Analysis of Surface Transportation Board Waybill Data for Freight Planning and Operations

MID-AMERICA FREIGHT COALITION

Authors

Anupam Srivastava
University of Wisconsin–Madison

Ernest Perry Co-Principal Investigator
University of Wisconsin–Madison

Soyoung Ahn Co-Principal Investigator
University of Wisconsin–Madison

About the Mid-America Freight Coalition (MAFC)

The industries and farms of the Mid-America region can compete in the marketplace only if their products can move reliably, safely and at reasonable cost to market.

State Departments of Transportation play an important role in providing the infrastructure that facilitates movement of the growing amount of freight. The Mid-America Freight Coalition was created to support the ten states of the Mid America Association of State Transportation Officials (MAASTO) region in their freight planning, freight research needs and in support of regional multi-state collaboration.

www.midamericafreight.org

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There is an extensive range of available data for multimodal freight planning and operations decision-making. Even so, the freight data available is often inadequate for timely and precise analysis on modal freight movements due to numerous shortcomings in data sources, including sample size concerns, aggregation of information, precision and accuracy, timeliness, ownership and accessibility, and the alignment and scope of data for the needed analysis.

The objective of this study is to review the STB rail waybill data, analyze it, and examine the adequacy of the data for state planning and operations decision-making. The study starts with a review of the waybill data, focusing on aspects including accessibility, composition, quality, and usability of the data. The study also compares the waybill data against alternate databases, specifically the Association of American Railroads (AAR) rail data, to weigh the waybill data's strengths and shortcomings and suggest where alternate sources should supplement the waybill data depending on analytical needs.

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1. INTRODUCTION

There is an extensive range of available data for multimodal freight planning and operations decision-making. All freight modes have representative data to gauge the level of activity, value, demand, and inferred infrastructure needs. Even so, available freight data is often inadequate for timely and precise analysis on modal freight movements due to numerous shortcomings in data sources, including sample size concerns, aggregation of information, precision and accuracy, timeliness, ownership and accessibility, and the alignment and scope of data for the needed analysis.

The Federal Highway Administration (FHWA) and Bureau of Transportation Statistics (BTS) have developed the comprehensive, multimodal Freight Analysis Framework (FAF) to address freight data needs. The Surface Transportation Board (STB), the American Association of Railroads (AAR), American Trucking Institute (ATI), US Army Corps of Engineers, the Commerce Department, and many other entities have also developed freight databases to support industry and policy analysis. However, none of the databases can singularly offer comprehensive and timely data required for detailed analysis of freight movements and infrastructure needs. Policy makers and state Departments of Transportation (DOTs) often supplement this data with customized local surveys of freight users to better identify trends, needs, opportunities, and constraints to efficiency and industry growth. It is important to note that Class I freight railroads have not historically shared data with public agencies. This has presented challenges to the procurement of accurate and detailed freight rail data.

Project Objective

The objective of this study is to review the STB rail waybill data, analyze it, and examine the adequacy of the data for state freight rail planning and operations decision-making. The study starts with a review of the waybill data, focusing on aspects including accessibility, composition, quality and usability of the data. The study also compares the waybill data against alternate databases, specifically the Association of American Railroads (AAR) rail data, to determine the waybill data's strengths and shortcomings, and suggest where alternate sources should supplement the waybill data depending on analytical needs. Given the user demand for timely and detailed freight rail data, the ease of procurement and use are examined. Additionally, potential deficiencies are examined considering the information needed for freight and rail planning.

This study intends to provide State DOT's with a better understanding of rail freight data and freight data in general. In doing so, State DOT's can make more informed planning and operational decisions, fully supporting the logistics systems that move the economy (see MAFC 20 – Freight Data Inventory and Training [1] for a general overview of freight data available for all modes).

Scope of Work

This report reviews the STB waybill data analyzing the following traits:

- **Data acquisition**: Review of the data acquisition process and cost for obtaining waybill data from STB.

- **Analysis of waybill data**: Analysis of the waybill database in terms of sample size and coverage, commodities addressed, completeness, timeliness, ease of use, availability, and adequacy for a range of planning and operation's needs.
- **Alternative data sets**: Analysis of alternative data sets that may be used to supplement the waybill data or be used in lieu of waybill data depending on analysis needs.
- **Usefulness of waybill data**: Review of the strengths and weaknesses of the waybill data. Identifying potential challenges in using the waybill data for analysis of rail freight movements, value of freight, and infrastructure needs. Discussion of issues related to privately generated versus public freight data. Discussion of issues related to sample size.

Organization of the Report

The main body of the report is organized as follows:

- Chapter 2 presents a review of the Surface Transportation Board's (STB) rail waybill data.
- Chapter 3 reviews rail data available through AAR.
- Chapter 4 presents an assessment of the STB waybill data as it compares to alternate databases.
- Chapter 5 presents an evaluation of the usability of the waybill data for State DOT needs using state freight plans as case studies and some concluding remarks.

2. THE SURFACE TRANSPORTATION BOARD WAYBILL SAMPLE

Introduction

The STB Confidential Carload Waybill Sample (CCWS) is a stratified sample of carload waybills for all US rail traffic submitted by rail carriers terminating 4,500 or more revenue carloads annually. The CCWS is generated every year with the latest available dataset, typically available roughly one year after the end of the period (2018 CCWS being the latest available in 2020 when this report was created). The Waybill Sample typically represents roughly 1% - 3% of all the freight traffic moved by rail carriers.

A total of 670,496 waybills were collected and processed for inclusion in the 2017 CCWS[1]. The CCWS represents an estimate of a collective 35,608,278 carloads of freight weighing over 2 billion tons and with a total revenue estimate of $87,419,662,575.

The Waybill Sample has been used for various purposes, ranging from judicial and regulatory evidence to administration, market research, modeling freight flows for the industry, and to analyze freight flows and prepare freight plans at the state and regional levels ([2], [3], [4], [5], [6]).

Creation of the Waybill Sample

STB collects data from US railroads under the requirement that all US railroads that terminate more than 4,500 revenue generating carloads annually, must submit a yearly sample of terminated waybills. The waybills are sampled under two different plans: the “MRI” plan, and the “Ex Parte 385” plan. The MRI (Machine-Readable-Input) plan for data delivered electronically stratifies sampled waybills into five different levels of sampling frequency depending on the number of carloads on the waybill, with waybills representing a larger number of carloads requiring higher sampling frequency (see Table 1). The “Ex Parte 385” plan allows manual sampling of waybills and is typically used by smaller railroads. This plan stratifies the waybills into three different sampling frequencies.

Railroads are permitted to “mask” contract revenue (considered highly sensitive) with a calculated or factored revenue figure, and thus the waybill figures may not represent actual revenue. Although a railroad could report a tariff value in place of the contract rate, accurate estimation of the actual contract rate is still required to be reported to the STB for internal use (provided through a relationship between reported tariff rate and actual contract rate at the three-digit Standard Transportation Commodity Code (STCC) level). These calculated revenues at the three-digit STCC level are indicated using the ‘Contract Rate Flag’ field in the waybill sample record. A flag set to 0 indicates that the rate is not specifically a contract rate, and a value of 1 means that the freight revenue is a calculated figure derived either from existing tariffs or from appropriate values.

[1] The 2017 CCWS was the most recent waybill sample available at the time when this project was initiated. The data acquired from STB for the project was thus from the 2017 CCWS. Therefore, all statistics and references mentioned in this report are from the 2017 CCWS. However, the 2018 CCWS has since become the most recent available waybill sample as of the creation of this document.

Table 1: Waybill stratum and corresponding sampling frequencies

	Stratum	Carloads per Waybill	Sampling Rate
1	MRI – 1	1-2	1 of 40 (2.5%)
2	MRI – 2	3-15	1 of 12 (8.33%)
3	MRI – 3	16-60	1 of 4 (25%)
4	MRI – 4	61-100	1 of 3 (33.33%)
5	MRI – 5	Over 100	1 of 2 (50%)
6	Hardcopy (Ex Parte 385) – 1	1-5	1 of 100 (1%)
7	Hardcopy (Ex Parte 385) – 2	6-25	1 of 10 (10%)
8	Hardcopy (Ex Parte 385) – 3	26 or more	1 of 5 (20%) / 1 of 6 (16.67%)

Acquisition of Waybill Sample

STB offers rail freight data in two forms: the CCWS, the most complete dataset available to users; and the Public Use Waybill Sample (PUWS), a free access subset of the CCWS. Both sets are available through STB. The PUWS can be downloaded directly from STB's website. The CCWS can only be acquired by submitting a formal application to STB with a letter of intended use, and list of all personnel requiring access to the data.

Confidential Carload Waybill Sample

The CCWS data can only be acquired through a formal application process, and is accessible to users that qualify under one of the following categories: 1. Railroads, 2. Federal agencies, 3. States, 4. Transportation practitioners, consulting firms, and law firms in specific proceedings working on projects commissioned by STB, and 5. Other users. The specific requirements for requesting access to the dataset varies depending on the type of user, as is the level of scrutiny involved in the application process, and the quality of data released (with respect to sensitivity of data), though all users are required to execute confidentiality agreements before receiving the data. The complete set of rules for release of the CCWS are codified under 49 C.F.R. 1244.9.

1. **Railroads**: Each requesting railroad may obtain any waybill record covering traffic that originated, terminated, or was bridged by that railroad.
2. **Federal Agencies**: Each requesting federal agency may obtain any waybill record subject to requirements that the agency shall make the information available only to its employees or those contractors working on the study that requires the waybill. The agency will ensure that railroads and shippers are provided same privilege and protection against disclosure of data as provided by STB. The agency shall not release data to the public that does not follow the 3-FSAC (Freight Station Accounting Code) rule. The agency must sign agreement to terms annually with STB.

3. **States**: Each requesting State may obtain any waybill record pertaining to traffic that was originated, terminated, interchanged in, or that passed through its State subject to the same requirements imposed on federal agencies above.
4. **Transportation Practitioners, Consulting Firms, Law Firms commissioned by STB**: Transportation practitioners, consulting firms and law firms commissioned by STB to work on an STB project may use data from the STB CCWS in preparing verified statements to be submitted in formal proceedings before the STB and/or State Boards (Board), with limitations similar to those imposed on the previous classes of users.
5. **Other users**: Users that do not qualify for any of the above categories, may file a formal request for data access to the STB stating the purpose of the requirement. Any requests filed under the category are published in the Federal Register and are subject to a notice and protest procedure where Railroads and shippers are able to file objections to be reviewed by the STB board. Access to the data is only granted if the STB board determines whether the request shall be accepted after reviewing any objections filed with the board.

Waybill data acquired for this study was requested under the 'other users' category. The formal request to obtain the data pertaining to the ten Mid America Association of State Transportation Officials (MAASTO) states, was filed with STB with clearance from all ten states. The request was reviewed by the STB board and posted on the Federal Register with a 14-day period for interested parties to file a comment of objection on. No objections were reported, and the data was processed and supplied in electronic format to the researchers for a cost of $450 (plus additional $58 per user) and required signatures from all users acknowledging confidentiality in the use of the waybill data.

An important aspect to note with regard to how States may use the Waybill Sample, is that any data or analysis of data released to the public (including those through reports such as the State Freight Plans), be subject to the 3-FSAC rule (further explained in chapter 4). This rule requires that there be at least three different freight stations (FSACs) on one railroad, or at least two more FSAC's than there are railroads present in the waybill data being aggregated.

Public Use Waybill Sample

The Public Use Waybill Sample (PUWS) is a non-proprietary abridged version of the STB CCWS. The PUWS is available for download to the public from the STB website and does not require a formal authorization process from STB.

The PUWS is created from the CCWS by obfuscating sensitive information with respect to economic competitiveness for railroads. Some of the key differences between the CCWS and the PUWS are listed below:

- The PUWS eliminates precise station and carrier information and instead reports origins and termini by their Business Economic Areas (BEAs), and junction points by state or province.
- Commodities (except munitions data) are identified at the 5-digit STCC level (coarser categorization) instead of the 7-digit codes (finer detailed categorization) used for the full CCWS.
- Due to the sensitive nature of munitions data, they are only reported at the 2-digit STCC level (STCC 19) and no geographic coding is included for such records.

- Movements only for commodities that were handled by at least three freight stations in the US are included in the PUWS. Any 5-digit commodity that was not handled by at least three Freight Station Accounting Codes (FSACs) nationwide, is removed from the PUWS. This means that rare commodities that are specific to very few FSACs in the country are not included in the data, to protect economically sensitive railroad data.
- Use of BEAs in the PUWS is subject to the "three-FSACs rule". A BEA is only reported if there is activity for at least three FSACs on one railroad for a given commodity within that BEA, or if there are at least two more FSACs with activity than there are railroads in that BEA for a given commodity. This guarantees that carrier information cannot be deciphered from the BEAs. Records that do not pass the three FSAC rule are included, but without any geographical coding.
- Intermediate junction data is shown only when the originating and terminating BEAs pass the above three FSAC rule.

The PUWS is available in a 247-Byte record layout format (for the 2017 PUWS) with 62 data fields per record compared to the 192 fields in the full CCWS. The 2017 PUWS contains a total of 670,047 records whereas the full 2017 CCWS is created from 670,496 records. It is estimated that the PUWS has full geographic data for roughly only 45-50% of the records.

Data format and details

The waybill (CCWS and PUWS) data is prepared and shared with users as a single file in a 900-Byte record layout (247-Byte in case of the public use sample) where each byte is a numeric or alphanumeric entry. Each record, representing a single waybill, is made up of 192 (62) data fields with varying length. The metadata for the record layout can be found in the corresponding year's STB Waybill Reference Guide (available through STB's website) including small descriptions for each field in the data. Figure 2-1 and Figure 2-2 show the 2017 CCWS record layout and Figure 2-3 shows the 2017 PUWS record layout for each waybill entry.

The CCWS record layout consists of important waybill tracking information such as the waybill number, date, number of carloads, and Commodity Code (STCC) in the first 12 fields. This is followed by information on type of movement (interstate, transit, intermodal, movement via water, etc.) in fields 18-28, along with stratum related information in fields 26, 53 and 54. The stratum information determines the multiplying factor (field 88) applied to weight / revenue values to adjust from sampled data to full population.

The origin, destination and routing information are split across several fields in the CCWS. Fields 31-33, 74 and 77 store the reporting railway, and waybill origin information (FSAC, railroad, Standard Point Location Code (SPLC), railroad alpha respectively). Fields 51, 52, 75 and 86 show the terminal information (FSAC, railroad, SPLC, and railroad alpha respectively). The routing information is stored within fields 34-50 (showing the interchange stations) and 78-85 (showing the bridge railroad routed through). Field 156 that spans 52 bits (one each for: the 48 continental / contiguous US state, DC, Canada, Mexico, and an 'All Other' category) is a flag set for any state that the waybill is routed through. Fields 56-73, 90, and 93-94 store information on car and equipment used (physical dimensions and mechanical features). Weight and Revenue information for the waybill are provided in fields 13-17, with fields 98-102 reporting the adjusted numbers for the full population.

The Waybill Reference Guide [7] below provides full descriptive information for each field individually.

Field	Data Description	No of pos	Form	Columns
1	Unique Serial Number	6	N	1-6
2	Waybill Number	6	N	7-12
3	Waybill Date (mmddccyy)	8	N	13-20
4	Accounting Period (mmccyy)	6	N	21-26
5	Number of Carloads	4	N	27-30
6	Car Initial	4	A	31-34
7	Car Number	6	N	35-40
8	Intermodal TOFC/COFC Service Code	3	A/N	41-43
9	Number of TOFC/COFCs	4	N	44-47
10	TOFC/COFC Initial	4	A	48-51
11	TOFC/COFC Number	6	N	52-57
12	Commodity Code (STCC)	7	N	58-64
13	Billed Weight	9	N	65-73
14	Actual Weight	9	N	74-82
15	Freight Revenue	9	N	83-91
16	Transit Charges	9	N	92-100
17	Miscellaneous Charges	9	N	101-109
18	Inter/Intra State Code	1	N	110
19	Transit Code	1	N	111
20	All Rail/Intermodal Code	1	N	112
21	Type Move (import/export)	1	N	113
22	Type Move Via Water	1	N	114
23	Substituted Truck for Rail	1	N	115
24	Shortline Miles	4	N	116-119
25	Rebill Code	1	N	120
26	Stratum Identification	1	N	121
27	Subsample Code	1	N	122
28	Intermodal Equipment Flag	1	N	123
29	Calculated Rate Flag	1	N	124
30	Waybill Identifier (MRI only)	25	A/N	125-149
31	Reporting Railroad	3	N	150-152
32	Origin FSAC	5	N	153-157
33	Origin Railroad	3	N	158-160
34	Interchange #1 Rule 260	5	A	161-165
35	First Bridge RR	3	N	166-168
36	Interchange #2 Rule 260	5	A	169-173
37	Second Bridge RR	3	N	174-176
38	Interchange #3 Rule 260	5	A	177-181
39	Third Bridge RR	3	N	182-184
40	Interchange #4 Rule 260	5	A	185-189
41	Fourth Bridge RR	3	N	190-192
42	Interchange #5 Rule 260	5	A	193-197
43	Fifth Bridge RR	3	N	198-200
44	Interchange #6 Rule 260	5	A	201-205
45	Sixth Bridge RR	3	N	206-208
46	Interchange #7 Rule 260	5	A	209-213
51	Termination Railroad	3	N	214-216
52	Termination FSAC	5	N	217-221
53	Population Count	8	N	222-229

Field	Data Description	No of pos	Form	Columns
54	Stratum Count	6	N	230-235
55	Reporting Period Length	1	N	236
56	Car Ownerâ€™s Mark	4	A	237-240
57	Car Lesseeâ€™s Mark	4	A	241-244
58	Car Capacity	5	N	245-249
59	Nominal Car Capacity - Expired	3	N	250-252
60	Tare Weight of Car	4	N	253-256
61	Outside Length	5	N	257-261
62	Outside Width	4	N	262-265
63	Outside Height	4	N	266-269
64	Extreme Outside Height	4	N	270-273
65	Type of Wheel Bearings and Brakes	1	A	274
66	Number of Axles	1	A/N	275
67	Draft Gear	2	N	276-277
68	Number of Articulated Units	1	N	278
69	Pool Code Number	7	N	279-285
70	AAR Equipment Type Code	4	A/N	286-289
71	Mechanical Designation Code	4	A	290-293
72	Licensing State (TOFC)	2	A	294-295
73	Maximum Weight on Rail	3	N	296-298
74	Origin SPLC	6	N	299-304
75	Destination SPLC	6	N	305-310
76	STCC w/o Hazardous -49 Codes	7	N	311-317
77	Origin Railroad Alpha	4	A	318-321
78	First Interchange RR Alpha	4	A	322-325
79	Second Interchange RR Alpha	4	A	326-329
80	Third Interchange RR Alpha	4	A	330-333
81	Fourth Interchange RR Alpha	4	A	334-337
82	Fifth Interchange RR Alpha	4	A	338-341
83	Sixth Interchange RR Alpha	4	A	342-345
86	Termination Railroad Alpha	4	A	346-349
87	Junction Frequency	1	N	350
88	Theoretical Expansion Factor	3	N	351-353
89	Routing Error Flag	1	A	354
90	STB Car Type	2	N	355-356
92	AAR/RAILINC Error Codes	6	N	357-362
93	Car Ownership Category	1	A	363
94	AAR Trailer/Container Equipment Type Code	4	A/N	364-367
95	Deregulation Date (ccyymmdd)	8	N	368-375
96	Deregulation Flag	1	A	376
97	Service Type	1	N	377
98	Expanded Carloads	6	N	378-383
99	Billed Weight in Tons	7	N	384-390
100	Expanded Tons	8	N	391-398
101	Expanded Trailer/Container Count	6	N	399-404
102	Expanded Total Revenue	10	N	405-414
103	Origin Railroad Split Revenue	10	N	415-424
104	First Interchange RR Split Revenue	10	N	425-434
105	Second Interchange RR Split Revenue	10	N	435-444

Figure 2-1: 2017 Waybill File Record Layout (source: screenshot from 2017 Waybill reference guide).

Field	Data Description	No of pos	Form	Columns
106	Third Interchange RR Split Revenue	10	N	445-454
107	Fourth Interchange RR Split Revenue	10	N	455-464
108	Fifth Interchange RR Split Revenue	10	N	465-474
109	Sixth Interchange RR Split Revenue	10	N	475-484
112	Termination Railroad Split Revenue	10	N	485-494
113	First Railroad Distance	5	N	495-499
114	Second Railroad Distance	5	N	500-504
115	Third Railroad Distance	5	N	505-509
116	Fourth Railroad Distance	5	N	510-514
117	Fifth Railroad Distance	5	N	515-519
118	Sixth Railroad Distance	5	N	520-524
119	Seventh Railroad Distance	5	N	525-529
122	Termination Railroad Distance	5	N	530-534
123	Total Distance	5	N	535-539
124	Origin State Alpha	2	A	540-541
125	First Junction State Alpha	2	A	542-543
126	Second Junction State Alpha	2	A	544-545
127	Third Junction State Alpha	2	A	546-547
128	Fourth Junction State Alpha	2	A	548-549
129	Fifth Junction State Alpha	2	A	550-551
130	Sixth Junction State Alpha	2	A	552-553
131	Seventh Junction State Alpha	2	A	554-555
134	Termination State Alpha	2	A	556-557
135	Origin BEA Area	3	N	558-560
136	Termination BEA Area	3	N	561-563
137	Origin FIPS Code	5	N	564-568
138	Termination FIPS Code	5	N	569-573
139	Origin Freight Area	2	N	574-575
140	Termination Freight Area	2	N	576-577
141	Origin Freight Territory	1	N	578
142	Termination Freight Territory	1	N	579
143	Origin SMSA	4	N	580-583
144	Termination SMSA	4	N	584-587
145	Origin NET3 Number	5	N	588-592
146	First Junction NET3 Number	5	N	593-597
147	Second Junction NET3 Number	5	N	598-602
148	Third Junction NET3 Number	5	N	603-607
149	Fourth Junction NET3 Number	5	N	608-612
150	Fifth Junction NET3 Number	5	N	613-617
151	Sixth Junction NET3 Number	5	N	618-622
152	Seventh Junction NET3 Number	5	N	623-627
155	Termination NET3 Number	5	N	628-632
156	State Through Indicators	52	N	633-684
157	International Harmonized Code	12	A	685-696
158	Standard Industrial Classification	4	A	697-700
159	International S. I. C.	4	A	701-704
160	Dominion of Canada Code	3	A	705-707
161	CS54 Group Code	2	A	708-709
162	Origin Freight Station Type	4	A	710-713

Field	Data Description	No of pos	Form	Columns
163	Destination Freight Station Type	4	A	714-717
164	Origin Freight Station Rating ZIP	9	N	718-726
165	Dest. Freight Station Rating ZIP	9	N	727-735
166	Origin Rate Base SPLC	9	A	736-744
167	Destination Rate Base SPLC	9	A	745-753
168	Origin Switch Limit SPLC	9	A	754-762
169	Destination Switch Limit SPLC	9	A	763-771
170	Origin Customs Flag	1	A	772
171	Destination Customs Flag	1	A	773
172	Origin Grain Flag	1	A	774
173	Destination Grain Flag	1	A	775
174	Origin Automobile Ramp Facility Code	1	A	776
175	Dest. Automobile Ramp Facility Code	1	A	777
176	Origin Intermodal Flag	1	A	778
177	Destination Intermodal Flag	1	A	779
193	Transborder Flag	1	N	780
194	Origin Railroad Country Code	2	A	781-782
195	First Interchange Railroad Country Code	2	A	783-784
196	Second Interchange Railroad Country Code	2	A	785-786
197	Third Interchange Railroad Country Code	2	A	787-788
198	Fourth Interchange Railroad Country Code	2	A	789-790
199	Fifth Interchange Railroad Country Code	2	A	791-792
200	Sixth Interchange Railroad Country Code	2	A	793-794
201	Termination Railroad Country Code	2	A	795-796
202	Fuel Surcharge	9	N	797-805
179	Blank (Space reserved for future changes)	13	A/N	806-818
180	Origin Census Region	4	A	819-822
181	Termination Census Region	4	A	823-826
182	Exact Expansion Factor	7	N	827-833
183	Total Variable Cost	8	N	834-841
185	Railroad 1 Variable Cost	8	N	842-849
186	Railroad 2 Variable Cost	8	N	850-857
187	Railroad 3 Variable Cost	8	N	858-865
188	Railroad 4 Variable Cost	7	N	866-872
189	Railroad 5 Variable Cost	7	N	873-879
190	Railroad 6 Variable Cost	7	N	880-886
191	Railroad 7 Variable Cost	7	N	887-893
192	Railroad 8 Variable Cost	7	N	894-900

Figure 2-2: 2017 Waybill File Record Layout contd. (source: screenshot from 2017 Waybill reference).

Field	Name	No of Pos	Form	Columns
1	Waybill Date (mm/dd/yy)	6	N	1-6
2	Accounting Period (mm/yy)	4	N	7-10
3	Number of Carloads	4	N	11-14
4	Car Ownership Category Code	1	A	15
5	AAR Equipment Type Code	4	A/N	16-19
6	AAR Mechanical Designation	4	A	20-23
7	STB Car Type	2	N	24-25
8	TOFC/COFC Service Code	3	A/N	26-28
9	Number of TOFC/COFC Units	4	N	29-32
10	Trailer/Container Unit Ownership Code	1	A	33
11	Trailer/Container Unit Type Code	1	A	34
12	Hazardous/Bulk Material in Boxcar	1	A	35
13	Commodity Code (STCC)	5	N	36-40
14	Billed Weight in Tons	7	N	41-47
15	Actual Weight in Tons	7	N	48-54
16	Freight Revenue ($)	9	N	55-63
17	Transit Charges ($)	9	N	64-72
18	Miscellaneous Charges ($)	9	N	73-81
19	Inter/Intra State Code	1	N	82
20	Type of Move	1	N	83
21	All Rail/Intermodal Code	1	N	84
22	Type of Move via Water	1	N	85
23	Transit Code	1	N	86
24	Substituted Truck for Rail Service	1	N	87
25	Rebill Code	1	N	88
26	Estimated Short Line Miles	4	N	89-92
27	Stratum Identification	1	N	93
28	Subsample Code	1	N	94
29	Exact Expansion Factor	5	N	95-99
30	Theoretical Expansion Factor	3	N	100-102
31	Number of Interchanges	1	N	103
32	Origin BEA Area	3	N	104-106
33	Origin Freight Rate Territory	1	N	107
34	Interchange State #1	2	A	108-109
35	Interchange State #2	2	A	110-111
36	Interchange State #3	2	A	112-113
37	Interchange State #4	2	A	114-115
38	Interchange State #5	2	A	116-117
39	Interchange State #6	2	A	118-119
40	Interchange State #7	2	A	120-121
41	Interchange State #8	2	A	122-123
42	Interchange State #9	2	A	124-125
43	Termination BEA Area	3	N	126-128
44	Termination Freight Rate Territory	1	N	129
45	Waybill Reporting Period Length	1	N	130
46	Car Capacity	5	N	131-135
47	Nominal Car Capacity - Expired	3	N	136-138
48	Tare Weight of Car	4	N	139-142
49	Outside Length	5	N	143-147
50	Outside Width	4	N	148-151
51	Outside Height	4	N	152-155
52	Extreme Outside Height	4	N	156-159
53	Type of Wheel Bearings and Brakes	1	A	160
54	Number of Axles	1	A/N	161
55	Draft Gear	2	N	162-16
56	Number of Articulated Units	1	A/N	164
57	AAR Error Codes	4	N	165-168
57-A	Blank	46	N	169-214
58	Routing Error Flag	1	A	215
59	Expanded Carloads	6	N	216-221
60	Expanded Tons	9	N	222-230
61	Expanded Freight Revenue	11	N	231-241
62	Expanded Trailer/Container Count	6	N	242-247

Figure 2-3: 2017 Public Use Waybill Sample File Record Layout (source: screenshot from 2017 Waybill reference guide)

3. ASSOCIATION OF AMERICAN RAILROADS

Introduction

The AAR is a trade association primarily representing the major freight railroads of North America. AAR membership is made up of all seven Class 1 freight railroads and Amtrak as full members, and numerous non-Class 1 and commuter railroads, rail supply companies, engineering firms, signal and communications firms, and railcar owners as affiliates or associate members.

AAR was created in 1934 through a merger between existing industry groups (the American Railway Association, the Association of Railway Executives, the Bureau of Railroad Economics, the Railway Accounting Officers Association, and the Railway Treasury Officers Association).

AAR is included in the analysis as it is another primary source of rail data relevant to freight planning. It also plays an integral role in the industry and, in fact, is affiliated with the collection of the data included on the STB waybill sample. As indicated above, AAR is not a government entity but rather an industry group providing a range of data and management services to the industry and under the industry's authority.

RAILINC

Railinc is a subsidiary of AAR that specializes in providing technology solutions to the railroad industry. Railinc provides processed rail data to the industry (data as a service product) and provides software tools relevant to the industry (software as a service product). Railinc started as an information technology department within AAR before evolving into a full, for-profit subsidiary of AAR in 1998 operating out of Cary, North Carolina. It is important to note that Railinc is responsible for collecting and processing waybills for inclusion in the STB CCWS.

Railinc's website lists a total of 39 products and services offered by the company, including the following key products and services:

- *The Umler System*: The industry's official source for rail equipment information including freight cars, loading platforms, locomotives, and end of train devices. The name was originally an acronym for Universal Machine Language Equipment Register but has been changed since 2009 to a lower-case trademarked name.
- *RailSight*: Railsight is a suite of tools that deliver rail shipment and equipment management data. The suite includes 5 modules: Track and Trace, a single-source shipment-tracking service that sends out real-time rail data tracking railcars and intermodal equipment; Monitor, a tool to monitor real-time information about issues with cars and shipments; Demand Trace for monitoring the lifecycle of shipments and equipment; Alerts, a module for creating and managing customized alerts; and Messaging, a communications tool.
- *Damaged and Defective Car Tracking (DDCT)*: The DDTC system is used to identify and track damaged and defective rail cars.
- *Equipment Health Management System (EHMS)*: The EHMS monitors equipment to identify possible mechanical issues with the cars and car components, sending alerts to responsible parties when repairs may be needed.
- *Railinc Message Service (RMS)*: RMS delivers messages over its electronic data interchange network, including waybills, trip plans, and blocking requests.

- *Rail Service Finder (RSF) and MidRange Industry Reference File (MRIRF)*: The RSF and MRIRF services, replace the old Freight Rail 411 system, and allow quick access to information on a variety of rail-related industries, carriers, stations, and various industry related references.

In addition to the tools above, Railinc also provides Rail Data as a service. As mentioned, Railinc is responsible for collecting and processing waybills for inclusion in the STB CCWS. This includes various degrees of validation and correction of data issues.

Transportation Technology Center Inc. (TTCI)

TTCI is another wholly owned subsidiary of AAR. TTCI is a facility located in Colorado that specializes in railroad testing and training services. AAR and Federal Railroad Administration (FRA) came together to form a cooperative research program to jointly develop and implement railway technology at the Transportation Technology Center in the early 1970s. AAR maintained stewardship of the TTC since 1982 until 1998, when the TTCI was established as a subsidiary of AAR. The TTCI's purpose is to support the development and deployment of innovative technologies to increase reliability, safety, and efficiency of the railroad industry.

Data and Reports

AAR generates a variety of reports with analysis of the rail industry in North America, rail traffic data, rail cost indices, and fact sheets. The reports are either available online through AAR's datacenter (typically aggregated statistics) or can be purchased through their online catalogue (detailed reports).

Purchasable Reports and Packages

The following presents a summary of purchasable reports offered by AAR. AAR typically hosts a report using data from the most recent year available and another using data from the year prior. Accurate and up-to-date pricing information for each publication can be obtained through AAR's website. All reports are available for free to AAR members.

The ***AAR Railroad Cost Indexes*** report is generated quarterly and contains the Rail Cost Recovery Index (RCRI), the Rail Cost Adjustment Factor (RCAF), the All-Inclusive Index, the All-Inclusive Index Less Fuel, and Spot Indexes of Fuel and Materials & Supplies. The indices are widely used as an estimate of trends of change in prices for inputs to railroad operations, such as wage rates, fuel prices, and materials prices.

The ***Analysis of Class 1 Railroads***, also known as the Green Book, is an annual publication containing over 750 financial, operating, equipment, employee and traffic statistics for each US Class 1 freight railroad and aggregates for Class 1 railroads as a whole.

The ***Freight Commodity Statistics*** reports are published yearly with detailed commodity statistics including gross revenue, carloads and tonnage information for each commodity up to the 5-digit STCC level. The statistics are reported at the US, East, and West geographic aggregation levels, and are reported across US for each Class 1 railroad.

The ***Railroad Facts*** annual publication provides a synopsis of the US freight rail industry for the year (and comparison with recent years) including summaries on railroad finances, traffic, operating averages, plant and equipment, employment and wages, and fuel consumption and costs.

The ***Railroad Ten-Year Trends,*** an annual publication, is a collection of trends over the previous ten years in the rail industry. The sections in this publication include synopsis of the US freight railroad industry, Class I railroad statistics (Performance, Traffic & Revenue, Financial, Labor, Plant & Equipment, Operations), List of railroads, Organizations, and Glossary.

The ***AAR Publication Package*** is a package subscription that combines quarterly cost indices, the Analysis of Class 1 Railroads report, Freight Commodity Statistics, Railroad Facts, and Railroad Ten-Year Trends into a single package.

The ***Weekly Railroad Traffic*** is a weekly publication that reports rail traffic data for the week as reported by major US railroads, the two major Canadian railroads, and the two major Mexican railroads. Carload data are broken down into one of 20 major commodity groups including coal, chemicals, grain, steel, autos, lumber, paper, scrap, and petroleum products. Intermodal traffic (containers and trailers) is reported separately.

These reports, while being a comprehensive reflection of various useful railroad freight statistics, are not geographically bound. Thus, they provide analysis tools to observe general trends in railroad freight, but do not offer direct demand and usage statistics relevant to a bounded geographical region (such as state or county within a state) in which DOTs are typically are interested when developing plans for multimodal freight projects in their states.

Free Reports and Infographics

In addition to the publications available for purchase, AAR also compiles and shares certain aggregate freight rail information at the weekly, monthly, and annual aggregations through the Data Center section of their website. The statistics are categorized under one of the following categories: Rail Traffic Data, Freight Rail in your State, Rail Cost Indexes, Fact Sheets and Backgrounders, and Infographics.

Rail Traffic Data

The Rail Traffic Data category presents a synopsis of weekly rail traffic data and a sample of the information covered in the Weekly Railroad Traffic report. All major North American railroads report their traffic weekly to AAR (with a delay of 1 week), and the data is used to create and publish the Weekly Railroad Traffic report each Wednesday. The carloads are classified into 20 commodity categories and intermodal traffic is reported separately. The commodity categories may combine multiple related STCCs under a single category or may split certain subcategories out (such as the Farm Products category including grain mill products, food products, and farm products, but excluding grain).

The traffic data is also rolled up to the monthly and the annual aggregations where a user can see graphically represented traffic numbers for various commodity categories (Autos, Chemicals, Coal, Forest Products and Paper, Grain, Metals and Ores, Petroleum and Products, Intermodal units, or total carloads) (see Figure 3-1) for freight originating in US, Mexico and Canada.

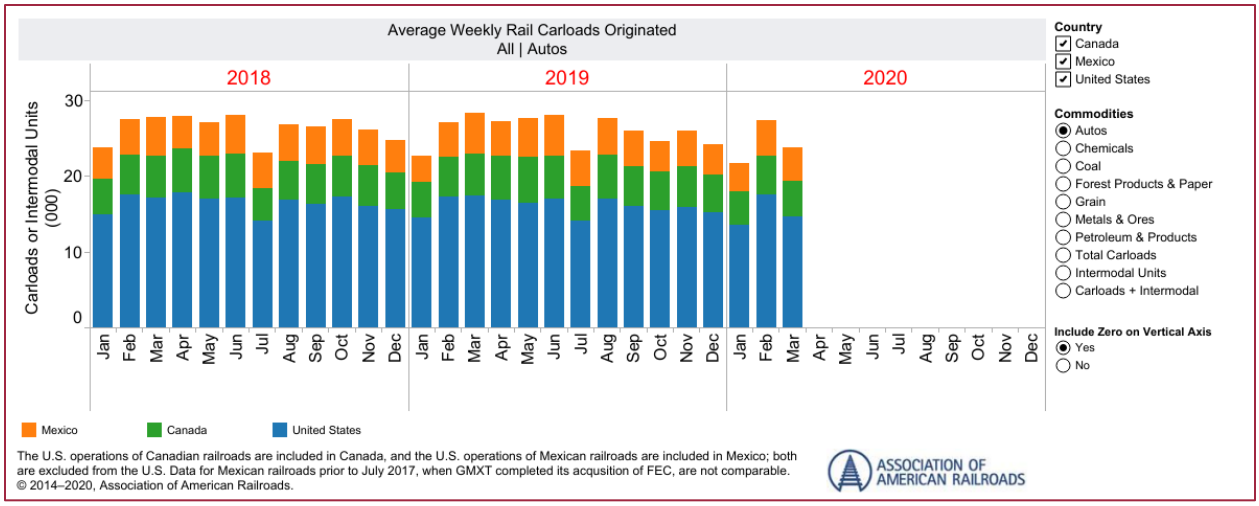


Figure 3-1: Average weekly rail carloads originated (source: AAR website **[8]**)

Freight Rail in your State

The Freight Rail in your State category provides a synopsis of total freight movement originating and/or terminating in each state, categorized by commodity (see Figure 3-3 and Figure 3-4). In addition, a fact sheet is published for each state that offers aggregate analysis and review of freight movement for the state (see Figure 3-5 and Figure 3-5). The fact sheet provides information on the number of railroads operating within the state, total freight rail mileage during the reporting year, employment and wages statistics for the industry, tonnage and carload statistics for various broad commodity categories, mileage operated information for all railroads operating within the state for the given year (including Class 1, regional, local, as well as switching and terminal railroads), and maps showing the major freight railroad lines operating in the state.

Figure 3-2: Snapshot of freight railroad industry in U.S. (source: AAR website **[8]**)

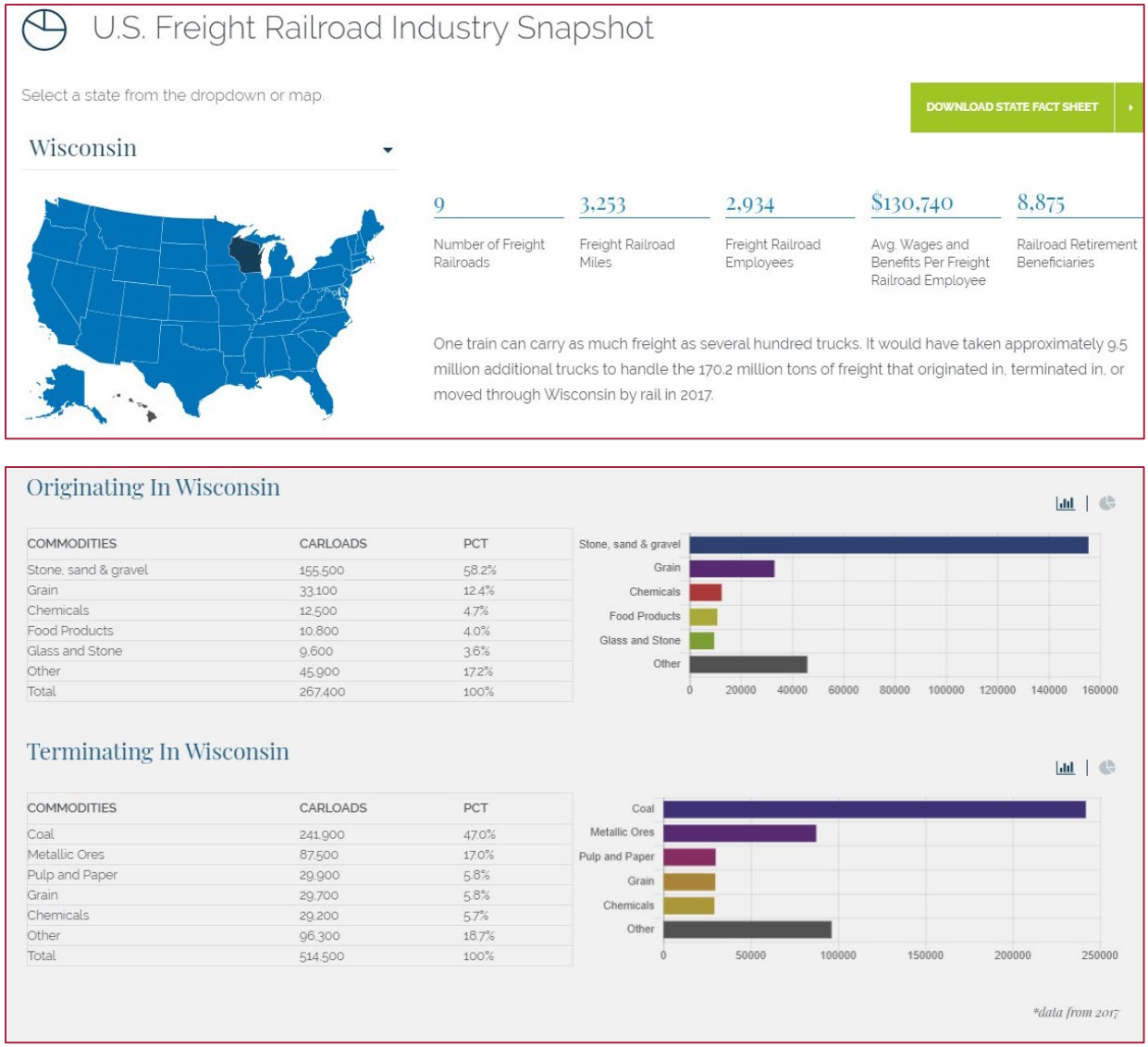


Figure 3-3: Snapshot of freight railroad for the state of Wisconsin (source: AAR website **[8]**)

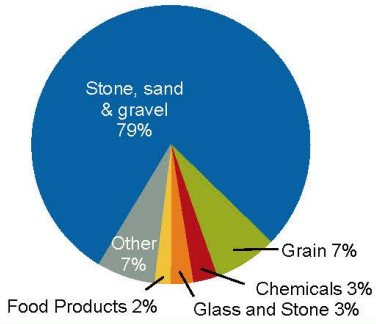
ASSOCIATION OF AMERICAN RAILROADS

Freight Railroads in Wisconsin

Rail Fast Facts For 2017

Operations	Number of freight railroads	9
	Freight railroad mileage	3,253
Employment and Earnings	Number of freight rail employees	2,934
	Average wages & benefits per freight rail employee	$130,740
Railroad Retirement	Number of railroad retirement beneficiaries	8,875
	Railroad retirement benefits paid	$198 million
Economic Impact	Nationwide, in 2017, major U.S. railroads supported approximately 1.1 million jobs (about eight jobs for every railroad job), nearly $219.5 billion in annual economic activity, $71 billion in wages and almost $26 billion in tax revenues.	
Fuel Efficiency	In 2017, America's railroads moved a ton of freight an average of 479 miles on one gallon of fuel. That's like going from Milwaukee to Lexington, KY. On average, railroads are four times more fuel efficient than trucks. Moving freight by rail instead of truck reduces greenhouse gas emissions by on average 75 percent.	
Cutting Highway Gridlock	One train can carry as much freight as several hundred trucks. It would have taken approximately 10.4 million additional trucks to handle the 187.4 million tons of freight that originated in, terminated in, or moved through Wisconsin by rail in 2017.	

Rail Traffic Originated in 2017 — Total Tons: 41.4 million — Total Carloads: 398,100

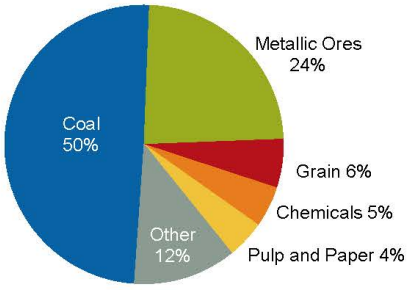


Commodity	Tons	Carloads
Stone, sand & gravel	32,587,000	293,500
Grain	3,056,000	30,400
Chemicals	1,163,000	12,600
Glass and Stone	1,067,000	10,800
Food Products	792,000	9,100
Other	2,760,000	41,700

Source: AAR Analysis of STB Waybills

(Percentages based on tonnage)

Rail Traffic Terminated in 2017 — Total Tons: 55.5 million — Total Carloads: 542,100



Commodity	Tons	Carloads
Coal	27,468,000	229,900
Metallic Ores	13,196,000	123,100
Grain	3,133,000	31,500
Chemicals	2,636,000	27,500
Pulp and Paper	2,444,000	28,400
Other	6,611,000	101,700

Source: AAR Analysis of STB Waybills

(Percentages based on tonnage)

 July 2019

Figure 3-4: Wisconsin freight railroad fact sheet – general statistics (source: AAR website **[8]**)

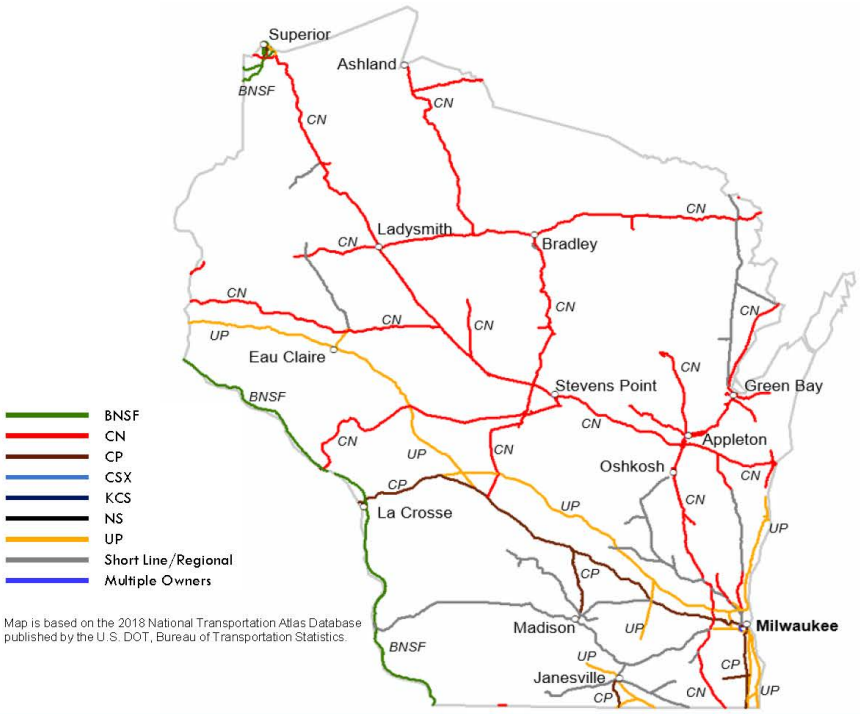
ASSOCIATION OF AMERICAN RAILROADS

Freight Railroads in Wisconsin

	Miles Operated In Wisconsin in 2017
Class I Railroads	
BNSF Railway Company	249
Canadian National	1,404
Canadian Pacific Railway	608
Union Pacific Railroad Co.	930
	3,191
Regional Railroads	
Wisconsin & Southern Railroad, LLC	644
	644
Local Railroads	
Escanaba & Lake Superior Railroad	116
Tomahawk Railway, LP	9
Wisconsin Northern	58
	183

Wisconsin 2017 Totals	Number of Freight Railroads	Miles Operated Excluding Trackage Rights	Miles Operated Including Trackage Rights
Class I	4	2,500	3,191
Regional	1	570	644
Local	3	182	183
Switching & Terminal	1	1	1
Total	9	3,253	4,019

	Miles Operated In Wisconsin in 2017
Switching & Terminal Railroads	
Madison Terminal Railway, LLC	1
	1



Class I Railroad: A railroad with 2017 operating revenues of at least $447.6 million. **Regional Railroad:** A non-Class I line-haul railroad that has annual revenues of at least $40 million, or that operates at least 350 miles of road and revenues of at least $20 million. **Local Railroad:** A railroad which is neither a Class I nor a Regional Railroad, and which is engaged primarily in line-haul service. **Switching & Terminal Railroad:** A non-Class I railroad engaged primarily in switching and/or terminal services for other railroads.

 July 2019

Figure 3-5: Wisconsin freight railroad fact sheet – haul lengths (source: AAR website **[8]**)

4. ASSESSMENT OF WAYBILL DATA

The Waybill Sample data offers a stratified sampled representation of waybill data collected from all major railroads operating in the country. The Waybill Sample is useful for a variety of needs, such as being a source for geographically categorized rail demand for use by the State DOTs. The sampling rates are known by classification of waybill, thus allowing the sample data to be extrapolated to aggregate numbers that are representative of all rail freight movements recorded. Each waybill record contains detailed information on the goods moved (tonnage, value, number of carloads), as well as routing of the waybill. The Waybill Sample offers a valuable source of rail freight movement data that can be used in combination with other sources (such as FAF) for a variety of freight rail analyses.

The Waybill Sample provides high accuracy and current data that can be related directly to geographical regions at low cost to the State DOTs. The data is easily interpreted, dispatched in a tabular form where each row of data represents a waybill record and each row consists of alphanumeric values that represent various fields of data (detailed information on fields presented in Chapter 2). The data provided is economically sensitive data obtained directly from the private industry (railroads) and thus is the only source of data of its kind. The Waybill Sample provides various freight rail statistics that are also available through AAR's purchasable reports (which in turn use the waybill data as their primary source, but post-process the data using other sources where reliability is a concern).

Shortcomings

The Waybill Sample, created from sampled waybills (stratified under different sampling rates based on carload size), suffers from various shortcomings. As with any sample, some portions of the total population are better represented than others.

Railinc identified the following weaknesses of the Waybill Sample:

Waybill Sampling Rate

The exact sampling rate in the Waybill Sample is a function of the waybill submission method used: Machine Readable Input (MRI) vs Hardcopy, as well as the billing method chosen by the railroad. For MRI submissions, the sampling rate varies from 2.5% to 50%, and for hardcopy submissions, the rate varies from 1% to 20%. In addition, the billing method used by the railroad also influences sampling rate as a railroad may bill multiple car movements as a series of single car moves, thus reducing the sampling rate (due to a change in the stratification). While the quality of the population estimate remains unchanged (as exact sampling rates are used for each record), single car billing of multiple carload movements may alter calculated individual waybill movement costs (single cars would not receive multiple car costing adjustments).

The MRI sampling method adds the benefit of inclusion of data on each observation that enables the calculation of the exact sampling rate for each waybill movement. Comparison of the population count and the total number of records in each stratum enable the user to calculate the specific sampling rate rather than using the theoretical sampling rate. This alleviates issues such as non-sampling bias when investigating small subsamples of the data as the true sampling rate is always known. Using the theoretical sampling rate in such scenarios could lead to systematic non-sampling bias as differences between theoretical and true sampling rate would have an exaggerated impact for smaller subsamples. As an example, for a subsample being considered that evaluates a set of 20 under MRI-1 stratum requiring a 1 in 40 sampling rate. There would be

1 single waybill sampled from the population for inclusion into the Waybill Sample. If the true sampling rate (1 in 20 or 5%) is not known, and theoretical (1 in 40 or 2.5%) is used, the population would be heavily overestimated in any analysis using this data.

Reported Revenues

Due to the sensitive nature of contract rates and revenues for railroads, railroads can disguise or mask their contract revenues by using a scalar value at the three-digit STCC level. Railroads that employ this masking technique provide STB with a table that indicates that all records with a "calculated rate flag" have been factored to either scale up or down the revenues based on the three-digit STCC. The factor tables are confidential (known only to the reporting railroad and STB) and are only utilized by STB for their internal analyses. This means that the revenue numbers on the Waybill Sample (both CCWS and PUWS) are intentionally inaccurate.

Billed Vs. Actual Weight

Freight weight statistics are typically generated based on billed weights rather than actual weights. While carloads may be weighed (actual weight) for reasons such as checking for overloading, checking that weight received at destination matches weight at origin, or to ensure minimum tariff weights are met, STB does not require the actual weight to be provided on all waybills. Instead the billed weight is used as a mandatory record. While the difference between billed and actual weight is typically small when both are made available (up to 7% deviation on average across all carloads, p=0.01 for statistically significant difference [7]), any analysis that uses the billed weights from the waybill sample come with the caveat that the billed weights might not be an accurate representation of actual weights. This can potentially limit DOT analysis of commodity flows and not allow for a focus on economic development and systems expansion where needed.

Freight Mandatory Rule 11

Freight Mandatory Rule 11 allows railroads to rebill deregulated traffic, often creating waybill records for additional 'local' movements. For example, long distance movement through Illinois may be rebilled at Chicago thus inflating the number of carloads originating and/or terminating in Illinois and potentially understating commodity length of haul numbers. Transcontinental shipments may often be billed as two or more separate waybills.

Freight mandatory rule 11 rebilling has the effect of overstating tonnage and units (carloads and intermodal boxes), while understating the length of haul in the Waybill Sample. The total distance moved, and ton-mile statistics are unaffected as a longer movement is simply split across multiple waybills.

In order to adjust for the impact of the rebilling, an estimate needs to be made on what share of the traffic was rebilled. AAR uses an adjustment methodology based on the technique used by Manalytics [9].

This potential for over-reporting could result in showing higher numbers for local short distance hauls compared to long hauls, and possibly skewing rail investment impact study results.

Intermodal Carloads

Intermodal traffic records in the Waybill Sample contain the number of intermodal units (boxes) and the number of cars for the waybills sampled. Due to being billed at single unit prices, a large fraction of intermodal records are a one-box-to-one-car combination even when the car contains multiple platforms/boxes. Because of this billing format (one box to one car), the Waybill Sample may overstate the number of intermodal cars moved.

AAR performs an adjustment to the intermodal car numbers using the Universal Machine Language Equipment Register (Umler) car-type in the waybill record and applying the number of platforms from the Umler Specification Manual. The number of cars can be adjusted to reflect the assignment of boxes to platforms rather than to cars. The adjustment is performed through an approximate utilization factor for the platforms based on the Umler car-type specification in the waybill record. AAR's recommended adjustment process applied to the 1992 sample (that was used to validate the process) resulted in a pre-adjustment share of car miles for intermodal traffic at 42% being adjusted down to a post-adjustment share of 28% of all car miles as compared to 26% reported in the R-1 annual reports which was used as source of truth.

3-FSAC Rule

The use of the CCWS is subject to certain confidentiality agreements with STB. Specifically, any data (raw data, calculations, or results of calculations) released to the public or published in reports should be aggregated to at least the level of three shippers by following the 3-FSAC rule. Under this rule, there must be at least three different freight stations as identified by the Freight Station Accounting Code (FSAC) on one railroad or there must be at least two more FSAC's than there are railroads present in the waybill data being aggregated.

Thus, the 3-FSAC rule makes sure that there are at least three railroads at both the origin and the destination of a given group of data.

While it is possible to use alternate aggregation methods if the project necessitates it and if the approach protects the identity of individual shippers, doing so requires filing an official request with the Director of Office of Economics at STB and is subject to approval.

This is a requirement of note for states when assessing the use of the CCWS data for any published reports that States generate. While State Freight Plans could report data aggregated at the state and county level, the 3-FSAC rule would typically restrict reporting at more disaggregated geographic levels. In effect, the fidelity of data available in the public use data set establishes the legal limit of disclosure and while the requested data provides greater detail, any analysis results shared with the public need to be aggregated to the 3-FSAC aggregation before being reported. This has implications for the levels of investment in Freight Rail Plans and data acquisition as additional spending and analysis may not be suitable for public reporting.

5. CASE STUDIES (STATE FREIGHT PLAN)

As part of the study, we conducted interviews with selected individuals at DOTs that work with state rail data to find how and where they were currently using the Waybill Sample data. The choice of which states to interview was based on our work with the states since 2006, and on their expertise in freight rail development, and previous experiences with the use of rail data. The following sections present the information obtained from the surveys.

Wisconsin

Wisconsin Department of Transportation (WisDOT) purchases the state government copy of the STB Waybill Sample each year. The Waybill Sample is incorporated into annual TRANSEARCH commodity flow databases, providing a consistent modal comparison with respect to tons and value of goods compared to other freight modes (such as trucking). WisDOT does not purchase a TRANSEARCH database every year. In years without a purchase, the Waybill Sample is used directly for analysis.

The waybill data is primarily used in preparing the Wisconsin State Rail Plan, contributing to the assessment of freight demand and growth in tonnage and value of goods for rail freight. Since the data is used through TRANSEARCH, the rail freight values are also directly compared against other freight modes such as trucking, water, and air freight. These numbers are then forecasted for future years (see Figure 5-1, Figure 5-2).

Wisconsin Rail Plan 2030

Wisconsin Rail Plan 2030 [10], adopted officially in 2014, is the current statewide rail transportation plan for the state. The Rail Plan provides vision for freight, intercity passenger, and commuter rail, identifying priorities and strategies for future rail investments in Wisconsin. Due to STB confidentiality agreements, any data from waybill is summarized at the state and the county level instead of being reported on a station to station (FSAC) level of detail, thus catering to STB's 3-FSAC requirement.

The Wisconsin Rail Plan 2030 (in Chapter 5) uses Waybill Sample data, through TRANSEARCH, for forecasting freight rail demand to 2030, using actual data from 2017 and earlier as the source. This is presented at the state level, categorized by inbound, outbound, intrastate and overhead movements, reporting the actual 2017 and projected 2030 figures for carloads, tonnage, and carload value in dollars (see Figure 5-3).

Wisconsin freight shipments by tonnage, 2017					
	Outbound	**Inbound**	**Within State**	**Overhead**	**TOTAL**
Rail	42,901,724	56,950,144	3,000,750	87,466,458	190,319,076
Truck	126,338,697	92,422,092	117,177,504	54,483,711	390,422,004
Water	19,988,613	7,138,894	95,804	-	27,223,311
Air	47,854	54,011	492	-	102,357
Other	635	151,359	-	17	152,011
TOTAL	**189,277,523**	**156,716,500**	**120,274,550**	**141,950,186**	**608,218,759**

Wisconsin freight shipments by value ($), 2017					
	Outbound	**Inbound**	**Within State**	**Overhead**	**TOTAL**
Rail	5,840,617,445	13,008,504,179	1,440,581,082	130,903,820,499	151,193,523,205
Truck	121,144,927,852	90,326,180,146	49,036,306,291	91,014,486,320	351,521,900,609
Water	1,298,781,382	1,673,019,528	93,804,143	-	3,065,605,053
Air	4,955,773,009	5,156,436,067	19,355,516	-	10,131,564,592
Other	5,903,123	50,388,114	-	349,207	56,640,444
TOTAL	**$133,246,002,811**	**$110,214,528,033**	**$50,590,047,031**	**$221,918,656,026**	**$515,969,233,901**

Figure 5-1: Wisconsin 2017 freight by mode (source: WisDOT, created using 2017 IHS TRANSEARCH database).

Table 5-2: Wisconsin freight shipments by weight, 2007 and 2030 (thousands of tons)

	Leaving WI			Entering WI			Within State			Overhead			All		
	2007	2030	% Change	2007	2030	% Change	2007	2030	% Change	2007	2030	% Change	2007	2030	% Change
Rail	15,234	14,580	-4.3%	75,415	72,635	-3.7%	3,771	3,971	5.3%	86,067	118,073	37.2%	180,487	209,934	16.3%
Truck	92,467	99,387	7.5%	52,990	67,702	27.8%	118,392	112,779	-4.7%	76,462	106,568	39.4%	340,350	386,519	13.6%
Water	21,365	NA	NA	8,106	NA	NA	425	NA	NA	0	NA	NA	29,896	NA	NA
Air	199	NA	NA	76	NA	NA	<1	NA	NA	0	NA	NA	275	NA	NA
Unknown	54	NA	NA	621	NA	NA	0	NA	NA	0	NA	NA	675	NA	NA
Total	129,319	NA	NA	137,208	NA	NA	122,519	NA	NA	161,799	NA	NA	5550,845	NA	NA

Source: Global Insight TRANSEARCH

Table 5-3: Wisconsin freight shipments by value, 2007 and 2030 (thousands of $)

	Leaving WI			Entering WI			Within State			Overhead			All		
	2007	2030	% Change	2007	2030	% Change	2007	2030	% Change	2007	2030	% Change	2007	2030	% Change
Rail	$12,751	$7,867	-38.3%	$20,843	$23,356	12.1%	$1,867	$1,905	2.0%	$146,887	$180,531	22.9%	$182,348	$214,262	17.5%
Truck	$226,014	$263,031	16.4%	$248,884	$380,169	52.7%	$184,272	$229,436	24.5%	$329,504	$513,445	55.8%	$988,726	$1,386,298	40.2%
Water	$6,939	NA	NA	$1,113	NA	NA	$387	NA	NA	$0	NA	NA	$8,439	NA	NA
Air	$763	NA	NA	$1,218	NA	NA	$2	NA	NA	$0	NA	NA	$1,983	NA	NA
Unknown	$6	NA	NA	$187	NA	NA	$0	NA	NA	$0	NA	NA	$193	NA	NA
Total	$246,473	NA	NA	$272,245	NA	NA	$186,497	NA	NA	$475,900	NA	NA	$1,181,689	NA	NA

Source: Global Insight TRANSEARCH

Figure 5-2: Wisconsin freight shipment 2030 projections by mode (source: Wisconsin Rail Plan 2030 **[10]**, Table 5-2 and 5-3).

Table 5-4: Wisconsin freight rail shipments by weight, units and value, 2007 and 2030

	Leaving WI			Entering WI			Within State			Overhead			All		
	2007	2030	% Change	2007	2030	% Change	2007	2030	% Change	2007	2030	% Change	2007	2030	% Change
Carload Tons (000s)	14,794	14,458	-2.3%	75,176	72,448	-3.6%	3,771	3,971	5.3%	68,057	96,291	41.5%	162,452	187,837	15.6%
Intermodal Tons (000s)	439	122	-72.2%	238	187	-21.4%	0	0	0%	17,349	21,782	25.6%	18,035	22,097	22.5%
Total Rail Tons (000s)	15,234	14,580	-4.3%	75,415	72,635	-3.7%	3,771	3,971	5.3%	85,406	118,073	39.0%	180,487	209,934	16.3%
Carload Units	184,398	163,892	-11.1%	714,681	697,110	-2.5%	43,596	43,728	0.3%	821,639	1,121,498	36.5%	1,771,254	2,026,228	14.4%
Intermodal Units	22,800	6,631	-70.9%	21,280	19,140	-10.1%	0	0	0%	1,319,800	1,740,325	31.9%	1,364,640	1,766,096	29.4%
Total Rail Units	207,198	170,523	-17.7%	735,961	716,249	-2.7%	43,596	43,728	0.3%	2,141,49	2,861,823	33.6%	3,135,894	3,792,324	20.9%
Carload Value (millions $)	$10,860	$7,362	-32.2%	$19,850	$22,614	13.9%	$1,837	$1,905	2.0%	$77,422	$94,040	21.5%	$110,416	$125,921	14.0%
Intermodal Value (millions $)	$1,891	$505	-73.3%	$993	$741	-25.4%	$0	$0	0%	$69,036	$87,095	26.2%	$71,931	$88,341	22.8%
Total Rail Value (millions $)	$12,751	$7,867	-38.3%	$20,843	$23,356	12.1%	$1,837	$1,905	2.0%	$146,458	$181,135	23.7%	$182,348	$214,262	17.5%

Source: Global Insight TRANSEARCH

Figure 5-3: Wisconsin freight rail projections (source: Wisconsin Rail Plan 2030 **[10]**, Table 5-4).

Wisconsin State Freight Plan

In addition to the State Rail Plan (SRP), WisDOT also created the State Freight Plan (SFP) in 2018 [11] (adopted in March 2018) to provide a vision for multimodal freight transportation and to position the state to remain competitive in the global marketplace.

The SFP used rail Waybill Sample data to develop a “Freight Factor Score” for all main railroad lines within the state, scoring the rail lines on a scale of 1-99. This offers a benchmark to prioritize various rail corridors by their importance to freight movement within the state. The score was developed using a variety of criteria and corresponding weightage given to the criterion, including tonnage and value of outbound, inbound, and internal movements, as well as connectivity to ports, rail yards, intermodal and transload facilities (thus offering multimodal connectivity). The waybill sample was thus used to categorize state owned rail lines as Primary, Secondary, and Supporting based on their corresponding Freight Factor Scores (see Figure 5-4).

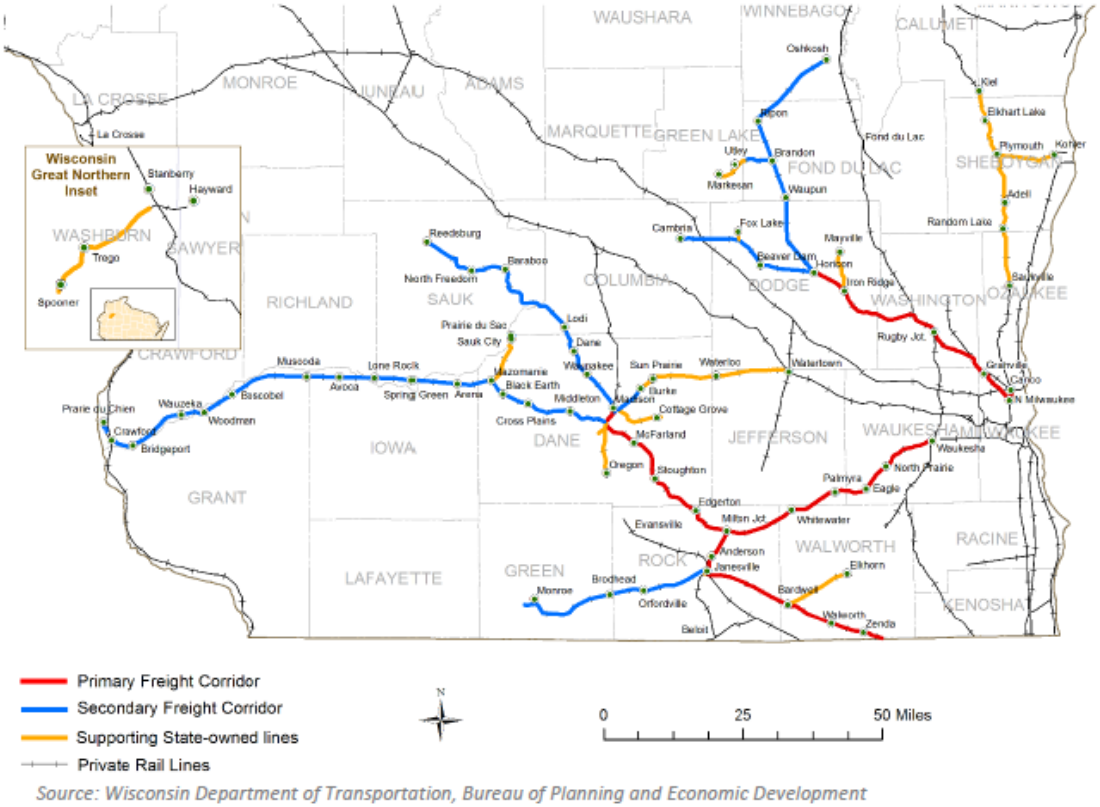


Figure 5-4: Mobility analysis of Wisconsin state owned rail lines by Freight Factor Score (source: Wisconsin State Freight Plan 2018 **[11]**)

Northwoods Freight Rail Study, 2018

In addition to the SFP and the SRP, WisDOT also used waybill data recently in its study of rail in the Northwoods region of the state [12]. The study was a collaborative effort between WisDOT and Northwoods Rail Transit Commission (NRTC). The purpose of the study was to re-evaluate the need for rail services in the counties that make up the NRTC (see Figure 5-5).

An important component of this study was to assess the historical trends of railroad freight movement in the state and more specifically in the Northwoods region. Waybill data (purchased through TRANSEARCH) was used to generate the number of rail freight carloads moved for each county in the region for 6 historical years (2007-2015) (see Figure 5-6). In addition, waybill data was also used to generate a list of commodities shipped in each county of the region for the given years.

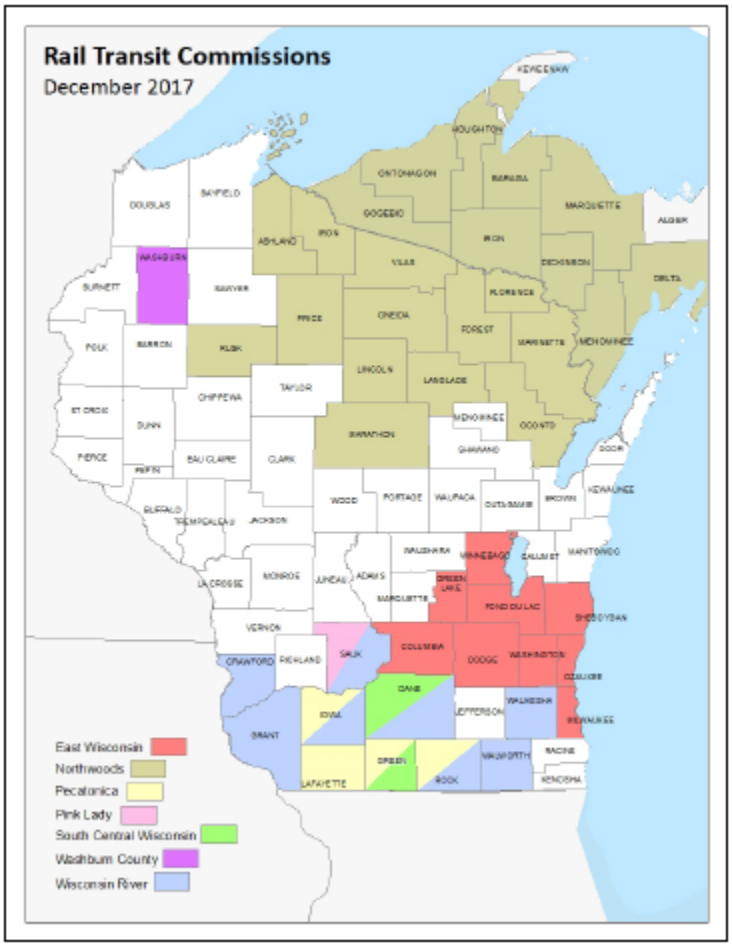


Figure 3: Wisconsin Rail Transit Commissions-2017

Figure 5-5: Wisconsin county map showing Northwood Rail Region (source: Northwoods Freight Rail Study, 2018 **[12]**)

Table 14: Inbound Carload History (2011-2015)

	2007	2011	2012	2013	2014	2015
Ashland	80	-	40	120	-	-
Florence	-	-	-		-	-
Forest	160	-	-		-	-
Iron	-	-	-		-	-
Langlade	-	-	-		-	-
Lincoln	280	2,044	1,776	2,040	2,196	1,044
Marathon	22,834	31,484	28,644	29,584	28,164	22,484
Marinette	4,296	1,956	1,320	1,360	1,640	1,440
Oconto	160	80	40	40	120	-
Oneida	1,000	796	520	720	560	1,680
Price	560	840	800	1,448	880	1,000
Rusk	572	40	-	120	188	80
Vilas	-	-	-	-	-	
Total	**29,942**	**37,240**	**33,140**	**35,432**	**33,748**	**27,728**

Figure 5-6: Northwoods incoming freight carload history by county (source: Northwoods Freight Rail Study, 2018 **[12]**)

Ohio

Like other states, Ohio Department of Transportation (ODOT) uses the Waybill Sample Data when developing their State Rail Plan. Specifically, the waybill data is used to generate information for the freight demand and growth section in the SRP.

The 2018 State of Ohio Rail Plan [13] (most recent rail plan for Ohio at the time of this study) is an update to the 2010 Ohio Statewide Rail Plan. The Ohio Rail Plan is an analysis of past, current, and forecasted passenger and freight rail trends and is a key document used to position Ohio for federal grant opportunities, and to identify issues, opportunities, and needs associated with the Ohio rail system. The Ohio Rail Plan was completed with consultant support.

The 2018 Ohio Rail Plan uses carload and tonnage information obtained from the 2015 and the 2016 STB Waybill Samples. Key reported values include the overall tonnage handled by Ohio (including inbound, outbound, intrastate, and overhead movements), tonnage by commodity type in the state (see Figure 5-7), and break down of originating and terminating freight rail tonnage for the year for each county. In addition, commodity trends (originating and terminating) within the state are computed and forecasted for future years from historic tonnage information from the Waybill Sample, combined with statistics and forecast values from AAR and FHWA FAF (see Figure 5-8).

Table 2-13. Rail Tonnage by Direction 2016

Direction	Tons	Percentage of Total
Inbound	48,086,117	17%
Intrastate	21,272,617	7%
Outbound	42,780,777	15%
Overhead	177,387,918	61%
Total	**289,527,429**	**100%**

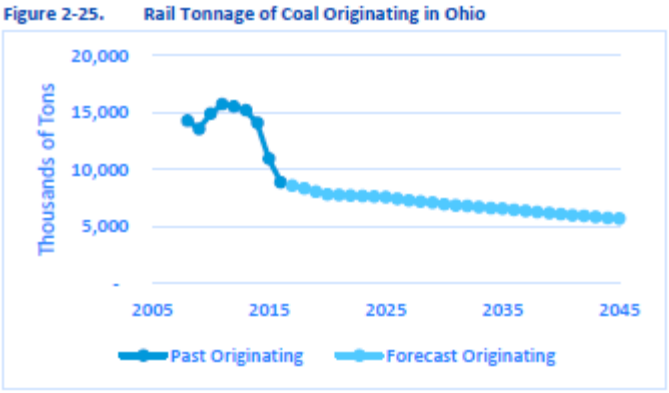
Sources: 2016 Surface Transportation Board Carload Waybill Sample

Figure 2-22. Top Commodities Originating or Terminating in Ohio by Rail (2016 Tons)

Commodity Type	Inbound	Intrastate	Outbound	Total with Endpoint in Ohio
Coal	10,385,608	8,088,981	798,743	19,273,332
Chemicals	7,006,929	697,800	3,615,835	11,320,564
Metal	5,192,411	656,848	4,919,634	10,768,893
Non-metallic Minerals	1,944,915	6,057,098	2,699,724	10,701,737
Petroleum Products	2,108,094	2,414,681	6,105,679	10,628,454
Mixed Shipments	4,233,120		4,185,080	8,418,200
Waste or Scrap	4,954,684	439,724	1,852,320	7,246,728
Metallic Ores	Withheld	Withheld	Withheld	7,071,833
Food Products	3,401,516	168,048	3,350,512	6,920,076
Farm Products	457,843	160,576	5,371,250	5,989,669
Other	6,512,689	776,328	6,511,008	13,800,025
Grand Total	**48,086,117**	**21,272,617**	**42,780,777**	**112,139,511**

Source: 2016 Surface Transportation Board Carload Waybill Sample

Figure 5-7: Waybill data for Ohio reported in Ohio's State Rail Plan (source: Ohio State Rail Plan 2018 **[13]**)



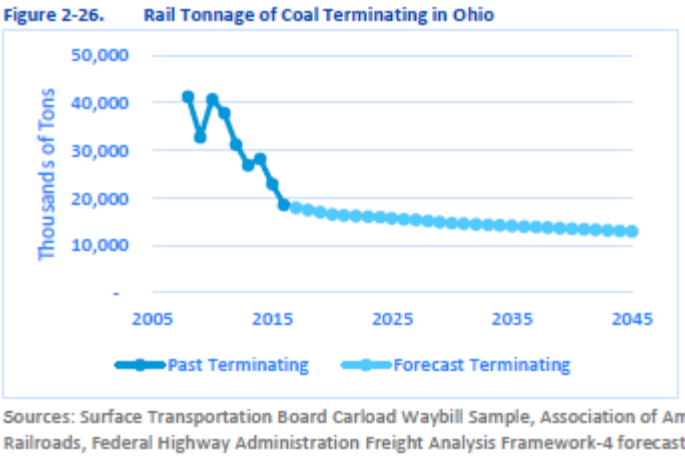


Figure 5-8: Coal freight tonnage trend in Ohio, using Waybill Sample data (source: Ohio State Rail Plan 2018 **[13]**)

In addition to freight tonnage numbers, Ohio has also used the length of haul information from the Waybill Sample to analyze freight movement on rail compared to trucking within the state.

Section 4.3 of the Ohio State Rail Plan specifically analyzes the average length of haul by freight rail into or out of the state (619 miles) compared to the national average (1,008 miles). Further, the ratio of ton-miles originating or terminating in Ohio that involved shipments of 60 or more carloads, was noted to be under 25%, compared to the national average of over 50%. The above information from the Waybill Sample was used to conclude that Ohio typically sees shorter length, and smaller shipments compared to the rest of the nation. The finding was used to reason that rail freight shipments were more vulnerable to convert to trucking in Ohio compared to other states.

Kansas

Kansas DOT typically only uses the STB Waybill Sample data for preparing their State Rail Plan updates. The exception would be during unique circumstances that require assessment of impacts on rail freight (such as the current COVID-19 pandemic).

The 2017 Kansas Statewide Rail Plan [14] was developed as an update to the 2011 Kansas State Rail Plan and is currently the most recent State Rail Plan for Kansas. The Kansas SRP is intended to formulate a state vision for railroad transportation (passenger and freight) for the state and a guide to developing strategies to achieve the vision. Kansas employed consultant support in preparing the SRP, and the waybill data was used either directly from source, or through TRANSEARCH in preparing the report.

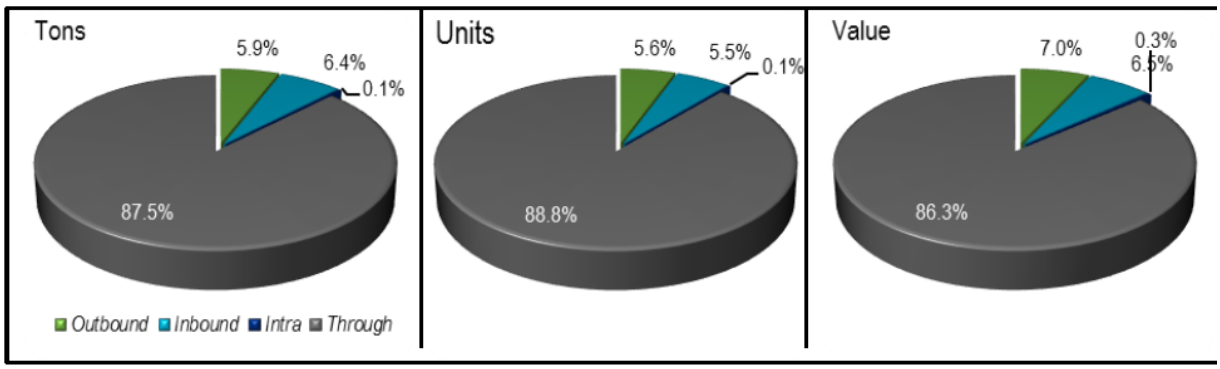
The 2017 Kansas SRP uses tonnage and value of freight movement information obtained from the 2014 Waybill Sample for reporting freight demand and growth in the state (see Figure 5-9). More specifically, statewide aggregates for tonnage, number of units, and value of shipment are reported categorized by inbound, outbound, intrastate, or through movements in Kansas, with through movements dominating a large ratio of overall traffic. All numbers reported from the waybill data are at the state aggregation level.

Table 2.5: Rail by Direction, 2014

Direction	Tons		Units		Value (in millions)		Average
	Amount	Percent	Amount	Percent	Amount	Percent	Value/Ton
Outbound	21,919,113	5.9%	386,788	5.6%	$22,622	7.0%	$1,032
Inbound	23,543,312	6.4%	381,768	5.5%	$21,005	6.5%	$892
Intra	489,604	0.1%	6,106	0.1%	$901	0.3%	$1,840
Through	322,447,524	87.5%	6,141,358	88.8%	$279,577	86.3%	$867
Total	368,399,553	100.0%	6,916,020	100.0%	$324,105	100.0%	$880

Source: prepared by CDM Smith, based on TRANSEARCH®/STB WAYBILL for 2014

Figure 2.18: Rail Percentages by Direction, 2014



Source: prepared by CDM Smith, based on TRANSEARCH®/STB WAYBILL for 2014

Figure 5-9: Freight rail in Kansas, obtained from 2014 Waybill Sample (source: 2017 Kansas State Rail Plan **[14]**)

Kansas typically also gets short line railroad data in the form of carload counts, directly reported by the short line operators within the state on a monthly frequency. The information is then aggregated to quarterly and annual resolutions. The short line railroad data is not just used to supplement STB Waybill data (especially for Class 3 railroads), but also to better define the overall railroad industry in the state. The data is usually aggregated to total tonnage and carload values such that individual railroad identities are not discernible from any reports or analysis published.

6. CONCLUSIONS

A key trend seen in the case studies is that State DOTs use the Waybill Sample data primarily in developing State Rail Plans, and more specifically in determining the freight rail demand for the state in terms of carloads, tonnage, and value of carload information. Freight planners play a critical role in ensuring that the freight data reflects reality and can be effectively included in planning efforts.

Identifying and securing rail data that is accurate, timely, and that provides economic analyses, site planning, and commodity profiles is difficult. The data is considered proprietary and a business asset. There is competition for line services and efficiency across the rail system which creates demand for industry and competitor data that could be used for advancing planning and operational decisions. Sharing cost, volume, and commodity data across competition could provide or remove a market or cost advantage. Lastly, railroads are private businesses, therefore the level of information they are required to share is limited.

It is also important to acknowledge that recent congressional authorizations of transportation funding sparked State DOT interest in new forms of freight rail data. Specifically, MAP21 and the FAST Act required State DOTs to link transportation investments with specific economic performance measures. Prior to these funding bills and competitive grant programs such as TIGER, State DOT work with railroads was mostly limited to the areas of railroad/highway crossings, rights-of-way, and drainage issues. The inclusion of freight planning and performance measures expanded the scope of State DOTs' partnerships with railroads. This expansion includes the need for rail and rail commodity data that measures economic and business growth factors.

MAASTO States have worked directly with rail lines to acquire data needed for engineering and to ensure safety. See [15] for an earlier evaluation of rail data collected by the MAASTO States. In some cases, requesting additional data on freight movements, markets, and development seems intrusive towards the railroads. In interviews with MAASTO States' freight and rail experts and based on observation of successful partnership and sharing efforts, there are five practices and conditions that can lead to increased sharing of rail data and planning information between railroads and State DOTs.

Trust. Trust is imperative when working with the private sector. In the KSDOT rail program, there has been a long history of support for shortline rail and intermodal connections. Freight practitioners in Kansas cite long-standing relationships with rail lines, formalized reporting processes, and data requests as important to both government entities and railroad companies and support collaboration and development.

Work Towards a Mutually Beneficial Relationship. Missouri, Illinois, Indiana, Kansas, Ohio, and Kentucky stressed that developing relationships and sharing information tends to be successful when a project that benefits both groups can be identified. This approach does provide project-specific insight but does not include state and regional information that could be used for planning. The increase in cooperation is seen in recent TIGER grants that include both railroads and DOTs as sponsors, investors, and partners.

Institutionalize the Relationship. Based on work in MAFC in 2018 [15], all of the 10 States had, and continue to have, requested reporting from railroads. Once established, it is important to formalize the relationship and process by which the data and planning information was obtained. Existence and familiarity of a process will allow for better coordination on future projects.

The More Information/Specifics in your request the Better. Several States mentioned that freight grant applications often required very specific freight and economic data that is not publicly

available. When requesting data and information from the private sector, it is important to be as specific as possible regarding the information you need, why the information is needed, what analysis will be completed, and what is required of the company. The potential and known risks should also be disclosed. In many cases, this requires practitioners to research the corridor and movements in order to make reasonable information requests.

Focused Stakeholder Efforts are more Successful than Broad. Wisconsin, Iowa, and Minnesota have shared lessons on gathering business and shipping data. In Wisconsin, a widely distributed and marketed electronic survey was distributed through business channels and association groups, and through word of mouth. The survey was designed to assess the possibility of intermodal terminal development in the state. WisDOT found it difficult to achieve a satisfactory response rate based on repeated requests for survey completion. However, for participants in their Freight Advisory Committee, there was overwhelming participation in the development and distribution of the survey. The relationship developed through the Freight Advisory Committee allowed the members to identify a mutually beneficial project and pursue it collaboratively. Business and industry stakeholders without direct working knowledge of the survey effort tended to not complete the survey.

Similarly, MnDOT completes business and industry surveys on a district-level, rather than statewide levels, to ensure participation and to relate issues directly to specific corridors or bottlenecks. MnDOT also has exemplary support from its Freight Advisory Committee in outreach and marketing for all their efforts.

In Iowa and in Kentucky, partnering efforts from development projects on the Mississippi River identified distinct operational issues and how they could be amended. Each location required stakeholder participation to share commodity and planning information, and to eventually participate in the project.

There has been interest in better freight rail data (data that is free, current, reliable, reflects information needs, and is accurate) since freight analysis increased during the 1990's. Rail data, marine data, freight data, and transportation and economic factors have all been lacking. Transportation data across the board, tends to be problematic: census data is updated every 10 years, the economic census is conducted every 5 years, easily available rail and waterway data is at least 2 years old. Rail data, especially economic, location, and planning data, is available from railroads only and sharing that information can compromise their competitive position.

Publicly available rail planning data should be of sufficient quality and timeliness to allow for responsible planning. Development of advanced datasets and specialized guidance on database usage should not be required for analysis of rail development. The data and information should be publicly available and user-friendly.

Another step towards improving freight rail, as well as all freight data, would be to establish national-level planning data focus groups. These groups would work to establish a common groundwork and data framework. The groups would consist of industry, agency, and academia representatives. The working group would identify the information needed for state rail planning, reasonable survey and response factors, and lastly, a strategy towards modernization and harmonization of the Nation's multimodal freight data system. This approach will ensure the range of data, variables, data collection nuances, information limits and data organization will be consistent and concise for each mode. Further, the data architecture can be streamlined across the modes to allow for intramodal, and cross-modal comparisons, identification of development opportunities, or quantification of performance and efficiencies.

Understanding rail waybill data and formulating the best mix of data to represent rail development and planning factors is a challenge. This project moves towards demystifying rail freight data.

Standardizing the expectations of the data and analysis for rail planning, and ensuring operations and planning data are available to support the analysis, would clarify the rail planning process and set the standard for transportation and economic planning. Once established, the rail data architecture and planning process can be used as an example across all modes and provide a vision for an overarching multimodal data set for operations and planning.

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www.midamericafreight.org

Mid-America Freight Coalition

Ernest Perry, PhD, Program Manager
ebperry@wisc.edu
608-890-2310

and

Soyoung Ahn, PhD, Executive Director
sue.ahn@wisc.edu
608-265-9067

University of Wisconsin–Madison
College of Engineering
Department of Civil and Environmental Engineering
1415 Engineering Drive, 2205 EH
Madison, WI53706