparison of mode circuities based on examination of 83 city pairs is shown on Figure 6. The route miles for each mode were determined according to the ground-rules described in Section 3.2. Bus circuities were omitted for pictorial clarity since the levels are similar to automobiles except the band upper limit is somewhat higher.

At short trip lengths, passenger rail circuities range from 1.0 to greater than 3.0. As trip distance increases, the band width reduces; however, minimum circuities are seen to increase to 1.3. These trends are a natural result of the large grid size of the AMTRAK network. Main freight lines give lower circuity levels but are not necessarily suitable for passenger trains.

Automobile trip circuities range from 1.0 to 1.4 on short trips and 1.1 to 1.2 on long trips. These levels and trends reflect the small grid size and comprehensive coverage by the nation's highway system.

Air is shown for reference only, since the inherent penalties are normally included in performance levels as discussed above. The line shown was obtained by application of ATA rules, which reflect airline experience. Circuities on short trips are greater than 1.5, but on long trips the levels are below 1.05. Currently available source data do not allow specific determination of the individual circuities for the 83 city pairs. However, it is likely that a bandwidth exists around the line shown.

A reasonable criticism of the comparison is that equal weighting is given for all city pairs. Perhaps the passenger traffic on highly circuituous rail routes is so small that the traffic weighted levels are close to the lower limit of the band. Unfortunately, city pair traffic density data are not available for all modes on each city pair. However, the argument may have merit since the dense traffic of the NE corridor would probably dominate the short trips. Rail circuities in this corridor are typically 1.0 to 1.2.

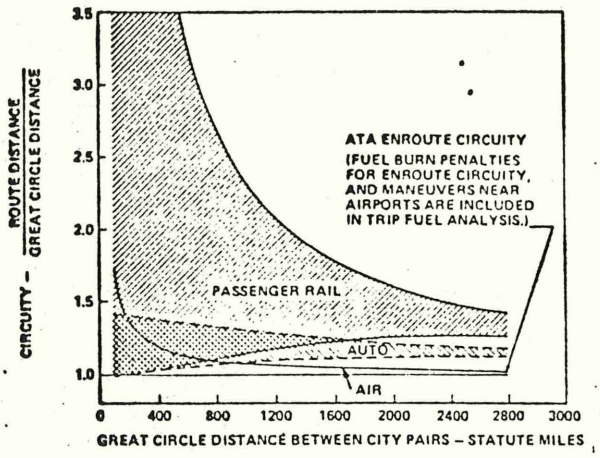


Figure 6.– Air, Rail and Highway Circuity Trends; Based on 83 City–Pair Analysis

5.0 SOURCE DATA AND ANALYSIS FACTORS

5.1 AIRPLANES

The fuel efficiency of the jet transport airplane is affected by many variables. These include equipment type, configuration, mission range, payload, flight operational procedures, and equipment condition. Source data are readily available from manufacturer's performance documents and CAB reports. The latter are used extensively by other authors. However, the latest complete reports do not reflect the post-embargo load factors and operational procedures. Also, the CAB data are generally limited to average trip statistics for each model type, and the reported fuel consumption includes cargo, training, and non-revenue flights. Therefore, the performance of a particular mode flying a particular mission cannot be isolated. *Despite these limitations, the general scope and quality of CAB statistics are far superior to those of other passenger modes.*

Airline operations for spring 1974 were characterized by fuel conservation procedures which include long range cruise Mach number, higher seating levels and load factors, near optimum cruise altitudes, drag improvement maintenance, and minimum reserves. Accordingly, this study accounts for these factors except that pre-embargo seating levels are assumed.

For each airplane model, energy utilization efficiency was calculated as a function of origin-destination great circle distance (ATA range) and passenger loading. Long range cruise Mach numbers were adopted and a step cruise altitude procedure of 31/34/39,000 ft was applied for ranges over 500 miles. This procedure was not practical for shorter trips where a constant cruise altitude was used with the altitude dependent on trip length. ATA rules were applied with

respect to reserves and allowances. Airplane weights and seating descriptions were taken from manufacturers' specifications. Average in-service seating levels were obtained from 1972 CAB statistics.[26] These were assumed applicable to 1974 operations.

Detailed results for the 727-200B and 747-200B airplanes are given on figures 7 and 8. These show fuel utilization efficiency as a function of ATA range and as a function of passenger loading. Solid lines are the performances at loadings up to specification mixed class seating, dashed lines are the performance levels for all-economy seating. Average airline seating capacity for 1972 operations is noted. Also, maximum brake release gross weight limits are identified (MBRGW).

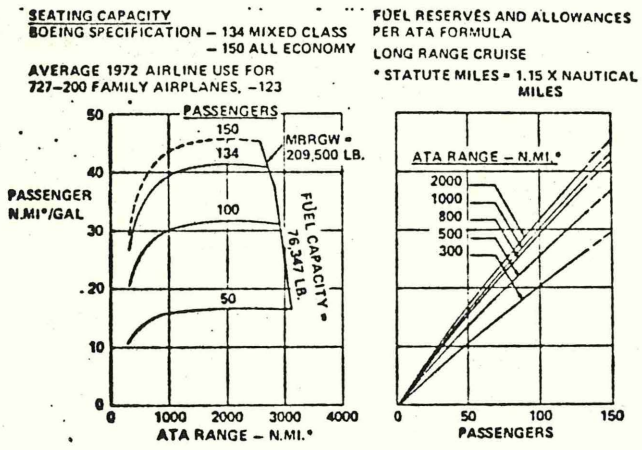


Figure 7.– Fuel Utilization, 727–200B

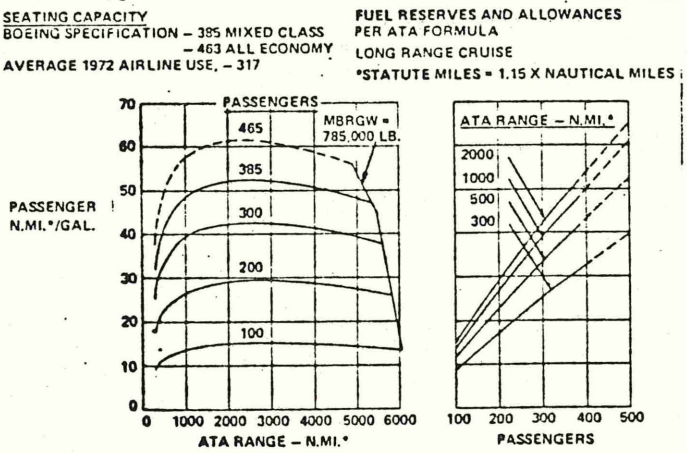


Figure 8.– Fuel Utilization, 747–200B

Similar results were developed for all the following airplanes:

NARROW BODY		WIDE BODY
737-200	DC-9-10	(747-200B)
727-100	DC09-30	(747SR)
727-200ADV	(DC-9-50)	(747SP)
727-200B	DC-8-55	DC-10-10
727-300	(DC-8-63)	(DC-10-30)
707-320B,C		L1011
		(A300B4)

For each city pair, in-service equipment was obtained from the May 1974 Official Airline Guide. Models in parentheses were not used during Spring 1974 on the ten city pair routes of this study. However they are included in figure 9, which summarizes the performance for all models. At full loads, the wide body airplanes are substantially more fuel efficient than the standard bodies because of the benefits of high-bypass engine technology. However, at reduced loads (below 200 passengers), the standard body models are more fuel efficient since they can be operated at high load factors. Also illustrated is the fuel utilization trend when a given

airplane is flown less than maximum range. Performance improves slightly until at short distances flight maneuvers, climb procedures, and the weight penalties of reserves become significant.

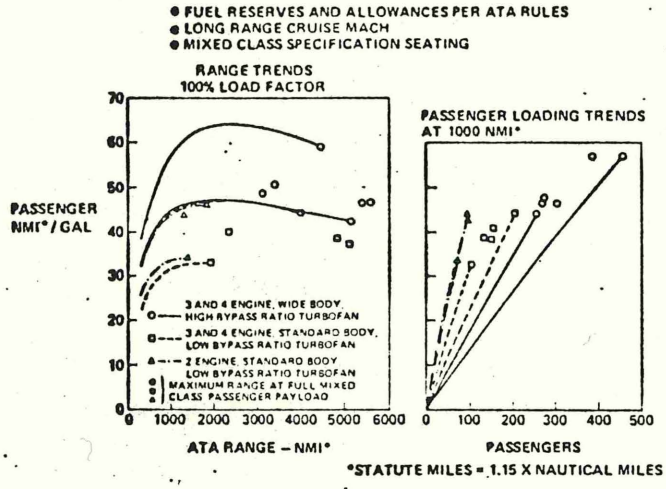


Figure 9.– Airplane Fuel Utilization

Finally, table 1 illustrates that calculated performance can provide close agreement with pre-embargo CAB statistics provided differences in load factor, seats offered, and operational procedures are considered.

Table 1.– 727–200 Calculations Compared Against CAB Data
*Flight Length = 498 Statute Miles**

		Cruise procedure	Passengers	Load factor	Pass St. miles / gallon
Boeing calculation	Calculated data at Spec seating	Long range cruise Mach and near optimum altitude	134	100%	36.2
	Corrected to avg. in-service seating, 1972 operations		123	100%	33.7
	Corrected to avg. payload of 1972 operations		65.4 plus cargo	53.1%	19.2
	Adjusted to typical 1972 cruise procedure	0.84 M 30 000 ft	65.4 plus cargo	53.1%	17.5
CAB data**	Average performance reported by U.S. airlines in 1972	427 mph average speed. Altitude not reported	65.4 plus cargo	53.1%	16.8

Δ = 4%

*498 statute miles was the average 727-200 flight length by U.S. operators in 1972

**Reference 26

5.2 INTERCITY AUTOMOBILES

The fuel efficiency of intercity automobiles is subject to a wide range of population and operational factors. These include:

Size, weight, and model year distribution
Highway speed
Power options
Driver habits
Mechanical Condition
Geography
Traffic conditions
Occupancy

Adequate source data are available for some of these factors but major source data deficiencies preclude rigorous analysis. Test results and reports published by the Federal Highway Administration (FHWA), Dupont, and Consumer Reports define fuel mileage as a function of highway speed, weight, and model year.[7,8,9] 1973 model year data are shown on figure 10 for low mileage automobiles. The FHWA and Dupont data agree. Consumer Report data show lower levels for their 340 miles trip tests due to variable speed and road conditions.

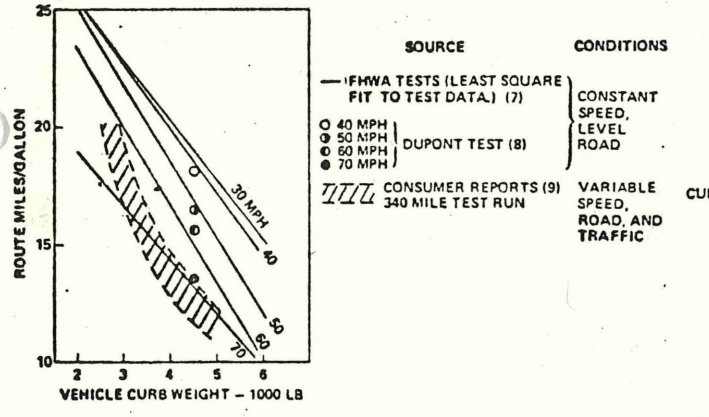


Figure 10.— Speed and Weight Effects, 1973 Automobiles

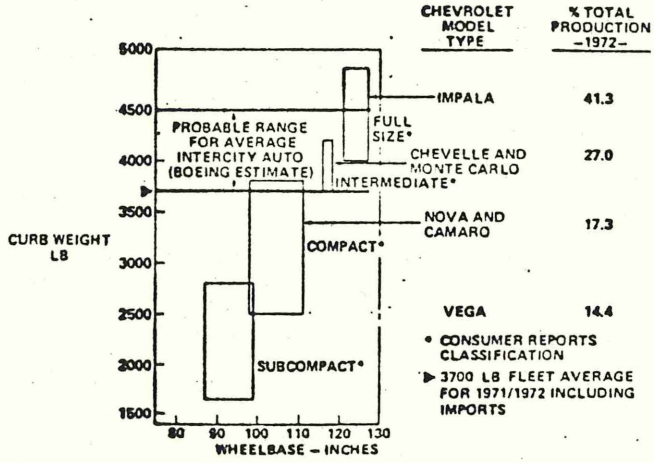


Figure 11.— Intercity Automobile Definition

Similar data are available for other model years. However, a major difficulty is that available statistics do not describe the population characteristics of automobiles used in intercity travel during 1974. Instead of considering all possible automobiles, this study concentrated on a range of weights (3700 lb - 4500 lb) and model years (1971/72) which were believed to encompass the average automobile used in 1974 intercity travel. A perspective on the weight range is indicated in figure 11.

An average highway speed of 50 mph was selected to be consistent with the 1974 speed limits of 55 mph. Penalties for air conditioning, driver habits, mechanical condition, and geography

were assessed collectively at 1.75 mpg. Additionally, Consumer Reports provided corrections for city driving conditions (figure 12). Application of these factors to the ten city pair trips provided the vehicle road-miles-per-gallon trends of figure 13. Satisfactory agreement is shown with the 340 mile Consumer Reports test results. An interesting feature is that the shorter trips are subject to greater impact from city driving effects.

Major analysis limitations derive from the source data scarcities regarding population distribution, driver habits, mechanical condition, and geography. However, FHWA is currently planning tests and surveys to provide data in these areas.

Finally, an overriding feature of automobile fuel utilization pertains to intercity automobile occupancy. Surveys conducted in the NE corridor and the State of Kansas show good agreement and were used in this analysis (figure 14). However, these data represent pre-embargo habits. The survey data of the National Personal Transportation Study are considered to be unsatisfactory because of the sample size for trips greater than 100 miles.[10]

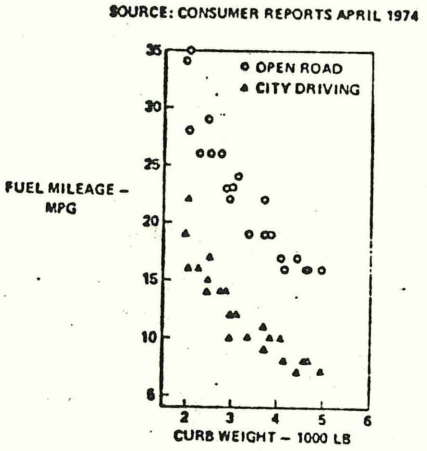


Figure 12.– Average Open Road and City Fuel Consumption, 1974 Passenger Cars

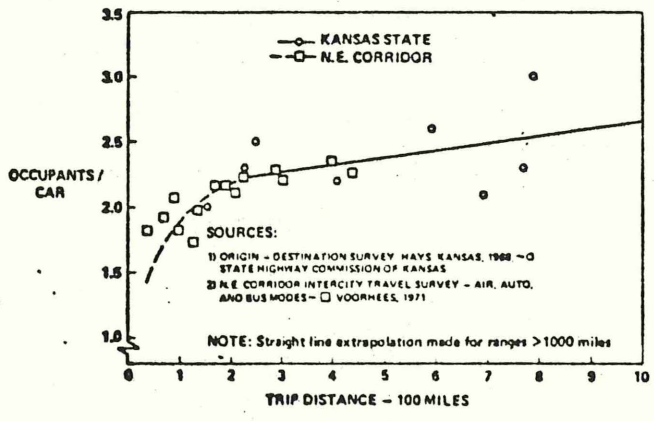


Figure 14.– Automobile Occupancy Trends

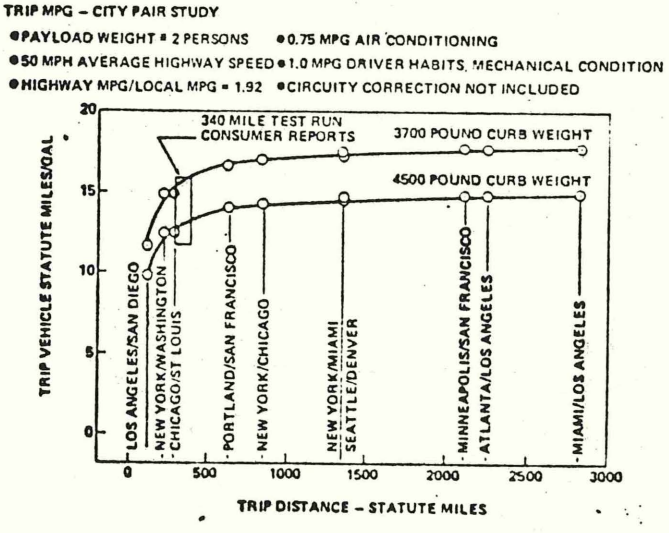


Figure 13.– Calculated Fuel Mileage Levels Compared to Consumer Reports

5.3 INTERCITY BUSES

The Class 1 bus operators do not formally report in-service fuel consumptions. Further, specific data for particular schedules, bus models, and operating procedures are not available. The National Association of Motor Bus Owners (NAMBO) provided verbal quotations as follows:

All Class I	6.0 mpg
National Greyhound	6.2 mpg
National Trailways	5.5 mpg
Range of Seats	34 to 57
Average Class I seats	43

Additionally, the authors have examined substantial proprietary data that confirm the above mileage levels.* Accordingly, *6.0 mpg ± 10% and 43 seats were* used for all city pairs of this study. In this respect the bus results are typical instead of being route specific.

Consideration was given to the impact of reduced speed limits from 60 to 55 mph. However, Department of Transportation tests showed that mileage improvements were terrain dependent and small.[11] Therefore, the impact of reduced speed limits was ignored.

Clearly the bus analysis is much simpler than the analyses of other modes. Yet the relative standing of the bus fuel efficiency could only be changed by a very large error in the numbers noted above. Hence, some simplification is justifiable.

5.4 INTERCITY TRAINS

Many other published analyses of in-service passenger trains are based on gross statistics compiled by the Interstate Commerce Commission and the American Association of Railroads. These data are subject to many anomalies and are probably not suitable even for gross analysis. Certainly they do not provide the intelligence necessary for the study of specific routes and services because of the attendant wide variations of equipment and terrain.

For diesel electric locomotives, only two sources of measured fuel consumptions are available in the public domain. One set was measured for the Empire Builder in AMTRAK tests from Seattle to Havre, Montana.[12] The other set was obtained by Southern Railroad during tests of the Southern Crescent on the Atlanta-Washington run.[13]

To apply these data to other routes, a semiempirical analysis model was developed, which includes provisions for assessment of configuration details, route terrain, duty cycle, train accelerations, auxiliary power requirements, heating, and schedule speeds, (figure 15). The

* Some of the TSC studies show buses in the range of 8 mpg depending upon cruising speed and the amount of highway driving involved.--MITTAL

model was checked against the measured fuel data and found to be 3% low relative to the Empire Builder tests (figure 16) but was 20% low relative to the Southern Crescent tests. Consequently, a banded estimate was made for each city pair of -0% + 20% relative to the model estimate of trip fuel. This technique was applied to trains on eight of the ten city pair trips.

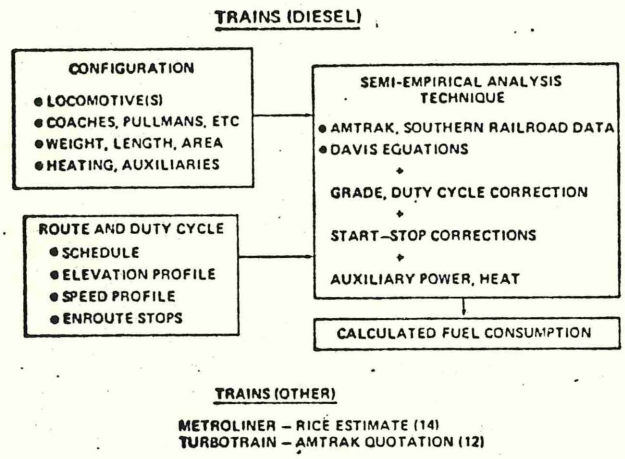


Figure 15.– Derivation of Train Fuel Consumption

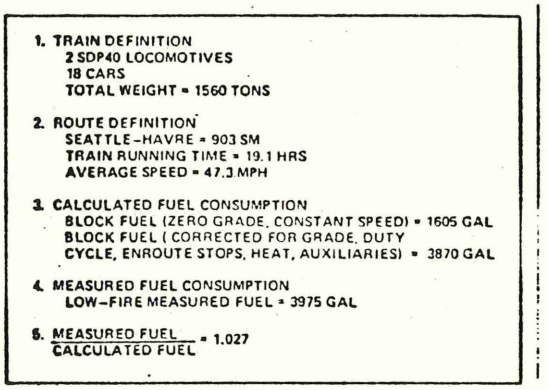


Figure 16.– Boeing Diesel Train Analysis Compared Against Seattle–Havre Tests

Inspection of the Empire Builder estimate shows that if the train could run under level track constant speed conditions, then the resulting trip fuel would be only 40% of the measured fuel (figure 16). Grade, duty cycle, auxiliaries, accelerations, and heating account for the remaining 60%. These penalties are often ignored in idealized train analyses.

The remaining two city pair routes are serviced by the Metroliner and the Turbotrain. The Metroliner estimates of Rice[14] were based on converting Penn Central electricity charges into gallons of fuel by assuming typical line and generation efficiencies. Boeing estimates confirm the Rice analysis. AMTRAK supplied the Turbotrain fuel consumption data. These were inclusive of operational service penalties.

Train configuration data and fuel consumptions are summarized in table 2 for low fire (summer) heating operations. Winter heating causes larger penalties; therefore, the levels used here may be optimistic for spring operations.

6.0 ENERGY EFFICIENCY COMPARISONS

Before presenting the generalized modal comparisons, it is necessary to review some of the underlying city pair data.

Table 2.– Train Configurations and Fuel

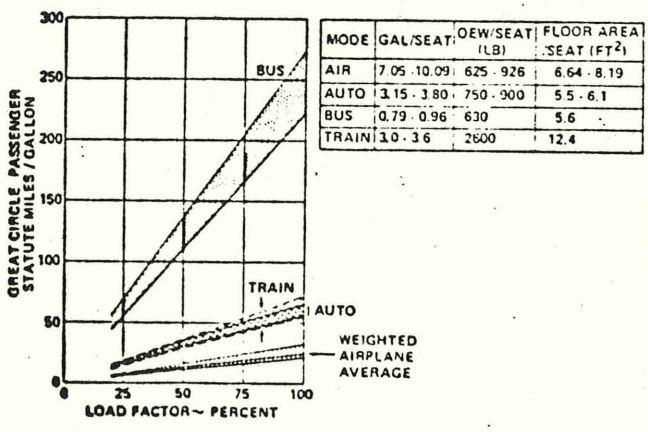
City Pair	Route Segment	Train Name	Locomotive No., Type	Cars No.; Type, Seats	Fuel Consumption Gallons (low fire)◊
			TRAIN		
Los Angeles - San Diego	Los Angeles - San Diego	San Diegans	1 - SDP40F	5 Coach 52	250 - 300
New York - Washington	New York - Washington	Metroliner		2 BDS } 382 4 Coach } ⊙	1160 □
Chicago - St. Louis	Chicago - St. Louis	Turboliner	Turbotrain	1 BDS } 296 5 Coach } ⊙	860
Portland - San Francisco	Portland - San Francisco	Coast Starlite	2-SD40	4 BDS △ 0 2 Sleeper 22 4 Coach 44	2050 - 2460
New York - Chicago	New York - Chicago	Broadway Limited	4 - E 8	5 BDS 0 2 Slpr 20 5 Slpr 22 6 Coach 52	4320 - 5190
New York - Miami	New York - Miami	Silver Meteor	3 - E 8	5 BDS 0 5 Slpr 22 1 Coach 32 7 Coach 44	5440 - 6510
Seattle - Denver	Seattle - San Francisco	Coast Starlite	2 - SD - 40	4 BDS 0 2 Slpr. 22 4 Coach 44	2500 - 3000
	San Francisco - Denver	SFC Zephyr	3 - E8	3 BDS 0 2 Slpr 22 4 Coach 44 1 Coach 75	4600 - 5500
Minneapolis - San Francisco	Minneapolis - San Francisco	Empire Builder	2 - SD40	5 BDS 0 6 Slpr 24 7 Coach 46	7870 - 9450
	Seattle - San Francisco	Coast Starlite	2 - SD40	4 BDS 0 2 Slpr 22 4 Coach 44	2500 - 3000
Atlanta - Los Angeles	Atlanta - New Orleans	Southern Crescent	2 DPT	3 BDS 0 2 Slpr 22 1 Coach 30 2 Coach 52	980 - 1180
	New Orleans - Los Angeles	Sunset Limited	4 FP 7	3 BDS 0 2 Slpr 22 3 Coach 70	4950 - 5940
Miami - Los Angeles	Miami - Birmingham	Floridian	3 - E 8	6 BDS 0 2 Slpr 20 2 Coach 41	2520 - 3020
	Birmingham - New Orleans	Southern Crescent		see above	660 - 790
	New Orleans - Los Angeles	Sunset Limited		see above	4950 - 5940

◊ Half round trip consumption
⊙ Train total seats
□ Rice (14) estimate
△ Baggage, diner, or sleeper

6.1 CITY PAIR MODAL EFFICIENCY COMPARISONS

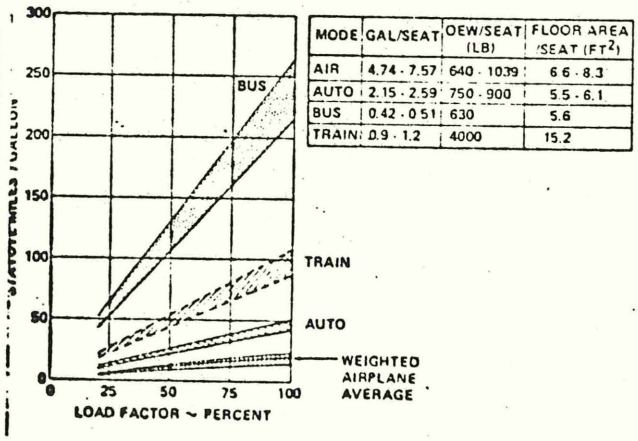
Since load factor data were not available for all public modes on each city pair service, the energy efficiency comparisons are shown plotted as a function of load factor. For consistency of presentation, the automobile performance is also shown versus load factor, assuming a seating capacity of 5 passengers. The round trip efficiencies are shown on figures 17-20 for four of ten city pairs.

Los-Angeles - San Diego (figure 17) presents a typical very short distance city pair. The bus is the most energy efficient mode by a wide margin as it is for all city pairs. The train shows up well because it is an all-coach train. The automobile suffers from a significant fraction of city driving, while airplanes suffer from the high allowances which ATA rules apply for such a short distance.



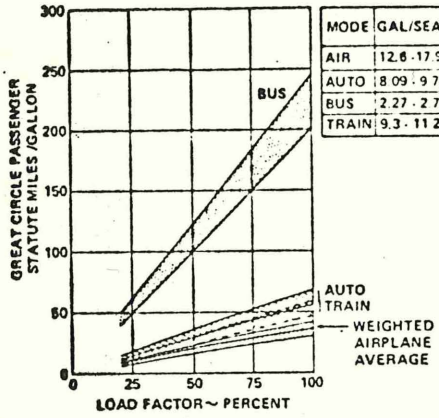
MODE	GAL/SEAT	OEW/SEAT (LB)	FLOOR AREA /SEAT (FT^2)
AIR	7.05 - 10.09	625 - 926	6.64 - 8.19
AUTO	3.15 - 3.80	750 - 900	5.5 - 6.1
BUS	0.79 - 0.96	630	5.6
TRAIN	1.0 - 3.6	2600	12.4

Figure 18.– Modal Efficiencies Versus Load Factor, New York–Washington



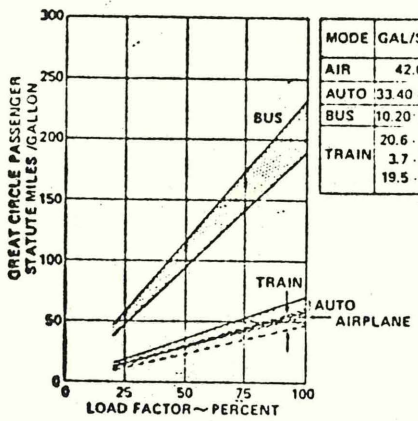
MODE	GAL/SEAT	OEW/SEAT (LB)	FLOOR AREA /SEAT (FT^2)
AIR	4.74 - 7.57	640 - 1039	6.6 - 8.3
AUTO	2.15 - 2.59	750 - 900	5.5 - 6.1
BUS	0.42 - 0.51	630	5.6
TRAIN	0.9 - 1.2	4000	15.2

Figure 17.– Modal Efficiencies Versus Load Factor, Los Angeles–San Diego



MODE	GAL/SEAT	OEW/SEAT (LB)	FLOOR AREA /SEAT (FT^2)
AIR	12.6 - 17.96	636 - 926	7.99 - 8.19
AUTO	8.09 - 9.75	750 - 900	5.5 - 6.1
BUS	2.27 - 2.77	630	5.6
TRAIN	9.3 - 11.2	9400	35.9

Figure 19.– Modal Efficiencies Versus Load Factor, Portland–San Francisco



MODE	GAL/SEAT	OEW/SEAT (LB)	FLOOR AREA /SEAT (FT^2)
AIR	42.05	945	9.36
AUTO	33.40 40.26	750 - 900	5.5 - 6.1
BUS	10.20 12.47	630	5.6
TRAIN	20.6 - 24.7	20 600	77.7
	3.7 - 4.4	8 800	35.5
	19.5 - 23.4	8 200	24.9

Figure 20.– Modal Efficiencies Versus Load Factor, Miami–Los Angeles

The significance of bandwidth for the modes is as follows. The bus upper limit is associated with 6.6 mpg, the lower limit with 5.4 mpg. The train's upper limit is derived using our semi-empirical prediction technique, while the lower limit comes from our fuel usage prelicition plus 20 percent. The 3700-lb and 4500-lb cars define the upper and lower limits of the auto band. The upper and lower limits for airplanes are the best and worst airplanes on that route; also shown is the weighted average based on number of flights and available seats.

The table adjacent to the graph shows that the bus OEW per seat is the lowest for all modes. The train, with 4000 lb/seat, looks heavy but in relity is one of the better trains.

New York-Washington (figure 18) shows autos and the train equally efficient. The train efficiency suffers, in the opinion of the authors, from the fact that the Metroliner has a severe duty cycle; it frequently speeds up to 100 mph and then slows down to 50 or 60 mph due to track limitations or oncoming trains. Both automobiles and airplanes show up better than for Los Angeles-San Diego.

Note the low OEW per seat of the Metroliner; only the Turbotrain (Chicago-St. Louis) with 1700 lb/passeger has a lower OEW for the 10 city pairs studied.

Portland-San Francisco (figure 19) is a typical medium distance city pair, showing autos, train and airplane are close together. The train trip involves riding three separate trains in each direction. Two of the three trains have conventional OEW per seat levles for cross-country trains. One train, the *Floridian, has exceptionally high levels of 20,600 lb per seat.*

6.2 MODAL FUEL UTILIZATION VS RANGE

The city pair data were used to derive generalized trends versus range. This was done by

assuming a 60 percent load factor for the public modes while automobile occupancy was varied as a function of range. For a given city pair and a particular mode, say the train, the circuity used in the calculations was known. The train efficiency for that city pair distance was now adjusted, first by assuming the lowest circuity at the range, then by assuming the highest. Doing this for all city pairs produced ten points through which the upper limit of the train efficiency band was faired and similarly 10 points defining the lower limit of the band. The bus and auto bands were obtained in a similar manner. The airplane band simply was faired through the best and worst points at each range since the ATA allowances and penalties are typical for each range.

Figure 21, so obtained, shows for Spring 1974 that buses are most energy efficient. Trains, automobiles and airplanes have comparable efficiencies except at the shortest distances where some trains tend to be better.

It should be borne in mind that the public modes serve *distinctly different markets* (figure 22). *Buses* are mostly used on *short distances* while trains are mostly used in high density city corridors, which have relatively short distances between cities. *Airplanes*, on the other hand are the predominant public carrier mode at *medium and long distances*, having a national average trip distance of about 700 statute miles in 1972.

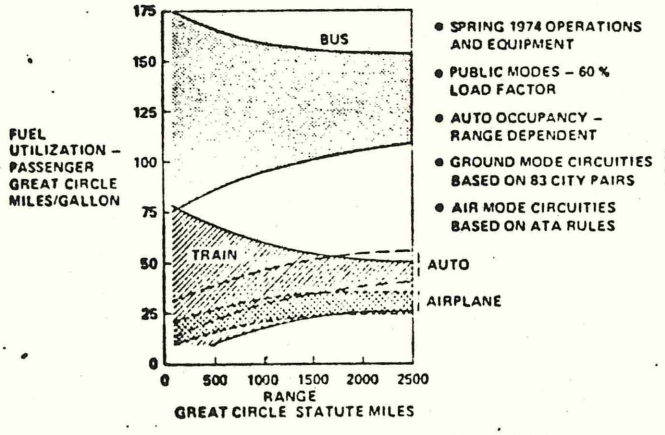


Figure 21.– Boeing Analysis – Modal Fuel Utilization Versus Range

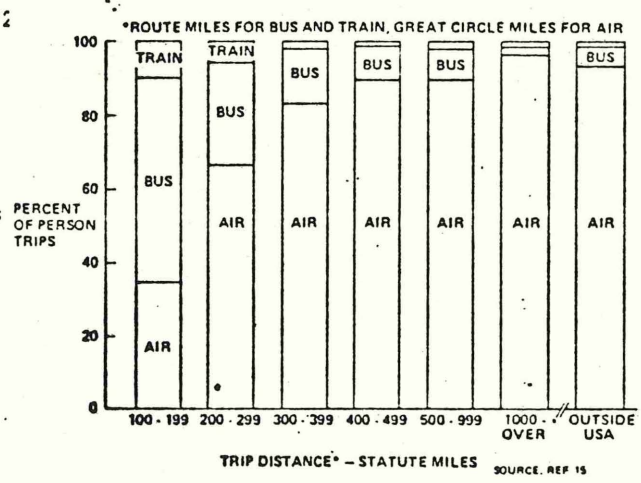


Figure 22.– Percent of Trips by Common Carrier Versus Trip Distance – 1972

One final commentary on trains. It can be agreed that the U.S. passenger trains of Spring 1974 show the results of many years of neglect. Better fuel efficiencies are achieved in other countries than are shown in figure 21. For example, the authors calculated 110 great circle passenger statute miles per gallon for the Japanese Tokaido train at 60% load factor (Tokyo-Osaka, 252 Great Circle Miles, 320 Route Statute Miles). On the other hand, such trains cover,

by U.S. standards, relatively short distances in densely populated areas. Furthermore, they require low-curvature rights of way and roadbed qualities which are not available on current AMTRAK routes. These limitations adversely affect the fuel efficiency realized with advanced technology AMTRAK trains such as the Metroliner and Turbotrain which are included in this study. Nevertheless, foreign train systems show what can be obtained with available technology if the required rights of way and maintenance levels and their associated funding are provided.

7.0 DIFFICULTY OF MAKING FAIR COMPARISONS

The results shown in figure 21 do not conform with many previously published comparisons. This is not surprising since, as far as is known, no other study uses the same ground-rules and analysis methods.

A major difficulty for users and readers of published comparisons is that many authors do not state the bases of the results. Nutter, referring to twelve other energy efficiency comparisons, showed the large differences in the literature.[1] He was unable to resolve the differences, mostly due to lack of precise information on ground-rules, assumptions and methods.

Even if modal efficiency data were calculated to clear and consistent ground-rules, it is incumbent on the reader to consider carefully whether these data are applicable to the problems for which he seeks solution. Unfortunately some papers have been widely quoted, though it should have been clear *that apples and oranges are compared and that the results are inapplicable to the problem at hand.*

Table 3 shows a rearrangement of Nutter's tabulation with passenger miles and seat miles per gallon comparisons grouped together. In addition, we include data from the recently published Project Independence Report.[16] The only objective of showing all these data together is to emphasize that it is incumbent on authors and readers alike to understand the limitations, value and applicability of any particular comparison. Many published analyses will not withstand close scrutiny and cannot be considered as fair comparisons.

Table 3.— Other Published Analyses of Passenger Transportation

Mode	Passenger Miles Per Gallon							Seat Miles Per Gallon				
Automobile Subcompact Average	48	30	30	32	38	32	25	64	100	100	85	91 78
Intercity bus	118	110	104	125	82	125	78	215	300	250	270	
Train Cross country Metroliner Commuter Suburban	36	50	150+	80	46	80 100 200	50	144 75 200 400	210	210		
Airplane Wide bodied jet Average	15	16	14	14	16	22 21	18	40 34	52	52	22	
Investigator and reference	FEA 16	DOT/TSC 17	DOT/OTEP 18	Hurst 19	Hirst 20	NCMP 21	Mooz 22	Rice 14	DOT/OST 23	Fraize 8	Lieb 24	Austen 25

The following subsections specifically identify a number of pitfalls so that future authors and users of data may be forewarned.

7.1 IMPORTANCE OF TIME PERIOD

One important ground-rule is to define for what point in time the data are calculated. In our study, data for Spring 1974 are desired. Therefore equipment actually used in the Spring of 1974 was used in the calculations.

However, no data were available for several factors for Spring 1974. Automobile occupancy is one example. The most recent statistics were for the years 1968 and 1969, and the assumption was made that these statistics were still valid. Similarly, there were no data available for the average number of seats in each of the airplane types flown in Spring 1974. The latest available data were used, even though it was known that the oil embargo had resulted in higher numbers of seats for almost all types of aircraft.

More severe problems are found in a number of published comparisons which base aircraft fuel efficiency on 1972 CAB statistics. The signifcant changes in aircraft operating procedures and the increased load factors make the 1972 statistics invalid for the post-embargo period. Yet 1972 CAB statistics have often been used in comparisons pertaining to future policy matters.

7.2 GROSS NATIONAL STATISTICS

Another problem is the use of gross national statistics. As has been pointed out, trains and airplanes serve distinctly different transportation sectors. Clearly, gross national statistics for these modes do not provide a suitable basis for analysis of any particular route. Particularly dubious are those estimates derived from different sources, e.g. total revenue passenger miles from a government statistic and total fuel consumed from a periodical.

In spite of these deficiencies, published comparisons based on gross *national statistics have received considerable publicity in the recent past.*

7.3 IDEALIZED OPERATIONS

Another pitfall frequently encountered is the use of *idealized data for one mode and actual operational data for another.* Figure 16 shows 3975 gallons measured for the Seattle-Havre, Montana trip. However, the same train traveling the same distance but on a straight and level track at constant speed would have used only 1605 gallons. Adding the several scheduled stops

enroute would increase the "idealized" consumption to approximately 1700 gallons, which is significantly lower than the actual consumption of 3975 gallons. Thus the frequently quoted efficiencies for a start-stop cycle are an invalid approximation for true operations.

This pertains in principle to all modes. Aircraft, for instance, must contend with queuing both in the air and on airports as part of their normal operations. The ATA enroute allowances do account for this apsect.

7.4 UNITS OF COMPARISON

As explained above, passenger great circle miles per gallon are used for comparison in this paper. Other literature uses either seat route miles per gallon or passenger route miles per gallon or equivalents thereof such as BTU's rather than gallons.

The use of available seat miles per gallon leads to high fuel efficiency values since a 100 percent load factor is implied. However, there is evidence that available seat miles per gallon not infrequently have been based on the fuel consumed with an average load factor and the available number of seats: clearly an incorrect procedure.

Where passenger miles per gallon were calcualted, it frequently was overlooked that the CAB reports total fuel used, i.e. for passengers plus freight carried. This number is then combined with total revenue passenger miles to obtain fuel efficiency: again in principle an incorrect procedure. Also, and more importantly, a fuel efficiency in terms of passenger miles per gallon means nothing if the associated load factor and number of available seats are not quoted.

Finally, it should be realized that all these fuel efficiencies are based on the finished product coming out of the refineries such as gallons of kerosene or BTU's of kerosene. A case can be made that it would be interesting for national economic studies to base fuel efficiency on the barrels of crude required to produce the finished product. However, a serious problem lies in the fact that refineries do have some degree of flexibility in their product line breakdown. This flexibility tends to be greater for the newer refineries. The situation is futher complicated by the wide variations in crude characteristics. Therefore, the use of barrels of crude injects significant uncertainties in the calculation of fuel efficiencies.

7.5 CIRCUITY

This subject was discussed in Section 4.0. However, circuities for ground and air modes are

fundamentally not quite comparable. While aircraft can fly direct non-stop routes, highways and railroads were deliberately so laid out that they serve the main populations centers on any route. Thus highway and railroad circuities are, in part, higher by design. This deliberate policy is, however, a disadvantage for the ground mode traveler on longer distance trips.

8.0 CONCLUDING REMARKS AND RECOMMENDATIONS

The authors set out to produce *fair energy efficiency comparisons for the Spring of 1974 for U.S. intercity passenger transportation modes.* The reader must carefully decide whether and to what extent these data are applicable to his problems.

Certainly it would be incorrect to use these data across the board for policy making. Policy making implies a choice between different broad scenarios for the future. This paper does not touch upon the future. All passenger transportation modes can improve their fuel efficiencies, although probably to different extents. No such speculations are made here. *Fuel efficiency will be only one factor among many which will define the form of future passenger transportation systems.*

Finally, the authors recommend that the appropriate government agencies carefully consider the gaps in our current insight of intercity passenger transportation fuel efficiency. A further recommendation is that current methods of collecting statistical data be updated to improve that insight.

9.0 NEW EQUIPMENT FOR AMTRAK

This paper does not seek to address the subject of the improvement potential in the various modes. However, currently incomplete studies of the subject suggest that railroad passenger transportation may have been put in an unfavorable light by selecting Spring 1974 as the time for comparison. In the recent past, AMTRAK has ordered about $250 million worth of rebuilt or new equipment, both locomotives and cars. This includes a number of light weight coaches (50 tons weight) with 84 seats per coach, which is high density seating compared to existing intercity railroad equipment.

These coaches may allow significant fuel efficiency improvements on the short routes where all-coach service would be acceptable. Estimated improvements for all-coach trains are shown in Figure 23. It should be kept in mind that this figure strictly addresses the technical potential. Whether the high density seating will find public acceptance on other than short trips

remains to be seen. Also, many short distance city pairs are serviced by long distance, full-service trains; the potential for improvement of these trains may be less than is shown here.

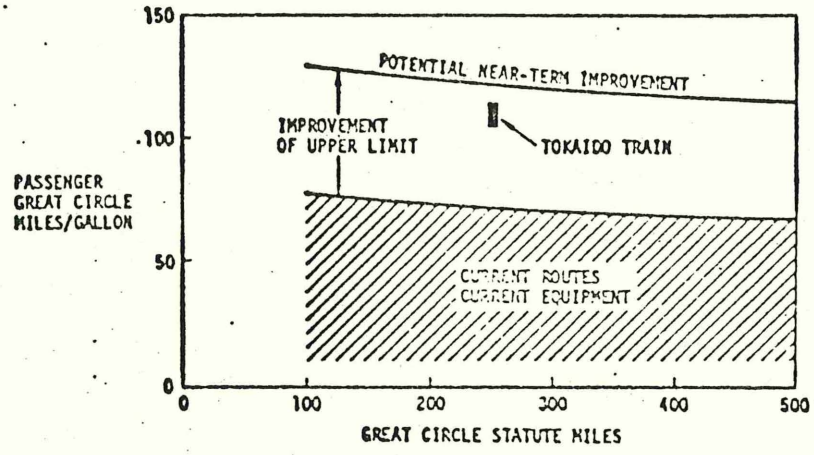


Figure 23.- Potential Near-Term Improvement for Short Distance Trains

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Section VI

A BRIEF ECONOMIC ANALYSIS OF THE AMTRAK ARROWHEAD TRAIN (1977)

After reading the Minnesota Department of Transportation report on the Amtrak "Arrowhead train," several topics suggest discussion from the economic point of view.

Perhaps to list them numerically and explore each in turn is the easiest way to develop the commentary.

1.) Rearranging the data for revenue passengers on a calendar year basis, there has been a substantial increase in "Arrowhead train" usage between the first nine months of 1977 as against the same period in 1976.

Table 1

REVENUE PASSENGERS

Month	1976	1977
January	2,209	1,888
February	1,963	3,407
March	2,271	4,625
April	3,461	5,329
May	2,345	9,566
June	2,278	10,442
July	2,776	9,643
August	3,226	9,914
September	1,954	7,077
TOTAL	22,483	61,891

Note that the monthly pattern for 1976 is rather haphazard with that of 1977 showing the "summer months curve" characteristic of other tourist-travel data for the state. This pattern is characteristic of automobile, airline and expenditure patterns. It appears that during the year 1977 the "Arrowhead train" has shown some maturing as a functional alternate mode of travel. The size of the increase plus the pattern of usage would suggest this. New car capacity and the extension of the line to a Duluth terminal must have been helpful in achieving this.

Another way of showing Amtrak's maturing as a tourist and travel facility is to take the two strongest summer vacation months for three calendar years and compare the onland, commercial, competitive modes of bus and rail.

Table 2

Ticketed Passengers

		Bus	Amtrak	Total
1975	July	19,353	3,885	
	August	20,992	5,665	
		40,345	9,550	49,895
1976	July	17,839	3,321	(Burning Ban)
	August	17,730	3,971	
		35,569	7,292	42,861
1977	July	15,139	10,522	
	August	15,521	10,789	
		30,660	21,311	51,971

Table 3

Amtrak Usage

As Percent of Total

1975	19.1%
1976	17.0%
1977	41.0%

The evidence of Amtrak penetration is highly evident. The slump on total passengers in 1976 is mainly attributable to the "burning ban."

2.) Operating expenses have risen dramatically over the two periods of comparison. It looks like there are rough levels of monthly expense: (a) $68,000, (b) $100,000, and (c) $135,000. See Table 4.

Table 4

Operating Expense

Month	1976	1977
January	$ 68,195	$ 94,907
February	67,899	109,269
March	67,673	108,764
April	68,059	132,733
May	67,847	128,182
June	66,998	130,708
July	96,111	124,973
August	96,217	131,411
September	100,776	149,532

This heavy cost increase becomes more apparent when seen on an accumulative basis:

Table 5

Accumulative Operating Expense

Month	1976	1977
January	$ 68,195	$ 94,907
February	136,094	204,176
March	203,767	312,940
April	271,826	445,673
May	339,673	573,855
June	406,671	704,563
July	502,782	829,536
August	598,999	960,947
September	699,775	1,110,479

The $410,704 increase in accululative operating expenses in the nine months comparison eats up the 39,408 passenger revenue increase during the same period. If the monthly expense during the first nine months of 1977 had been at $68,000, the expense per passenger would have been $9.89 and at $100,000/month, it would have been $14.54. As of September 1977, expense/passenger is $17.94 and as the passenger curve declines to the end of the year, the expense/passenger will increase.

The Department of Transportation report does not explain the heavy increase in expense but unless it is in nonrecurring items for upgrade, it seems inordinate.

3.) Because the pattern exhibited by the usage data suggests tourist-travel connection to be an economic life line for the "Arrowhead train," some increased usage techniques suggest themselves:

1) General promotion and marketing

2) Group activity usage development

3) Seasonal events development

4) Product improvement

5.) Innovative ideas, e.i. state employes usage.

The opinion on Amtrak service given by the seven-day passenger survey shows "Novelty" as the main response for usage. Because this is a disappearing element through time, other reasons for usage must be strengthened. It would seem that the increased usage techniques given above would be helpful in arriving at this end.

4.) The importance of the tourist-travel business to the Duluth economy is reflected in the total dollars receipts in hotel and lodging facilities by quarters (1976).

Table 6

Duluth Hotel Receipts (1976)

Quarter	Dollars
1st	$1,939,000
2nd	2,352,000
3rd	3,309,000
4th	1,983,000
	$9,583,000

Source: Minnesota Department of Revenue

34.5% of the business is in the 3rd Quarter.

The Duluth pattern is not characteristic of other major cities in the state:

Table 7
HOTEL RECEIPTS (1976)
in Thousands
by Quarters for Major Cities

	1st	2nd	3rd	4th
Minneapolis	11,777	11,581	11,691	11,656
Rochester	6,399	5,593	6,154	6,452
Bloomington	4,768	4,715	4,985	5,019
St. Paul	3,502	3,489	3,363	2,883

Source: Minnesota Department of Revenue

The other cities maintain a rather even seasonal distribution.

The main conclusion drawn from the points presented here would be that the "Arrowhead train" during the year 1977 began to become an economic link to the City of Duluth, tied most directly to the tourist-travel industry during the summer months. It should be remembered that an extension of travel activities by seasons will alter the pattern. Skiing would be a good example of this kind of alteration in seasonal pattern and growth development in passenger count.

The rapid growth of operating expense is some cause of alarm if in the main it constitutes fixed costs.

No attempt was made in this review to deal with the subjects of passes and subsidies as they impact on operating costs or intermodel competition because these are matters of policy decision.

Section VII

AMTRAK

"Arrowhead Train"

Minneapolis-St. Paul -- Duluth-Superior

The Rail Passenger Service Act of 1970 authorized the National Railroad Passenger Corporation (Amtrak) to manage the basic national rail network and to be responsible for all intercity passenger train operations. Section 403(b) of the Act provided that states could request from Amtrak intercity passenger service to cities off the basic nationwide system. Originally, legislation called for a 2/3 state subsidization of the 403(b) trains' operating deficit. Amtrak receives federal funding for its share of the deficit. This share was changed to a 1/2 (50%) state - 1/2 (50%) Amtrak distribution in October, 1976 by the Amtrak Improvement Act of 1976 Public Law 94-555.

In 1973, the Minnesota State Legislature appropriated $100,000 to the Minnesota Department of Public Service (Minn. Laws, Chap. 209, Sect. 1 (1973) to contract with Amtrak for rail passenger service between Minneapolis-St. Paul and Duluth pursuant to Section 403(b) of the Rail Passenger Service Act. The bill which called for the initiation of intercity passenger service within the biennium beginning July 1, 1973 was coauthored in the House by Willard Munger, Duluth; Fred Norton, Walter Hanson, St. Paul; Irvin Anderson, International Falls; and Don Samuelson, Brainerd. Senate sponsors included Roger Moe, Ada; Harmon Ogdahl, Minneapolis; and Ralph Doty, Duluth.

The $100,000 proved inadequate to cover the State's share of the expenses for the one-year demonstration service. Upon request from Minnesota and Wisconsin, the Upper Great Lakes Regional Commission granted $200,000 in April of 1975 for the interstate project.

The Minnesota Department of Public Service negotiated a renewal contract for the Arrowhead from April 1, 1976 through January 31, 1977. Appropriations included $300,000 from the Legislative Advisory Committee and $100,000 from the Upper Great Lakes Regional Commission. During this contract period, several changes in billing occurred. Incentive payments paid to Burlington Northern by Amtrak were discontinued in September, 1976, when the BN-Amtrak contract was renegotiated disallowing such incentive payments. In October of 1976, the cost share base was changed by federal legislation from 2/3 (66.67%) to 50% state share.

The Minnesota Department of Transportation was established on November 8, 1976. (Minn. Stat. §174.01 (1976). Responsibility for Amtrak operations transferred from the Public Service Commission to the Department of Transportation (Minn. Stat. §174.05, Sec. 6 (3) (1976).

In a supplementary agreement dated June 20, 1977, Amtrak and Mn/DOT agreed to continue train service from February 1, 1977 to June 30, 1977. The 1977 Legislature allocated $255,000 for the five month extension, and $69,051 to cover past deficits under the 1975-76 and 1976-77 contracts (Minn. Laws, Chap. 087, Sect. 1, Sub. 1 (1977).

The 1977 Legislature appropriated $650,000 for Amtrak for fiscal year 1978. An additional $650,000 is available for fiscal year 1979; however, this amount must be authorized by the Governor of the State of Minnesota before funds can be released for the subsidy. (Minn. Laws 1977, Chap. 454, Sec. 5, Subd. 2(d).

A second supplementary agreement (July 1, 1977) to the contract dated April 1, 1976, as amended June 20, 1977, extended services beyond June 30, 1977, for not more than one year or until a new agreement could be executed. Under the terms of this agreement, for Fiscal Year 1978, the total amount of the State's appropriation is $650,000.

STATE OF MICHIGAN

WILLIAM G. MILLIKEN, GOVERNOR

DEPARTMENT OF STATE HIGHWAYS AND TRANSPORTATION

STATE HIGHWAYS BUILDING, 425 WEST OTTAWA PHONE 517-373-2090
POST OFFICE BOX 30050, LANSING, MICHIGAN 48909

JOHN P. WOODFORD, DIRECTOR

January 5, 1977

National Conference of State Railway Officials
Rail Passenger Committee
403(b) States

Enclosed is a comparison of all Amtrak 403(b) trains for July 1976-June 1977. Please keep in mind that all the trains are not comparable. For example, Philadelphia-Harrisburg and Detroit-Jackson are commuter trains, while Detroit-Buffalo is a long-haul train with full dining and baggage service. However, the figures will make an interesting analysis and we appreciate your cooperation in providing them.

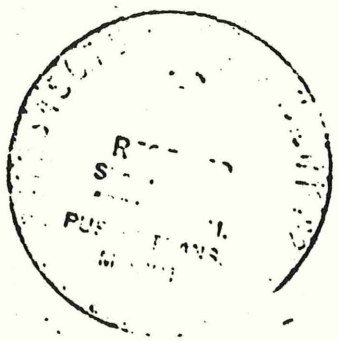
Please let me know any reaction you have and if we should pursue some course of action with Amtrak as a result.

Sincerely,

William Barwis

William L. Barwis, Chairman
Rail Passenger Committee

cc: Cliff Elkins



Section VIII

403(b) Composite (All States)

7/76 - 6/77

		Distribution Percent
Revenue		
Passenger	6,324,074	90.76
Dining & Buffet	577,321	8.29
Other	66,796	0.95
TOTAL REVENUE	6,968,191	100.00
Expense		
RR Costs billed to NRPC (ATSF, Conrail, ICG, GTW, D&H, Burlington)	10,592,489	56.26
RR Incentive	368,258	1.96
Dining & Buffet	743,279	3.95
On-board Service attds.	532,606	2.82
Facilities	4,536,463	24.10
Depreciation	591,252	3.14
Administration	490,886	2.60
Interest	445,062	2.36
Claims Liability	197,458	1.04
Other	332,102	1.77
TOTAL EXPENSE	18,829,853	100.00
Income/(Deficit)	(11,861,667)	
Adjustments	(28,917)	
Net Income/(Deficit)	(11,890,584)	
# of Passengers	847,040	
# of Train Miles	1,630,709	
Deficit/Passengers	$14.04	
Deficit/Train Miles	$ 7.29	

Minnesota 403(b) - 7/76-6/77

Train #'s 760-761

		Distribution Percent
Revenue		
Passenger	373,858	87.67
Dining & Buffet	38,307	8.98
Other	14,300	3.35
TOTAL REVENUE	426,465	100.00
Expense		
RR Costs billed to NRPC		
Burlington	1,000,324	76.79
Burlington Incen.	56,497	4.34
Dining & Buffet	22,985	1.76
On-board Service attds.	52,765	4.05
Facilities	81,568	6.26
Depreciation	57,047	4.38
Administration	1,200	0.55
Interest	--	--
Claims Liability	14,310	1.10
Other	10,000	0.77
TOTAL EXPENSE	1,302,696	100.00
Income/(Deficit)	(876,231)	
Adjustments	--	
Net Income/(Deficit)	(876,231)	
# of Passengers	59,025	
# of Train Miles	106,096	
Deficit/Passengers	14.86	
Deficit/Train Miles	8.26	

Illinois 403(b) 7/76-6/77

Train #'s - (370/372-371/375), (346/348, 347), (300, 305, 308), (380/381)

		Distribution Percent
Revenue		
Passenger	1,906,267	92.36
Dining & Buffet	144,736	7.01
Other	13,145	0.63
TOTAL REVENUE	2,064,148	100.00
Expense		
RR Costs billed to NRPC		
ICG RR, Burlington	3,203,267	51.35
Incentive (Burlington)	174,592	2.80
Dining & Buffet	190,879	3.06
On-board Service attds.	189,074	3.04
Facilities	1,804,441	28.93
Depreciation	241,325	3.86
Administration	174,486	2.80
Interest	202,232	3.25
Claims Liability	56,658	0.91
Other	--	--
TOTAL EXPENSE	6,236,954	100.00
Income/(Deficit)	(4,172,806)	
Adjustments	(59,486)	
Net Income/(Deficit)	(4,232,292)	
# of Passengers	244,426	
# of Train Miles	554,070	
Deficit/Passengers	17.32	
Deficit/Train Miles	7.64	

New York 403(b) 7/76-6/77

Train #'s 68/69, 69/72, 63/64 (not included, see Mich 403(b))

		Distribution Percent
Revenue		
Passenger	1,186,158	88.08
Dining & Buffet	157,853	11.72
Other	2,643	0.20
TOTAL REVENUE	1,346,654	100.00
Expense		
RR Costs billed to NRPC		
Delaware & Hudson, Conrail	2,762,629	71.78
Delaware & Hudson Incentive	51,672	1.34
Dining & Buffet	220,350	5.72
On-board Service attds.	79,631	2.07
Facilities	479,850	12.47
Depreciation	54,242	1.41
Administration	109,072	2.83
Interest	45,021	1.17
Claims Liability	39,539	1.03
Other	7,548	0.20
TOTAL EXPENSE	3,849,554	100.00
Income/(Deficit)	(2,502,901)	
Adjustments	30,569	
Net Income/(Deficit)	(2,472,332)	
# of Passengers	143,716	
# of Train Miles	278,902	
Deficit/Passengers	17.20	
Deficit/Train Miles	8.86	

Michigan 403(b) - 7/76-6/77

Train # 373/374, 364/365, 63/64

		Distribution Percent
Revenue		
Passenger	2,024,373	90.55
Dining & Buffet	175,609	7.86
Other	35,621	1.59
TOTAL REVENUE	2,235,603	100.00
Expense		
RR Costs billed to NRPC		
Conrail, GTW	2,368,948	43,33
GTW Incentive	85,479	1.56
Dining & Buffet	227,150	4.15
On-board Service attds.	190,290	3.48
Facilities	1,794,439	32.83
Depreciation	152,230	2.79
Administration	146,615	2.68
Interest	127,246	2.33
Claims Liability	59,579	1.09
Other	314,554	5.76
TOTAL EXPENSE	5,466,546	100.00
Income/(Deficit)	(3,230,943)	
Adjustments	--	
Net Income/(Deficit)	(3,230,943)	
# of Passengers	203,573	
# of Train Miles	435,452	
Deficit/Passengers	15.82	
Deficit/Train Miles	7.42	

California 403(b) - 7/76-6/77

Train #'s 773/774, 776/779

		Distribution Percent
Revenue		
Passenger	536,237	89.65
Dining & Buffet	60,816	10.17
Other	1,087	.18
TOTAL REVENUE	598,140	100.00
Expense		
RR Costs billed to NRPC AT & SF	1,009,206	60.73
_____	--	--
Dining & Buffet	81,915	4.93
On-board Service attds.	20,846	1.25
Facilities	330,148	19.87
Depreciation	86,408	5.20
Administration	44,697	2.69
Interest	70,563	4.25
Claims Liability	17,954	1.08
Other	--	--
TOTAL EXPENSE	1,661,741	100.00
Income/(Deficit)	(1,063,601)	
Adjustments	--	
Net Income/(Deficit)	(1,063,601)	
# of Passengers	101,300	
# of Train Miles	95,200	
Deficit/Passengers	10.50	
Deficit/Train Miles	11.17	

Pennsylvania 403(b) - 7/76-6/77

Train #'s 627, 610, 605, 621, 623, 624

		Exp. & Rev. Distribution Percent
Revenue		
Passenger	297,181	100.00
Dining & Buffet	--	--
Other	--	--
TOTAL REVENUE	297,181	100.00
Expense		
RR Costs billed to NRPC Conrail/Amtrak	248,115	79.43
	--	--
Dining & Buffet	--	--
On-board Service attds.	--	--
Facilities	46,017	14.73
Depreciation	--	--
Administration	8,816	2.82
Interest	--	--
Claims Liability	9,418	3.02
Other	--	--
TOTAL EXPENSE	312,366	100.00
Income/(Deficit)	(15,185)	
Adjustments	--	
Net Income/(Deficit)	(15,185)	
# of Passengers	94,000	
# of Train Miles	160,989	
Deficit/Passengers	0.16	
Deficit/Train Miles	0.09	

NATIONAL RAILROAD PASSENGER CORPORATION

INTERCITY RAIL PASSENGER ROUTES

VANCOUVER
SEATTLE
Everett
Wenatchee
Ephrata
Ellensburg
Yakima
Pasco
Spokane
Sandpoint
Libby
Whitefish
Belton
Glacier Park
Browning
Cut Bank
Shelby
Havre
Malta
Glasgow
Wolf Point
Williston
Stanley
Minot
Rugby
Devils Lake
Grand Forks
Portland
Pendleton
Paradise
Missoula
Deer Lodge
Butte
Bozeman
Livingston
Billings
Miles City
Forsyth
Glendive
Dickinson
Mandan
Bismarck
Jamestown
Valley City
Fargo
Breckenridge
Morris
Willmar
Detroit Lakes
Staples
St. Cloud
DULUTH
Superior
Sandstone
Cambridge
Minneapolis-St. Paul
Red Wing
Winona
La Crosse
Tomah
Wisconsin Dells
Portage
Columbus
Milwaukee
Sturtevant
CHICAGO
DUBUQUE
Eugene
Klamath Falls
Dunsmuir
Boise
Pocatello
Elko
Ogden
SALT LAKE CITY
Reno
Davis
Sacramento
Martinez
SAN FRANCISCO
OAKLAND
Salinas
Fresno
BAKERSFIELD
LOS ANGELES
SAN DIEGO
Barstow
Flagstaff
Lamy
Albuquerque
Yuma
Phoenix
Tucson
El Paso
Cheyenne
Omaha
Lincoln
Denver
Galesburg
QUINCY
Topeka
KANSAS CITY
La Junta
Dodge City
Newton
Emporia
Wichita
Oklahoma City
Ft. Worth
Dallas
Temple
Del Rio
San Antonio
HOUSTON
NUEVO LAREDO
Laredo
Little Rock
Texarkana
Jefferson City
ST. LOUIS
Springfield
Champaign-Urbana
Effingham
Cairo
Memphis
Jackson
NEW ORLEANS
PORT HURON
Kalamazoo
Battle Creek
DETROIT
Jackson
South Bend
Ft. Wayne
Toledo
Cleveland
Erie
BUFFALO
Rochester
Syracuse
Utica
Albany
MONTREAL
Plattsburgh
Essex Jct.
White River Jct.
Springfield
Hartford
BOSTON
Providence
New Haven
NEW YORK
Philadelphia
Harrisburg
Altoona
Pittsburgh
Lafayette
Muncie
Richmond
Dayton
Columbus
Lima
Canton
Cincinnati
Indianapolis
Louisville
Nashville
Cumberland
Baltimore
WASHINGTON D.C.
Parkersburg
Charleston
Tri-State Sta.
Charlotteville
Richmond
NEWPORT NEWS
NORFOLK
Petersburg
Roanoke
Lynchburg
Greensboro
Raleigh
Charlotte
Hamlet
Greenville
Columbia
Charleston
Savannah
Birmingham
Montgomery
Valdosta
Jacksonville
Wildwood
Orlando
TAMPA
ST. PETERSBURG
West Palm Beach
MIAMI

LEGEND

- Amtrak Passenger Routes
- Through Car Service With Southern Railway
- Trainside Motor Coach Connection
- Route End Point Cities
- Route Identification Points
- 403-B Routes

Note: Due to space limitations, not all Amtrak stations are indicated on the map.

Section IX

Greyhound Lines, Inc.

505 Sixth Avenue North
Minneapolis, Minnesota 55405

February 10, 1978

Mr. James Harrington
Minnesota Department of Transportation
Transportation Building
St. Paul, Minnesota 55155

Dear Mr. Harrington:

We have received a copy of the Minnesota Department of Transportation's January 18 report to the legislature on Amtrak service between the Twin Cities and Duluth. We would like to commend the department for its thoroughness in the preparation of this report.

We were rather pleased to learn from the department that many of the items such as economics and energy conservation which we have been relating publicly, were confirmed by this study. We are most gratified by the conclusions and recommendations made by the department.

We will lend any support we can in the recommendation to discontinue further funding of Amtrak.

Sincerely,

L. R. Hodnik

L. R. Hodnik
District Manager

LRH/cn

cc: J. Denn - Minn. Motor Transport Association

FDM
10

BURLINGTON NORTHERN

NORMAN M. LORENTZSEN
President

176 East Fifth Street
St. Paul, Minnesota 55101

Mr. Frank D. Marzitelli
Assistant Commissioner for
Management Consulting
Minnesota Department of Transportation
Transportation Building
St. Paul, Minnesota 55155

February 6, 1978

Dear Frank:

Please refer to your letter of January 24 attaching the report on the Amtrak passenger operation Twin Cities - Duluth.

I am sorry to be late in responding; however, travel out of the city for a number of days didn't help.

First, I should like to say passenger travel via rail can be as good and better than it ever was if new equipment, well maintained, is provided; and, secondly, the burden of the high cost of track maintenance necessary for a good, high speed passenger operation, is made available to the railroad involved.

There are some other points to consider:

1. Population density;

2. Highway (freeway) availability and the flexibility of personal conveniences involved; and,

FEB 8 1978

3. The economic factors involved with the different travel modes -- rail, air, highway.

The difficulty of realizing economic justification of this operation will not fade away. The present equipment is not going to continue to be operational much longer. Either major overhaul is essential or new equipment required. New equipment involves a long lead time (two-three years). The costs either way will increase substantially over any given period of time. Offsetting increased costs will require either substantially increased fares and increased ridership, plus further subsidization. When one also considers that payments currently by Amtrak for the use of railroad right of way, track, and facilities are less than compensatory, a secondary source of subsidy is being provided by a private corporation for the Amtrak operation.

All of the above comments are general. My personal views are that population density for successful passenger train operation must be equal to or approach the Boston-Washington equivalent; that the full costs of an Amtrak operation cannot be fully recoverable from the current patronizing public in this corridor. The decision on such an operation is primarily a political one and, as such, can and will never be reviewed in a full and objective manner.

Burlington Northern does now, regardless of the above, intend to work closely with Amtrak and others to provide the best possible service that can be done with the existing equipment and facilities. We do continue to seek and want to be made whole for this operation; and, in fact, believe we are entitled to a return on our investment; neither of which is now the case.

Thank you for the opportunity to comment.

Sincerely,

Norman