NON-GRAIN TRAFFIC ANALYSIS OF NORTH DAKOTA BRANCHLINES

By

Denver D. Tolliver
Research Associate

UGPTI Staff Paper No. 45

January 1983

NON-GRAIN TRAFFIC ANALYSIS OF NORTH DAKOTA BRANCHLINES

BY

DENVER D. TOLLIVER
RESEARCH ASSOCIATE

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

JANUARY 1983

SUMMARY

This report summarized activities undertaken pursuant to and in completion of Activity 4 of the FY 1982 contract between the North Dakota Highway Department and the Upper Great Plains Transportation Institute (UGPTI). The purpose of the activity is to develop methods for the measurement of non-grain traffic and to present estimates for the North Dakota branchlines.

Non-grain traffic estimates have been developed for North Dakota line-segments using railroad density charts, in conjunction with UGPTI statistics and the Rail Carload Waybill Sample (RCWS), obtained and maintained annually at the UGPTI. The process, simply stated, is to use the line-density charts in conjunction with UGPTI grain and oilseed statistics to determine the residual of grain traffic on each branchline. This residual, which represents the total of non-grain traffic, may then be used in other analyses concerning branchline viability.

Once the residual or total of the non-grain traffic has been determined, the relative composition of the traffic or the non-grain "mix" may be approximated form RCWS data. Some assumptions may then be made regarding the total traffic mix on the line-segment, and the degree of revenue burden each type of commodity might comprise.

The raw non-grain totals are depicted for select branchlines in Table 1. The table depicts the total number of revenue gross ton miles (cars and contents, excluding caboose and locomotive), the number of grain gross ton miles and the residual. From the number of gross ton miles, service statistics for the various commodities have been developed on the basis of average load factors and train sizes. Table 2 shows the estimated distribution

of non-grain traffic by class of commodity (coal lines have been excluded). These estimates have been derived by fitting the average non-grain composition across each line in the study.

The conclusions: (1) non-grain traffic, while marginal on most branchlines, took on significant propositions on other line-segments, (2) several branchlines are actually coal-dependent as opposed to grain dependent, and (3) fertilizer comprises a relatively large proportion of the non-grain traffic load.

INTRODUCTION

While North Dakota branchlines are normally considered to be grain-dependent, non-grain traffic, in certain instances, may be a significant factor in branchline viability, particularly where marginal lines are concerned. For this reason, methods of estimating non-grain traffic, and proxies of these totals for individual branchlines, are a concern to the Rail Planning Program in North Dakota.

Data Limitations

Line-segment statistics, while maintained internally by railroad firms, are normally considered to be proprietary data, and may not be available to public agencies-prior to the actual time of abandonment. Grain movement statistics are maintained at a detailed level for each line-segment in the state. Non-grain statistics, however, are not normally available and must be obtained by survey. Surveying, however, is frequently time-consuming and costly, and the quality of the respondents' answers may not always be what is desirable. Respondents, for example, may not readily have available traffic totals, or have adequate understanding of rates or traffic statistics. This method, therefore, may not be comprehensively successful.

An alternate to this would be to synthesize non-grain traffic totals from existing data sources. Once non-grain traffic totals have been synthesized, the traffic composition and characteristics of the movements may be derived from supplementary sources; the Rail Carload Waybill Sample (RCWS) primarily.

Data Sources and Flow

The data sources used, as noted earlier, consists of: (1) railroad line-segment density charts, (2) UGPTI grain and oilseed movement statistics, and (3) the RCWS. The density

charts show the total number of gross ton miles per mile originating and terminating on each line-segment in the carriers' system. UGPTI statistics, in conjunction with station-to-station mileages on the line-segment, allow the calculation of the grain gross ton miles per mile. The RCWS provides a statewide estimate of the traffic mix and movement characteristics of the non-grain traffic, which in turn may be used to derive the total for each line-segment.

The relationship between the various data sources, as well as their interactions are summarized in Figure 1. These various steps are discussed in greater detail below.

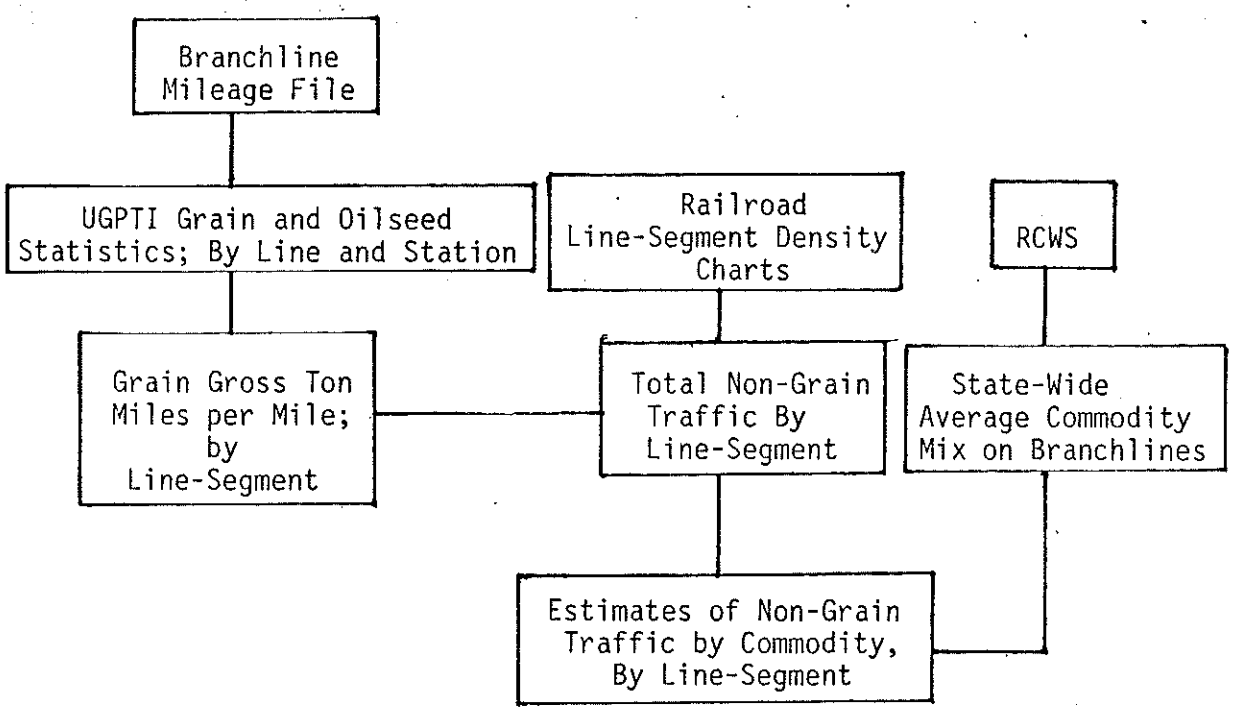

Figure 1. Data Sources and Linkages in Non-Grain Traffic Analysis.

Development of Revenue Traffic Totals

The railroad density charts mentioned above contain line-segment totals for each branchline in the State. These totals, expressed as gross ton miles per mile, include locomotive and caboose-related gross ton miles (GTM) as well as the gross ton miles of cars and contents. This latter figure is the desired one as it is the basic figure necessary for both costing and revenue analysis.

The number of locomotive and caboose related gross ton miles can be estimated on any branchline by using average way train statistics. These statistics, depicted in Table 3, give the number of trains on each line-segment during a year as the quotient of the total average train weight, including locomotives and caboose, and the total gross ton miles on the line-segment. Once this determination is made, the number of trains per year can be used to determine the portion of the gross ton miles attributable to the locomotive and caboose units. Once the non-traffic GTM have been determined, the remainder may be posited as traffic gross ton miles, grain and non-grain together.

Calculation of Grain Gross Ton Miles

Grain gross ton miles on each branchline are calculated from UGPTI movement data and branchline mileage tables in the manner depicted in Figure 1. The grain gross ton miles consist of two separate elements; the net ton miles of the lading and the tare ton miles of the freight cars. The series of calculations necessary to produce these statistics for individual stations is depicted in Table 3.

TABLE 2. DEVELOPMENT OF TRAFFIC-RELATED GROSS TON MILES PER MILE ON LINE-SEGMENTS.	
ITEM	**SOURCE**
1. Raw Gross Ton Miles Per Mile	Railroad Density Chart
2. Average Weight of Way Train (caboose, cars, and contents)	Schedule 755, R-1
3. Average Weight of Caboose	UMLER File
4. Average Weight of Train, Cars, and Contents	Line 2 - Line 3
5. Average Locomotive Units per Way Train	Schedule 755, R-1
6. Weight of Average Locomotive Unit	Schedule 755, R-1
7. Average Locomotive Weight Per Train	Line 5 * Line 6
8. Total Train Weight, Including Locomotive and Caboose	Line 2 + Line 7
9. Trains per Year	Line 1 ÷ Line 8
10. Annual Locomotive GTM	Line 7 * Line 9
11. Annual Caboose GTM	Line 9 * Line 3
12. Traffic Gross Ton Miles per Mile	Line 1 – (Line 10 + Line 11)

TABLE 3. CALCULATION OF GRAIN GROSS TON PER MILE ON BRANCHLINE SEGMENTS.	
ITEM	**SOURCE**
1. Tons Consigned, by Station	UGPTI Movement Statistics
2. Mile from Station to Mainline Junction	Mileage Files, UGPTI
3. Net Ton Miles of Lading	Line 1 * Line 2
4. Covered Hopper Cars Consigned	UGPTI
5. Boxcars Consigned	UGPTI
6. Tare Weight, Boxcars	UMLER File, AAR
7. Tare Weight, Covered Hopper	UMLER File, AAR
8. Tare Ton Miles, Boxcar	(Line 5 * Line 6 * Line 2) * 2
9. Tare Ton Miles, Covered Hopper	(Line 7 * Line 4 * Line 2) * 2
10. Total Tare Ton Miles	Line 8 + Line 9
11. Total Gross Ton Miles	Line 3 + Line 10

Once the individual station totals have been developed for all stations along a line-segment, the totals are then summed for that line, and divided by the branchline mileage, to yield the average number of grain gross ton miles per mile of road.

Once the average number of grain gross ton miles per mile has been derived, the total number of non-grain gross ton miles may be determined by subtracting the total of the grain traffic, as calculated in Table 4, from the revenue traffic total depicted in Table 3, Line 12. This new total represents the aggregate of non-grain traffic (cars and contents) on each segment. The next step is to disaggregate this total into commodity classes.

Statewide Distribution of Non-Grain Traffic

The statewide distribution of non-grain traffic has been determined specifically for North Dakota branchlines using the RCWS. The sample maintained by UGPTI assigns each sample movement originating or terminating within the State to its associated line-segment. From here, branchline origins and terminations may be separated from mainline traffic. Once this delineation has been made, the average characteristics of branchline traffic may be determined.

An additional distinction has been made, however, between coal and non-coal branchlines. The unsegregated data are shown in Table 5. Here it is obvious that coal shipments skew the line considerably. The second set of statistics shown in Table 6, therefore, were developed excluding coal branchlines. The difference is substantial. Once coal has been eliminated, movements of fertilizer tend to dominate branchline traffic. Intuitively, this appears logical as "a priori" reasoning felt that the traffic mix was dominated by fertilizer. These estimates of distribution, therefore, have been used to fit the data across the branchlines as shown in Table 8.

SUMMARY

This cluster of activities has produced two things: (1) a set of procedures which can be utilized to derive estimates on non-gross traffic totals on North Dakota branchlines, now and in the future, and (2) 1980-81 crop year estimates of non-grain traffic and traffic composition totals. While these procedures provide a foundation for line planning analysis, further refinement in certain of its procedures would be desirable. A statistically-valid fitting procedure such as Iterative Proportionate Fitting would tend to lead to more robust estimates of individual line-segment totals.