ANALYSIS OF RAIL COSTS FOR SHIPMENTS OF GRAIN AND GRAIN PRODUCTS TO AND FROM THE NORTH DAKOTA MILL AND ELEVATOR

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UGPTI Staff Paper No. 17
1981

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I. METHODOLOGY

Rail costs have been estimated under two separate assumptions. The first involves the development of revenue-cost ratios for the through movement of grain and grain products from country origin to final destination; the second, the development of revenue-cost ratios for the outbound portion of the movement only.

In costing the through movement, each segment has been analyzed separately. Individual revenues and costs have then been combined to obtain movement statistics.

In costing the outbound carload, the movement of wheat flour has been treated independently of the inbound movement. Revenue statistics, consequently, reflect only the prepaid total as depicted on the waybill which is the balance of the grain product rate from origin to destination times the weight shipped outbound.

Development of Service Units

Service units have been developed for the following items: 1) way train gross ton miles, 2) through train gross ton miles, 3) car miles, 4) carloads originated and terminated, and 5) where applicable, carloads interchanged.

Where interlining occurs, service units have been estimated for each carrier involved in the movement.

Unit Costs

For Burlington Northern and Soo Line portions of an outbound movement, individual carload costs have been applied.

However, in the instance of interlining carriers, regional carload costs have been used, taken from the ICC's applications of Rail Form A to regional groupings of carriers.

Gross Ton Mile Adjustment

For the BN and Soo Line, the raw Rail Form A gross ton mile expense has been adjusted to reflect 1978 train weights and performance factors.

These, in turn, have been derived from the carrier's Train and Yard Service Reports.

Way Train Miles

Route way train miles have been developed for the inbound movement of grain to Grand Forks by using carrier timetables and by routing the movement through the appropriate junctions and division points. For those movements originated on Soo Line trackage way train miles have been developed to Forrest River, or an appropriate junction enroute, with the remainder of the distance to Forrest River comprising through train miles.

Outbound from Forrest River, the distance from interchange junction to Grand Forks has also been treated as way train miles.

Through Train Miles: Inbound

For the remainder of the waybills costed, way train miles have been developed from origin to division point, with the residual classified as through train miles.

In certain instances, Walhalla for example, the total inbound mileage consisted of way train miles. In others, however, such as those carloads originating at Williston bound for Grand Forks, the entire inbound portion of the movement was treated as a through train haul.

Short Line Miles Outbound

For those interstate movements costed, the number of short-line miles between Grand Forks and final destination were obtained from an analysis of 1978 and 1979 carload waybill statistics, which are based on an ICC formula which computes the shortest rail line distance between origin and destination. The movements were then "routed" and the short-line distance between interchange junctions determined in this manner. Distances were then attributed to each carrier based on the short-line miles between junction stations.

Circuity

The short-line miles were then increased by a circuity factor of 20 percent to more closely approximate actual route mileage.

This multiplier is based on an ICC study of railroad operations and represents the average for interline traffic moving in covered hopper cars.

Load Factors and Freight Car Tare Weights

For the outbound portion of a movement, these were taken directly from the waybill. If, as in some instances, the tare weight was not noted on the waybill itself, then an average tare weight for that car type was utilized.

Inbound Carload Cost Factors

The carload *is* the basic unit for the development of rail costs. Thus the entire carload must be costed inbound and costs apportioned to the outbound carload.

For the inbound portion of the movement, however, the gross lading per carload and the tare weight of the freight car cannot be determined directly from the waybill, as only the weight applied outbound is noted in the inbound billing reference. Consequently, average load factors and system tare weights have been used for covered hoppers and boxcars to cost the inbound portion of the movement.

TABLE 1. AVERAGE LOAD FACTORS AND TARE WEIGHTS FOR WHEAT IN RAILROAD-OWNED EQUIPMENT

	Hopper	Box
Tare Weight	30.5	28.0
Load Factor	96.0	64.0

Allocation of Inbound Costs to Outbound Carloads

While the entire carload was costed inbound only a portion of such cost was applied to the outbound portion of the movement. This was determined by the ratio of the weight applied outbound as depicted in the inbound billing reference to the weight of the inbound carload of wheat or durum; which has the effect of attributing inbound and outbound tonnage to the through movement of grain and grain products.

Development of Inbound Revenues

Inbound revenues were developed for the through movement of grain and grain products by applying by the rate paid in to that portion of the inbound tonnage which moved in the outbound carload. This constitutes a factor of the through *wheat* rate from origin to Minneapolis for interstate movements and the same from origin to destination for intrastate movements.

Outbound revenues, as noted earlier, were taken directly from the waybill and reflect adjusted revenues from Grand Forks to final destination.

Inflation of Rail Costs

The revenue figures developed in this manner reflect the rate in effect at the time the movement occurred. Rail costs have been made compatible with these revenue figures by indexing 1977 unit costs to the date of the shipment.

To illustrate, for the inbound movement of wheat to Grand Forks which was originated at Lidgerwood on March 21 (waybill number 516505), rail costs have updated to the first quarter of 1980 by applying charge-out indices for that quarter which produced a multiplier of 1.272. For the outbound movement of wheat flour, however, which occurred in a subsequent quarter (July 19th) rail costs were updated using the ratio calculated specifically for that quarter (1.350).

This has the effect of making rail costs and revenues directly comparable for each portion of the movement and obviates the necessity to adjust revenues backward or forward. Furthermore, it seems preferable to the alternative which would be to place all costs at October 1st levels and develop through revenues on the basis of the through flour rate from origin to destination such as was done by BN.

Costing of Private Line Cars

In those instances where other than railroad-owned equipment was utilized, car ownership costs have been eliminated from the Rail Form A variable cost per carload and actual car-mile rentals have been substituted for Rail Form A averages. This has been accomplished as follows.

For each movement, total variable expenses have been divided by one plus the ratio of car ownership costs, which includes both car-mile and car-day expenses, to total Rail Form A variable expenses, rents, and taxes. (Together, car-day and car-mile expenses constitute approximately 17 percent of total Rail Form A variable costs for the Burlington Northern). Once accomplished, car-mile rentals have then been reassessed by substituting actual mileage payments for those private-line cars which were utilized.

Mileage rentals were developed using the average for all hopper cars comprising the fleet of the North Dakota State Mill. This figure of 21.4 cent represents the total cost per loaded car mile actually incurred by the Burlington Northern in the use of the Mill's private-line cars, with one exception.

The mileage rental has been increased by Rail Form A overheads to account for joint and common expenses attributable to freight car maintenance and depreciation which cannot be allocated to particular categories of freight car equipment.

TABLE 2. DERIVATION OF MILEAGE RENTALS USING RAIL FORM A OVERHEAD		
1.	Average Rental per Loaded Car Mile	21.38223¢
2.	Rail Form A Overhead (B 2268)	1.12206501
3.	Total Mileage Rental: Private Line Cars	23.99225¢

Once developed, the total mileage depicted in Table 2 has been multiplied by the one-way distance, increased by circuity, to determine car-mile costs per trip. This figure has then been added to the outbound variable cost to account for total car costs.

II. SUMMARY OF COST TABLES

Revenue-cost ratios for those waybills which were analyzed are depicted in Tables 3 and 4. As noted prior, these have been developed separately under two sets of assumptions.

The question of which approach is more appropriate and should be given legitimacy is a philosophical one. The Interstate Commerce Commission seems inclined to support the former; that is the costing of the through movement. This is not a final determination, however, as the Commission is unsure at present whether or not to cost internally in this manner.

Irregardless, both possibilities have been costed and the results treated as follows.

Through Versus Outbound Costs

By examining Tables 3 and 4 the effects of using one costing approach as opposed to another becomes readily apparent. In all instances those revenue-cost ratios which were developed on the basis of the through rate from origin to destination are substantially higher than those which were developed for the outbound portion of the movement only.

Nowhere is this more apparent than in the case of the intrastate sample, where the ratios, in some instances, doubled in value.

The major reason for this, of course, is that the outbound revenues are a factor of the through rate and in many instances constitute the lesser proportion of the through revenues.

TABLE 3

THROUGH REVENUE-COST RATIOS

Waybill	Car #	Tare Wgt.	Tons	Car Type	Destination City	Short Line Miles	Revenue	Total Costs	Ratio
507400	BN162141	23.65	44.45	B105	RosePort, MN	314.30	1181.9078	706.87022	1.672
508465	GN71940	27.50	50.25	L451	Mpls., MN	305.0	926.17	520.09009	1.781
508107	BN458763	31.75	53.30	L153	Sioux Falls, SD	384.20	2217.7685	1019.1094	2.176
508119	BN401078	30.50	48.87	L451	Louisville, KY	993.0	2786.1967	1511.8079	1.843
508029	BN453643	31.70	56.60	L153	Huron, SD	369.3	2138.96	1010.2086	2.117
507984	BN400085	28.80	49.75	L451	Long Island, NY	1509.0	3552.92	2338.5889	1.519
516280	BN401418	28.00	50.10	L451	Omaha, NE	599.40	2143.2595	1060.0044	2.022
508508	CBQ87527	29.80	49.85	L451	Lincoln, NE	594.0	2337.915	823.52363	2.839
516505	BN400642	30.50	47.0055	L451	Minot, ND	207.1	660.0361	690.39269	0.956
516421	BN400048	30.50	48.15	L451	Fargo, ND	78.0	578.75	566.34209	1.022
506788	CBQ87430	30.50	46.7995	L451	Minot, ND	207.1	619.9155	686.92305	0.902
506787	BN401075	30.50	47.6325	L451	Fargo, ND	78.0	563.5325	573.06852	0.983
506709	BN400085	30.50	47.6705	L451	Fargo, ND	78.0	629.876	663.37761	0.949
517434	NP75857	30.50	46.55	L451	Fargo, ND	78.0	708.535	803.57362	0.882
506651	BN401010	30.50	47.837	L451	Fargo, ND	78.0	703.9984	839.68007	0.838
506733	BN400831	30.50	47.0075	L451	Minot, ND	207.1	744.68	796.93516	0.934
506678	NP75894	30.50	46.90	L451	Minot, ND	207.1	804.3809	919.95662	0.874
506625	BN400349	30.50	46.6655	L451	Minot, ND	207.1	814.28115	944.84051	0.862
516406	BN400147	30.50	46.99	L451	Minot, ND	207.1	791.247	927.78184	0.853
506621	BN453643	30.50	55.8	L153	Dickinson, ND	376.0	1109.19	1224.0185	0.906

TABLE 3

THROUGH REVENUE-COST RATIOS

Waybill	Car #	Tare Wgt.	Tons	Car Type	Destination City	Short Line Miles	Revenue	Total Costs	Ratio
515874	GACX 48204	30.5	50.02	L451	St. Louis, MO	886.80	2054.1786	1402.4279	1.456
515740	GACX 44478	27.65	50.15	L451	Kansas City, MO	778.40	2520.00	1243.3666	2.027
508025	GACX 400164	35.6	89.8	L453	Louisville, KY	990.0	5541.67	2472.5769	2.241
507976	GACX 44479	27.8	49.8	L451	Buffalo, NY	1078.0	3469.78	1940.2356	1.788
515740	GACX 45514	29.15	50.02	L451	Lebanon, PA	1413.0	3423.3673	2262.4056	1.513
508455	GACX 400163	35.5	91.58	L453	Lebanon, PA	1413.0	6801.6638	3035.6927	2.241
508451	GACX 48205	29.2	50.5	L451	Jersey City, NJ	1494.0	3516.34	2152.7732	1.633
507125	GACX 48114	29.15	48.73	L451	Springfield, MO	936.0	3699.7764	1568.4084	2.359
508522	GACX 400159	35.65	90.30	L453	Springfield, MO	936.0	5691.2101	1856.9018	3.065
508521	GACX 400170	35.55	90.45	L453	Omaha, NE	599.4	3731.7372	1472.105	2.535
508117	BN 410547	30.5	90.0	L453	Champaign, IL	801.0	5843.456	1790.7958	3.263
515794	GACX 48107	29.15	48.84	L451	Champaign, IL	801.0	2169.1408	1191.1421	1.821
508111	BN 410546	35.65	90.15	L453	Jersey City, NJ	1494.0	6843.7424	2351.69	2.910
508358	GACX 400167	35.6	90.0	L453	Long Island City, NY	1509.3	6589.38	2957.8033	2.228
516359	BN449035	30.5	46.87	L153	Dickinson, ND	376.0	921.901	1057.6854	0.872
506573	CBQ 184977	30.5	51.05	L153	Dickinson, ND	376.0	1016.135	1127.3397	0.901
506724	BN449342	30.5	52.45	L153	Dickinson, ND	376.0	944.494	959.85779	0.984
506749	BN481163	30.5	54.24	L353	Dickinson, ND	376.0	915.88	892.17939	1.027
506674	GN171305	30.5	62.55	L154	Grandin, ND	52.0	876.185	949.15838	0.923

TABLE 4

OUTBOUND COSTS ONLY

Waybill	Car #	Origination City	Destination City	Revenue	Variable Costs	Ratio
507400	BN162141	Grand Forks, ND	Roseport, MN	341.85	506.56	0.6748
508465	GN71940	" "	Minneapolis, MN	132.22	349.29525	0.379
508107	BN458763	" "	Sioux Falls, SD	685.03	655.64942	1.045
508119	BN401078	" "	Louisville, KY	1921.18	1298.8155	1.479
508029	BN453643	" "	Huron, SD	910.74	672.04863	1.355
507984	BN400085	" "	Long Island, NY	2687.27	2153.8209	1.248
516280	BN401418	" "	Omaha, NE	815.53	763.99327	1.067
508508	CBQ87527	" "	Lincoln, NE	1256.17	581.21105	2.161
516505	BN400642	" "	Minot, ND	180.58	449.63984	0.402
516421	BN400048	" "	Fargo, ND	87.62	303.7045	0.289
506788	CBQ87430	" "	Minot, ND	198.72	421.98967	0.471
506787	BN401075	" "	Fargo, ND	134.84	303.40709	0.444
506709	BN400085	" "	Fargo, ND	57.83	303.42893	0.191
517434	NP75857	" "	Fargo, ND	89.42	302.78496	0.295
506651	BN401010	" "	Fargo, ND	72.55	303.5246	0.239
506733	BN400831	" "	Minot, ND	180.59	422.26567	0.428
506678	NP75894	" "	Minot, ND	191.80	422.12302	0.454
506625	BN400349	" "	Minot, ND	193.63	421.81186	0.459
516406	BN400147	" "	Minot, ND	166.28	422.24295	0.394
506621	BN453643	" "	Dickinson, ND	367.05	598.55756	0.613

TABLE 4

OUTBOUND COSTS ONLY

Waybill	Car #	Origination City	Destination City	Outbound Revenue	Outbound Variable Costs	Ratio	Tons	Carriers
515874	GACX 48204	Grand Forks, ND	St. Louis, MO	1223.83	1294.3792	0.946	50.02	3
515740	GACX 44478	" "	Kansas City, MO	1476.88	1091.2658	1.353	50.15	2
508025	GACX 400164	" "	Louisville, KY	3530.15	2104.5043	1.677	89.8	4
515740	GACX 45514	" "	Lebanon, PA	2508.16	2064.3636	1.215	50.02	4
508455	GACX 400163	" "	Lebanon, PA	4800.19	2465.992	1.947	91.58	4
508451	GACX 48205	" "	Jersey City, NJ	2743.69	2116.0489	1.297	50.50	2
507125	GACX 48114	" "	Spring Field, MO	2159.94	1263.5255	1.710	48.73	2
508522	GACX 400159	" "	Spring Field, MO	4002.60	1521.9964	2.630	90.30	2
508521	GACX 400170	" "	Omaha, NE	1748.32	1040.0953	1.681	90.45	2
508117	BN410547	" "	Champaign, IL	3215.31	1226.3977	2.622	90.00	2
515794	GACX 48107	" "	Champaign, IL	1421.95	1099.5595	1.293	48.84	2
508111	BN 410546	" "	Jersey City, NJ	4897.89	1852.39	2.644	90.15	2
508358	GACX 400167	" "	Long Island City, NY	4861.38	2534.2821	1.918	90.00	4
516359	BN449035	" "	Dickinson, ND	298.53	580.49911	0.514	46.87	1
506573	CBQ 184977	" "	Dickinson, ND	337.17	587.57966	0.574	51.05	1
506724	BN449342	" "	Dickinson, ND	405.10	590.81525	0.686	52.45	1
506749	BN481163	" "	Dickinson, ND	427.72	594.95219	0.719	54.24	1
506674	GN171305	" "	Grandin, ND	44.27	285.61585	0.155	62.55	1
507976	GACX 44479	" "	Buffalo, NY	2354.26	1645.6194	1.431	49.8	3

Intrastate Ratios

For the most part, those intrastate movements which were costed produced the lowest revenue-cost ratios under either scenario.

There are several reasons why this is so. First of all, the majority of stations costed represent Soo Line origins. Because of the routing associated with these movements, via Forest River in most instances, an unusually high number of way train miles is incurred, ranging as high as 428 on the inbound movement from Fredonia to Grand Forks. Furthermore, where interchange is required on the inbound haul, a cost of nearly $35 must be assessed per car-load, further driving the ratios downward.

Second, the outbound portion of the movement constitutes, in several instances, a relatively short haul in relation to the inbound portion of the movement, as illustrated again by the Fredonia to Fargo movement which involves 428 miles inbound but only 79 outbound. This further has the effect of lowering revenue-cost ratios since the more costly way train operations comprise a substantial portion of total movement costs.

There is another consideration here as well. Because outbound distances are short terminal costs which are fixed for a journey are spread over fewer line-haul miles, which has the effect of creating higher unit costs per mile of output.

To illustrate, both Grand Forks to Fargo and Grand Forks to Lincoln are single line movements for the Burlington Northern. In both instances, the load factor is approximately 49 tons and the equipment railroad-owner hopper cars. Yet, in the case of the former, the variable cost per loaded car mile figures to be $3.89, compared to $0.98 for the latter.

Thus, in general, it would appear that the low revenue-cost ratios intrastate are attributable to: (1) origin-destination pairings, (2) interchange switching, and (3) inbound routing characteristics.

Intrastate Ratios

Like the intrastate ratios mentioned above, interstate ratios follow generally discernible trends. First of all, they are somewhat higher than the intrastate ratios; and secondly, the gap between through and outbound costing is not always so apparent.

This latter effect is due primarily to the relationship of outbound to inbound mileages. As opposed to intrastate patterns, the outbound haul on wheat flour is the dominating factor in this instance. The revenue-cost ratios on the inbound portion are thus of lesser significance.

With regard to the distribution of cost ratios, the statistics breakdown as follows. The larger hoppers have the most favorable ratios. This should be no surprise due to lading capacity and private-line ownership.

Next in order come the Mill's smaller hopper cars. Again, this should come as no surprise, as they have a distinct cost advantage over railroad-owned equipment but yet do not have the lading capacity of the 400,000 series.

While favorable ratios were, in certain instances, recorded in railroad owned hopper cars, these related almost exclusively to the large hopper car. However, on inbound movements in railroad hoppers and boxcars, the ratios, as noted earlier, were generally below one intrastate.

Routing and Operating Characteristics

A further consideration in the distribution of the cost ratios relates to routing of the outbound carload, the frequency of interchange, and the final destination.

Generally speaking, those carloads bound for points south and east, including Springfield, Champaign, Omaha, Lincoln, and Louisville, produced more favorable ratios than did those carloads eastbound at a comparable tonnage. This is attributable to several factors: (1) more direct routing, (2) a lesser frequency of interchange, particularly on BN-Frisco movements, and (3) the absence of Conrail in the costing equation.

As a rule, those movements which were BN direct, BN-Frisco, or BN plus a local delivery produced ratios which were superior to the Minneapolis-Chicago-Conrail routing.