MULTIPLE CAR RAIL COSTS IN NORTH DAKOTA

By

Denver D. Tolliver
Research Associate

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DENVER TOLLIVER
RESEARCH ASSOCIATE

UPPER GREAT PLAINS TRANSPORTATION INSTITUTE
NORTH DAKOTA STATE UNIVERSITY
P. O. BOX 5074
FARGO, NORTH DAKOTA 58105

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SUMMARY

This analysis presents the results of a rail cost study for North Dakota grain. The purpose of the analysis is to describe the relative costs associated with various grain gathering alternatives. To that extent, four different levels of service have been analyzed: (1) 52-car single-origin; (2) 52-car two-origin; (3) 26-car single-origin; and (4) 26-car two-origin.

Tables 1-A and 2-A present estimates of average variable and total cost for wheat moving in covered hopper cars on the Burlington Northern Railroad. A series of stations has been analyzed which represent clusters of branchline and mainline stations situated in different geographic and producing regions of the state. These stations are not intended to represent any kind of statistically-valid sample nor are the results suggested to be representative of the State as a whole. The stations, rather, were chosen on the basis of location and production regions.

It should be further noted, in conjunction with this point, that the costs are not intended to be representative of absolute cost levels for the State or any particular region. The purpose of the analysis, rather, is to show the relative level of costs or the cost relationships between service levels.

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Interpretation of Results

Tables 1-A and 2-A show a relatively consistent relationship between multiple-origin and single-origin options. The differences here, whether 26- or 52-car, are primarily due to differences in switching and train time at origin. The tables also show a relationship between 26- and 52-car consignments (single-origin). The difference is least for mainline stations, particularly eastbound, where it may be five cents per hundred pounds or less. The difference is greatest for branchline stations located relatively far from the regional classification yard, and particularly greatest where hauling against the market to the classification yard occurs (as in the case of shipments from Stanley or Grenora westbound).

Cost differences to the Pacific Northwest, all things being equal, are slightly greater than to eastern markets. This is because part of the efficiencies between 52- and 26-car consignments are related to line-haul or distance-related operations. For this reason, the greater the distance, all things being equal, the difference per hundredweight between the service options will be slightly higher.

TABLE 1-A

COMPARATIVE HUNDREDWEIGHT - COSTS OF TRANSPORTING NORTH DAKOTA WHEAT TO MAJOR DESTINATIONS

(Variable Cost Level)

	26-Car Two-Origin			26-Car Single-Origin			52-Car Two-Origin			52-Car Single-Origin		
City	Minneapolis	Duluth	Pacific Northwest	Minneapolis	Duluth	Pacific Northwest	Minneapolis	Duluth	Pacific Northwest	Minneapolis	Duluth	Pacific Northwest
Arthur	0.33052	0.34930	1.23441	0.31772	0.33651	1.22161	0.27775	0.29657	1.17427	0.26198	0.28080	1.15850
Carrington	0.40990	0.42868	1.23111	0.39562	0.41441	1.21684	0.35212	0.37093	1.16582	0.33635	0.35517	1.15005
Casselton	0.32221	0.34099	1.22610	0.31017	0.32896	1.21406	0.27205	0.29087	1.16857	0.25628	0.27510	1.15280
Devils Lake	0.41693	0.40301	1.12620	0.40664	0.39272	1.11591	-0-	-0-	-0-	0.35723	0.34329	1.05880
Dickinson	0.50769	0.52648	1.04962	0.49740	0.51619	1.03933	0.46391	0.48272	0.99786	0.44814	0.46696	0.98209
Golden Valley	0.52704	0.54583	1.20622	0.50876	0.52754	1.18793	0.45553	0.47435	1.12696	0.43976	0.45858	1.11119
Grenora	0.60821	0.62699	1.19511	0.58458	0.60337	1.17148	0.51829	0.53711	1.09729	0.50252	0.52134	1.08152
Jamestown	0.36606	0.38491	1.18728	0.35577	0.37462	1.17699	-0-	-0-	-0-	0.30627	0.32509	1.11998
Mandan	0.43907	0.45785	1.11824	0.42878	0.44756	1.10795	-0-	-0-	-0-	0.37940	0.39822	1.05083
Minot	0.46149	0.48027	1.04839	0.45120	0.46998	1.03810	0.41763	0.43644	0.99663	0.40186	0.42067	0.98086
Stanley	-0-	-0-	-0-	0.49997	0.51875	1.08687	-0-	-0-	-0-	0.43866	0.45748	1.01766
Starkweather	0.44095	0.42703	1.15022	0.42847	0.41456	1.13774	0.38947	0.37553	1.09104	0.37371	0.35977	1.07528
Watford City	0.61183	0.63062	0.99198	0.59816	0.61694	0.97830	0.55647	0.57529	0.92837	0.54070	0.55952	0.91260
Williston	0.54711	0.56589	0.96277	0.53682	0.55560	0.95247	0.50339	0.52221	0.91086	0.48762	0.50644	0.89509

TABLE 2-A

COMPARATIVE HUNDREDWEIGHT - COSTS OF TRANSPORTING NORTH DAKOTA WHEAT TO MAJOR DESTINATIONS

(Full Cost Level)

	26-Car Two-Origin			26-Car Single-Origin			52-Car Two-Origin			52-Car Single-Origin		
City	Minneapolis	Duluth	Pacific Northwest	Minneapolis	Duluth	Pacific Northwest	Minneapolis	Duluth	Pacific Northwest	Minneapolis	Duluth	Pacific Northwest
Arthur	0.42967	0.45409	1.60473	0.41304	0.43746	1.58810	0.36108	0.38554	1.52655	0.34058	0.36504	1.50605
Carrington	0.53287	0.55729	1.60045	0.51431	0.53873	1.58189	0.45775	0.48221	1.51557	0.43726	0.46171	1.49507
Casselton	0.41887	0.44329	1.59393	0.40322	0.42764	1.57828	0.35367	0.37813	1.51914	0.33317	0.35763	1.49864
Devils Lake	0.54201	0.52392	1.46405	0.52863	0.51054	1.45068	-0-	-0-	-0-	0.46439	0.44627	1.37643
Dickinson	0.66000	0.68442	1.36451	0.64662	0.67104	1.35113	0.60308	0.62754	1.29722	0.58258	0.60704	1.27672
Golden Valley	0.68516	0.70958	1.56808	0.66138	0.68580	1.54431	0.59219	0.61665	1.46504	0.57169	0.59615	1.44454
Grenora	0.79067	0.81509	1.55365	0.75996	0.78438	1.55293	0.67378	0.69824	1.42648	0.65328	0.67774	1.40598
Jamestown	0.47588	0.50039	1.54346	0.46250	0.48701	1.53008	-0-	-0-	-0-	0.39816	0.42262	1.45597
Mandan	0.57079	0.59521	1.45372	0.55741	0.58183	1.44034	-0-	-0-	-0-	0.49323	0.51769	1.36608
Minot	0.59993	0.62435	1.36290	0.58656	0.61098	1.34953	0.54292	0.56737	1.29562	0.52242	0.54688	1.27512
Stanley	-0-	-0-	-0-	0.64996	0.67437	1.41293	-0-	-0-	-0-	0.57026	0.59472	1.32296
Starkweather	0.57323	0.55514	1.49528	0.55702	0.53893	1.47906	0.50632	0.48819	1.41836	0.48582	0.46770	1.39786
Watford City	0.79538	0.81980	1.28957	0.77760	0.80202	1.27179	0.72341	0.74787	1.20688	0.70291	0.72737	1.18638
Williston	0.71124	0.73566	1.25159	0.69787	0.72228	1.23822	0.65441	0.67887	1.18412	0.63391	0.65837	1.16362

Overview of Procedures

The costs presented in Tables 1-A and 2-A have been developed using adjusted Rail Form A costs and service units.* Adjustments have been made to: (1) car hours at origin and destination; (2) car hours running; (3) car hours yard switching; (4) engine minutes at origin-destination; (5) engine minutes, intermediate yards; (6) station clerical expenses; and (7) train weights and locomotive capacity. The manner in which these adjustments have been carried out is documented in greater detail in the accompanying documentation.

I. OVERVIEW OF PROCEDURES

This section of the analysis provides an overview of the procedures used in developing the cost comparisons, as well as an overview of the operating assumptions which underlie certain cost adjustments. The Rail Form A unit costs used are derived from BN-SLSF Rail Form A (1977) which have been used by Burlington Northern in branchline abandonment cases before the ICC. The unit costs, which are not shown (other than for adjustment purposes), are the same contained in File 5-50-1977-BN-SLSF.

This discussion begins with an overview of some of the general service assumptions which have been used in the analysis of multiple-carload service.

*The unit costs reflect a return on road and equipment of 11.7 percent.

General Service Assumptions

The 52-car single-origin has been costed on the basis of train-load service. The consignment has been treated as a single unit, operating between origin and destination as a self-contained train. The 52-car consignment, in other words, is not assumed to be blocked into a larger through train at the classification yard, but is assumed to proceed directly from origin to destination.

The 52-car two-origin consignment has been costed in a similar fashion to the single-origin. One additional switch is necessary in the gathering phase, however, plus the train time is slightly different. But once the second switch has been made, the consignment has been costed on the basis of trainload service from origin to destination.

The 26-car consignment has been costed on the basis of multiple carload service between origin and destination. The consignment has been assumed to travel in a system-average through freight train from the regional classification yard beyond, and to require declassification at the terminating yard.

II. OPERATING AND COST ADJUSTMENTS

In addition to the standard cost adjustments mentioned above, adjustments have been made to: (1) car hours at origin and destination; (2) car hours running; (3) yard switching; and (4) train weights and consist. These, as well as the standard adjustments, are discussed below.

Car Days: Origin and Destination

Car hours loading and unloading at origin or destination have been set equal to the tariff maximum for both levels of service (which is 24 hours from the time of constructive car placement). On-demand service has been assumed in both instances. At origin, for example, the car is spotted on day one. Day two encompasses the 24 hour load cycle; with the unit being pulled on day three. This process is repeated at destination.

Table 1 summarizes the estimation of car days at origin and destination for 26- as opposed to 52-car options. The difference is caused by the fact that the line-haul cycle begins at origin for the 52-car unit, as soon as the consignment is loaded and ready for pick-up by the train set. The block does not have to be pulled back to the yard for blocking as does the 26-car consignment. This is the assumption of trainload service as noted earlier. Nor does the block have to be switched-out at the terminating yard and delivered as does the 26-car unit. The consignment is delivered directly, rather, by the road train crew to the consignee's siding.

TABLE 1

CAR DAYS: ORIGIN AND DESTINATION

	26	**52**
Spotting of Empties	1	1
Loading Cycle	1	1
Pulling of Loads	1	-
Spotting of Loads	1	-
Unloading Cycle	1	1
Pulling of Empties	1	1
Total Origin to Destination	**6**	**4**

Line-Haul Car Days

Line-haul car days consist of three elements: (1) actual running time; (2) time spent in train switching; and (3) intermediate yard time.

Running times for both classes of service have been calculated using the system-average train speed for 1981 (R-1, Schedule 755). Intermediate yard time has not been allocated to the 52-car consignments with the exception of a limited amount of time to account for bad-order switching, locomotive refueling (if necessary), changing of crews and mileage inspection of freight cars. One hour yard time has been allocated for every 200 miles of the movement for such purposes.[1]

The slowing of the train as it passes through intermediate yards, it should be noted, is already accounted for in the system-average train speed, as this figure is an average of running speed under all types of traffic conditions.

Yard time for the 26-car consignment eastbound reflects two yard switches, one at origin and destination, plus a mileage allocation of two hours for every two hundred miles for the through freight.[2] For West Coast movements, one additional yard switch has been allocated for train reconfiguration at Spokane (Yardley Yard), making a total of three complete yard switches plus the additional allocation of time noted above.

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[1]Based on conversations with Burlington Northern operating personnel.

[2]Ibid.

Car Hours Train Switching: 52-Car

The car hours train switching at origin and destination are included in the line-haul time for the 52-car consignments. (For the 26-car consignments, this is included in the car days at origin-destination: Table 1). The time that the consignment spends in train switching is shown in Table 2. These times represent the adjusted RFA switching times for the size of the carload block being switched.

TABLE 2

TRAIN SWITCHING TIME: ORIGIN-DESTINATION

	Origin		Destination		Movement	
	Single-Origin	**Two-Origin**	**Single-Origin**	**Two-Origin**	**Single-Origin**	**Two-Origin**
Number of Loaded-Car Switches	1	2	1	1	2	3
Cars Per Cut	52	26	52	52		
Unadjusted RFA Minutes/Car	10.8947	10.8947	10.8947	10.8947	21.795	21.795
Adjusted RFA/Car	2.736	5.0115	2.736	5.0115	5.447	7.73
Minutes per Consignment	141.63	260.6	141.63	141.63	283.26	402.23
Hours per Consignment	2.3605	4.3334	2.3605	2.3605	4.721	6.7038

Again, it should be noted that the car hours spent spotting the empties at origin and pulling the empties at destination are reflected in Table 1 for the 52-car consignments. The purpose of Table 2 is simply to calculate the loaded train switching times which are not reflected in this total. For the 26-car consignment, train switching times loaded and empty are reflected in the car day totals since the consignment is assumed to be classified and declassified.

Switching Minutes: Origin-Destination

Switching minutes at origin and destination for the loaded freight car have been depicted in Table 2. For total time, spotting and pulling, the switching times have been doubled.

The adjustments to the switching times have been developed using adjustment factors originally developed by ICC staff in Ex Parte 270 Sub. No. 4 and later refined by the Office of Rail Public Counsel (see, 1977 Revenue Burden Study and Increased Rates on Coal, L & N RR, ICC No. 37063). Using Ex Parte 270 adjustments, Rail Public Counsel plotted a linear regression of switching minutes against cutsize. Reading from the slope of the regression line, adjustment factors of 0.46 and 0.25 can be obtained for 26- and 52-car blocks respectively.

Station Clerical Costs

Station clerical costs at origin and destination have been adjusted using standard ICC adjustments as well. The adjustment allocates 25 percent of the system-average cost to the shipment and 75 percent to the carload (again, see 1977 Revenue Burden Study).

III. TRAIN SERVICE ADJUSTMENTS

In addition to the operating and costs adjustments noted above, adjustments to train weights and related operating factors have been developed. These are explained below.

Train Service Characteristics

In the case of the 52-car consignment, trainload service has been assumed. Costs have been developed specifically for this weight and size of consignment, which has different characteristics than either a system-average way train or through train.

For 26-car consignments, adjustments to way train characteristics have been made as well.

Way Train adjustment: 26-Car

The average trailing weight of a (non-unit) system-average BN way train is considerably less than the average trailing weight of the 26-car consignment, as depicted in Table 3. The cost per gross ton mile will thus differ from the system-average (non-unit) way train. However, the system-average way train, including unit train traffic, has a higher trailing weight and additional locomotive capacity (Table 4). This type and consist of a train would more closely approximate way train service for multiple carload traffic. The raw gross ton mile expense has thus been adjusted as shown in Table 5, using these train weights and locomotive statistics.

TABLE 3

CALCULATION OF AVERAGE TRAILING WEIGHTS FOR CONSIGNMENTS (IN TONS)

		26-Car	52-Car
1.	Load per Car*	98	98
2.	Weight of Lading	2,548	5,096
3.	Tare Weight per Car**	30.6	30.6
4.	Tare Weight of Consignment	795.6	1,591.2
5.	Average Trailing Weight	2,069.5	4,139.2
	[Line 2 + (Line 4 * 2)] /2		

* Tariff minimum load factor.

** 1982 average for covered hopper cars.

TABLE 4			
LOCOMOTIVE UNITS AND TRAIN WEIGHTS FOR SYSTEM-AVERAGE TRAFFIC*			
	Way	**Through**	**Average**
Train Weight	2,354.3	5,052.5	4,467.3
Locomotive Units	2.006	3.312	3.029

SOURCE: File-5-50-1977-BN-SLSF-1, 05/05/81.

TABLE 5		
GROSS TON MILE ADJUSTMENT FOR MULTIPLE CARLOAD WAY TRAIN SERVICE*		
1.	Raw gross ton mile expense: B(3261)	$0.00205926
2.	Average trailing weight	2,354.25
3.	Cost per train mile (Line 1 * Line 2)	4.848011
4.	Locomotive unit per train	2.006
5.	Cost per unit mile: B(3262)	1.11070251
6.	Cost per train mile (Line 4 * Line 5)	2.280035
7.	Crew wages per train mile: B(3316)	5.12586212
8.	Other train mile expenses: B(3263)	1.03119469
9.	Total variable cost per train mile (Line 3 + Line 7 + Line 8)	13.2330713
10.	Cost per revenue gross tone mile (Line 9 ÷ Line 2) ÷ B(88)	0.0057791285

SOURCE: File 5-50-1977-BN-SLSF-1 05/05/81

Through Train Adjustment

The through train adjustment is similar to the way train adjustment, in the case of the 26-car consignment. Here, system-average train statistics have been used to develop an adjusted gross ton mile expense for through train shipments.[3]

For the trainload consignments, however, gross ton mile costs have been developed individually for the train-set.

Trainload Service Characteristics

An adjusted gross ton-mile expense has been developed for the grain trainload traffic as follows. First, all crew wages and train-mile expenses have been allocated to the 52-car consignment, as it is the only consignment in the train, and must bear all common train-mile expenses. Next, locomotive unit miles have been allocated to the 52-car consist on the basis of the train weight. The system average through train for the Burlington Northern (non-unit) pulls 4,214 tons with 2.97 locomotive units.[4] The trailing weight of the 52-car wheat consignment is roughly equal to that of the BN through train. Thus, the system-average number of locomotive units should be able to pull the 52-car consignment with some remaining capacity. The locomotive unit miles have been allocated to the specific consignment using the ratio of the trailing weight of the consignment (4,139.2 tons) to the system-average train weight (4,214 tons). This adjustment has the effect of tailoring the system-average locomotive capacity to the specific requirements of the 52-car consignment.

Table 6 shows the development of the 52-car gross ton mile expense.

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[3]The adjusted expense is $0.0041180024 from File 5-50-1977-BN-SLSF-1.

[4]**Source**: File 5-50-1977-BN-SLSF-1.

TABLE 6		
GROSS TON MILE ADJUSTMENT FOR 52-CAR TRAIN		
1.	Train weight (Table 4)	4,139.2
2.	Raw Gross Ton Mile Expense	$0.00205926
3.	Cost Per Train Mile (Line 1 * Line 2)	$8.52368892
4.	Locomotive Units Per Train	2.9699
5.	Cost Per Locomotive Mile	$1.11070251
6.	Cost Per Grain Mile (Line 4 * Line 5)	$3.2986753
7.	Adjustment Ratio	.982249644
8.	Adjusted Cost Per Train Mile (Line 6 * Line 7)	$3.240122639
9.	Crew Wages, Train Mile	$3.87014484
10.	Train Mile, Other	$1.03119469
11.	Total Per Train Mile (Line 3 + Line 8 + Line 9 + Line 10)	16.66515109
12.	Gross Ton Mile Expense/Train Mile (Line 11 ÷ Line 1)/B(88)	0.0041393755

IV. MULTIPLE-ORIGIN OPERATING ADJUSTMENTS

Most of the operating adjustments for the 52-car consignment were noted above. There, it was pointed out that a 52-car multiple-origin consignment differed from the 52-car consignment only in the gathering phase, where one additional switch was necessary; resulting in fewer switching efficiencies and greater train time. Out-of-line routing, in addition, may be necessary in the gathering phase in order to pick up the additional block.

For a station such as Grenora, for example, to pool a consignment with Stanley would require a greater number of train miles in the gathering phase than under a single-origin alternative. Where hauling against the market occurs, this difference could become pronounced.

Because of the distribution of country elevators, distances between feasible stations within a cluster may conceivable be large. To account for this out-of-line routing in the gathering state, therefore, a circuity factor has been applied to the first 100 miles of the journey. After 100 miles, the train should be out of the gathering phase and into the line-haul journey. From this point on, therefore, timetable mileages have been used for the remainder of the distance to the market.

26-Car Multiple Origin

Multiple-origin costs for the 26-car consignment have been developed in a similar fashion to the 26-car single-origin. The difference is that the switching time is higher at origin since two cuts of 13 cars, on the average, are being switched instead of 26. Also, the most direct routing is not assured, so a circuity factor is applied to the way train miles to account for out-of-line routing to pick up the additional station. It should be noted, however, that because the stations are normally blocked along segments or adjacent segments, such out-of-line routing would be minimal.

The same way train characteristics have been assumed as in the case of 26-car single-origin shipment. Billing efficiencies are the same, since the consignment should be on a single bill-of-lading. And, the same through train characteristics have been assumed.

Just as in the case of 52-car consignment, once the 26-car multiple-origin consignment leaves the regional classification yard, it is no different than a 26-car single-origin consignment. It should be treated as one block enroute and one block at destination.

V. SUMMARY

With the adjustments noted above, movement cost for the three service levels have been developed in accordance with traditionally acceptable Rail Form A methods. The adjustments, to summarize, were made to: (1) train weights and locomotive capacity; (2) engine switching minutes at origin and destination; (3) train switching and running time; (4) station clerical costs; (5) yard switching and car time; and (6) car hours at origin and destination.