Appendix B

COMMODITY FLOW ANALYSIS

MARCH 2015

COMMODITY FLOW ANALYSIS

The future needs of Minnesota's rail system are substantially driven by what future freight demand might look like. This section presents existing and future potential demand for rail freight in the State for the plan year of 2040. For this purpose, the Federal Highway Administration's Freight Analysis Framework version 3.5 (FAF3.5) was applied to the 2012 edition of the Surface Transportation Board's (STB) Confidential Carload Waybill Sample. This forecast provides a "baseline" against which future demand for goods movement by rail can be considered, and thus is not only a reflection of current macro-economic trends, but also the current trends in logistics, distribution, sourcing etc. within the freight dependent economic sectors. Obviously, over the next 28 years there will be unanticipated changes in the economy, freight logistics, technology, public policy and other factors that will greatly influence the general demand for goods movement and that of the individual modes such as rail.

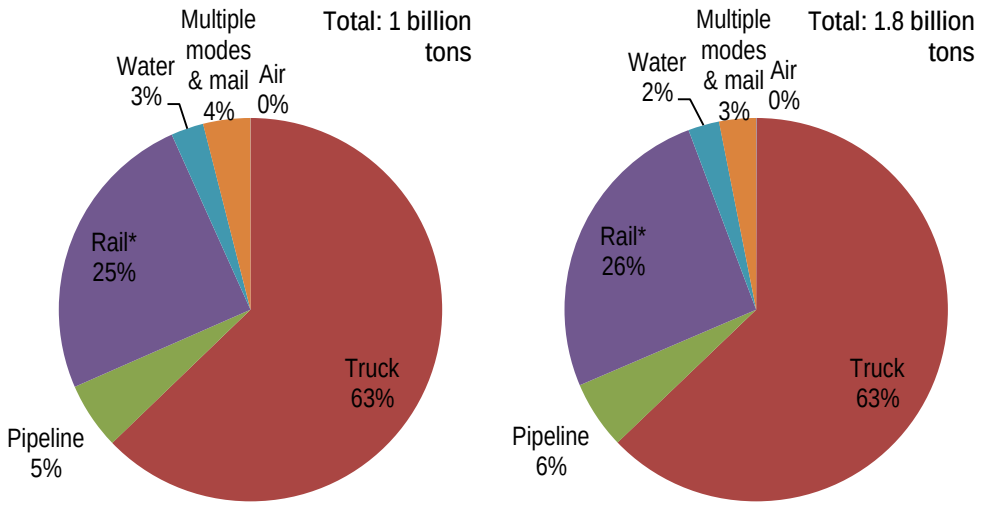
Overview of Freight System Demand

In 2012[1], 1 billion tons of freight moved over Minnesota's transportation system. Trucks carried 63 percent of all inbound, outbound, intrastate and through freight tonnage, while rail (carload and intermodal) carried about 25 percent. Multiple modes and mail[2] accounted for 4 percent. The remaining 8 percent was moved by pipeline and water, and air volume was negligible. By 2040, the FAF forecast indicates total volume to amount to 1.8 billion tons, an increase of 44 percent overall. With mode shares somewhat remaining unchanged through the forecast period, rail volumes are expected to grow proportionately.

Figures B.1 and B.2 display the current and future mode breakdown of total freight tonnage and value. By value, $912 billion in freight moved over the State's transportation system in 2012, an amount that is expected to grow 161 percent to $2.3 trillion by 2040. Trucks carried 67 percent of the State's freight value and by 2040 this share is expected to decrease to 63 percent. Rail carried 21 percent of the freight value and this share is expected to remain somewhat constant through the forecast period. Multiple modes and mail, which is largely comprised of intermodal traffic, accounted for 7 percent of the freight value. The share of multiple modes is expected to increase to 11 percent by 2040. Air, which accounted for 2 percent of all freight transported in 2012 by value, is expected to double to 4 percent by 2040.

[1] The data source for freight demand for other modes but rail was FHWA's Freight Analysis Framework version 3.5 (FAF3.5). FAF utilizes a 2007 base year with synthesized 2012 values, and a 2040 forecast.
[2] Multiple modes and mail includes shipments by multiple modes and by parcel delivery services, U.S. Postal Service, or couriers (it is not limited to containerized or trailer-on-flatcar shipments). All rail intermodal shipments have been excluded from this category and included in rail.

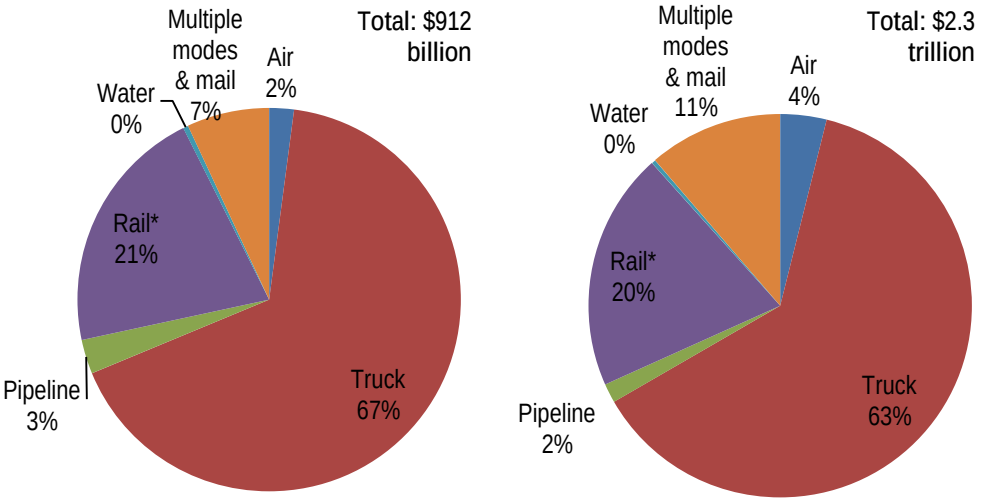
Figure B.1: Mode Share by Weight
2012 (left) and 2040 (right)



Source: FHWA FAF3 2015 Provisional estimates and 2040 Forecast, and through truck traffic estimated by routing these data; and, STB 2012 Confidential Carload Waybill Sample and FHWA FAF 3.5 forecast for 2040 processed by Cambridge Systematics.

Note: *Rail intermodal was excluded from Multiple Modes and Mail and included in Rail.

Figure B.2: Mode Share by Value
2012 (left) and 2040 (right)



Source: FHWA FAF3 2015 Provisional estimates and 2040 Forecast, and through truck traffic estimated by routing these data; and, STB 2012 Confidential Carload Waybill Sample and FHWA FAF 3.5 forecast for 2040 processed by Cambridge Systematics.

Note: *Rail intermodal was excluded from Multiple Modes and Mail and included in Rail.

Overview of Rail Freight Demand

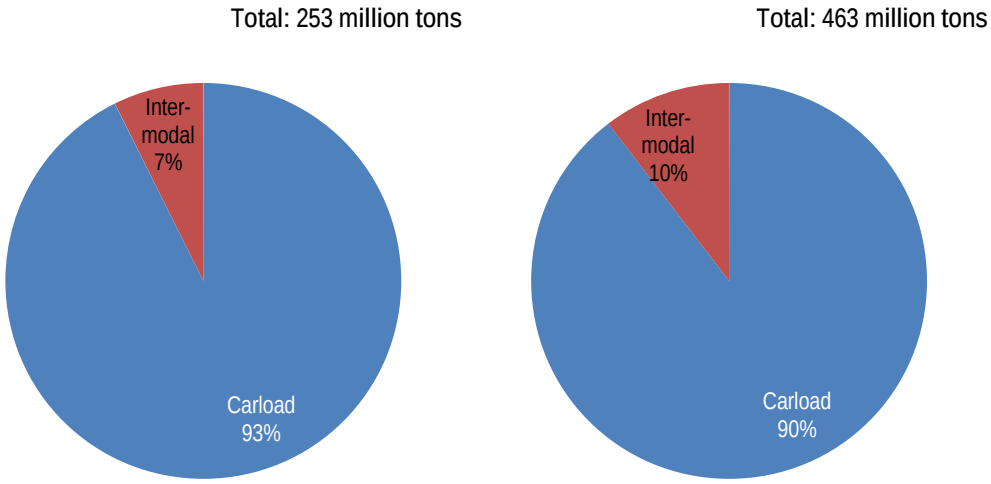
In 2012, 253 million tons of freight moved over Minnesota's rail system, valued at $191 billion. By 2040, it is projected that Minnesota's rail system will carry more than 463 million tons of freight annually, valued at $466 billion, an increase of 83 percent by tonnage and 144 percent by value.

Minnesota's rail system has some of the highest volumes in the nation, and these flows are projected to continue to grow through 2040. Figures B.3 and B.4 show the current and future rail system volumes. Measured in units, in

2012 over 3.9 million units moved in, out of, within and through the State's rail system, a volume that is expected to increase by 108 percent to 8 million units by 2040.

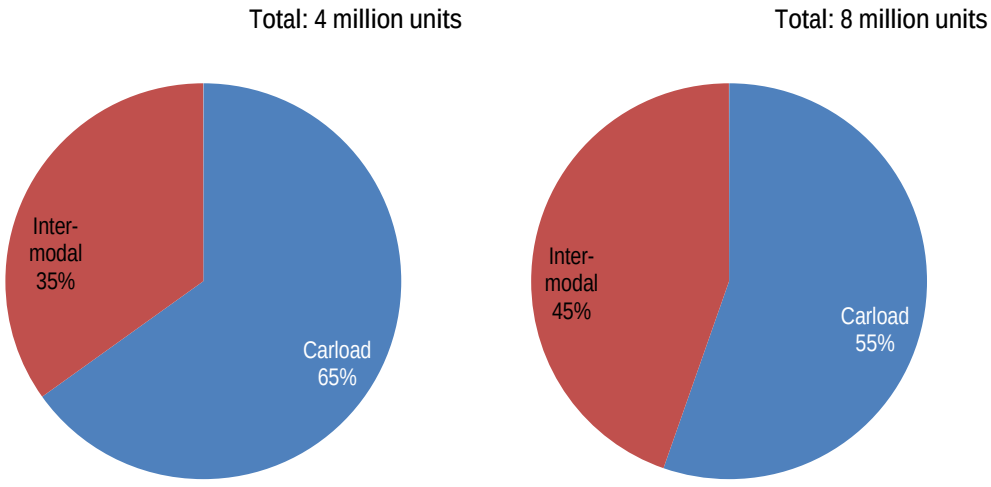
By type of rail equipment – carload or intermodal container – the data show that in 2012 93 percent of tonnage (234 million tons) was carried in railcars and 7 percent (19 million tons) in intermodal equipment (containers and trailers). When measured in units of railcars and intermodal equipment, in 2012 65 percent (2.5 million units) were railcars and 35 percent (1.4 million units) intermodal equipment. Rail intermodal volume growth is expected to continue to outpace rail carload growth through 2040, with intermodal tonnage increasing to 10 percent and units to 45 percent of all traffic. Figures B.3 and B.4 show the distribution of total rail tonnage and units by rail equipment type.

Figure B.1: Total Rail Tonnage by Equipment Type
2012 (left) and 2040 (right)



Source: STB 2012 Confidential Carload Waybill Sample and FHWA FAF 3.5 forecast for 2040 processed by Cambridge Systematics.

Figure B.2: Total Rail Units by Equipment Type
2012 (left) and 2040 (right)



Source: STB 2012 Confidential Carload Waybill Sample and FHWA FAF 3.5 forecast for 2040 processed by Cambridge Systematics.

Directional Analysis

Table B.1 and Figure B.5 displays rail freight flows by weight and direction in 2007, 2012 and 2040, while Figure B.6 graphically displays the proportion of current and future statewide rail tonnage by direction. In 2012, 49 percent of the rail freight flows by weight were through moves that neither originated nor terminated within the State. In 2040 through moves are expected to continue to make up the majority – 59 percent - of rail freight traffic in Minnesota.

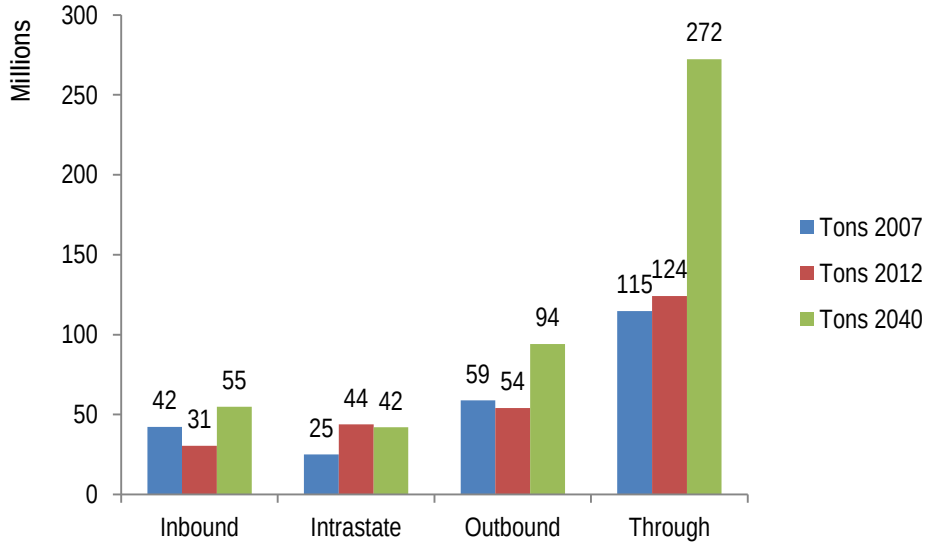
Outbound rail freight was the second largest component, accounting for 21 percent of the 2012 total and 20 percent in 2040. Intrastate rail freight was the third largest component in 2012 with 18 percent of the tonnage, a share that is expected to decrease significantly to 9 percent through 2040. Inbound freight accounted for 12 percent of the total rail movements in 2012, and this share is projected to remain stable through 2040.

Table Error! Use the Home tab to apply 0 to the text that you want to appear here..1: Total Tonnage by Direction
2012-2040, Tons in Thousands

DIRECTION	2007	2012	2040	%CHANGE 2012-2040
Inbound	42,204	30,508	54,899	80%
Intrastate	24,983	43,961	42,021	-4%
Outbound	58,892	54,045	94,143	74%
Through	114,809	124,077	272,363	120%
TOTAL	240,887	252,591	463,426	83%

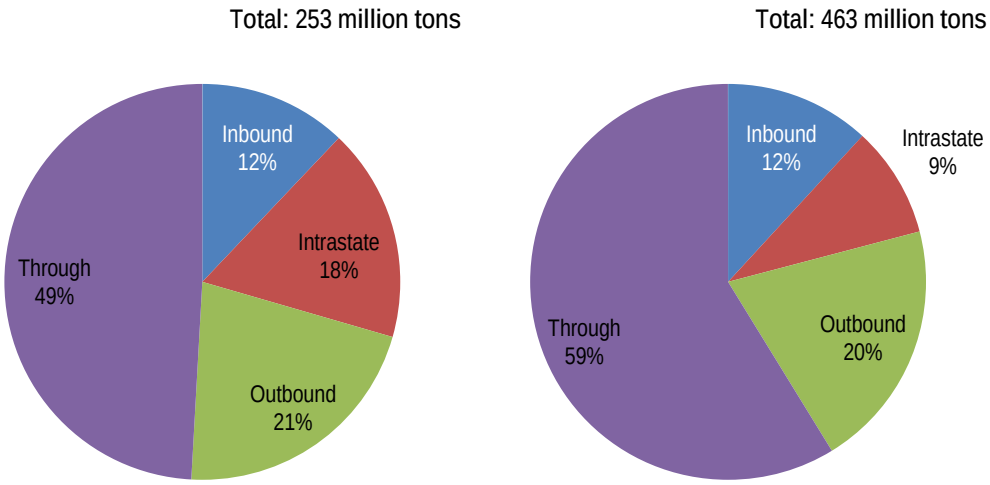
Source: STB 2012 Confidential Carload Waybill Sample and FHWA FAF 3.5 forecast for 2040 processed by Cambridge Systematics; and, Minnesota Comprehensive Statewide Freight and Passenger Rail Plan for 2007 rail data.

Figure B.1: Freight Tonnage Growth by Direction
2007, 2012 and 2040



Source: STB 2012 Confidential Carload Waybill Sample and FHWA FAF 3.5 forecast for 2040 processed by Cambridge Systematics; and, Minnesota Comprehensive Statewide Freight and Passenger Rail Plan for 2007 rail data.

Figure B.2: Direction of Total Freight Flows by Weight
2012 (right) and 2040 (right)



Source: STB 2012 Confidential Carload Waybill Sample and FHWA FAF 3.5 forecast for 2040 processed by Cambridge Systematics.

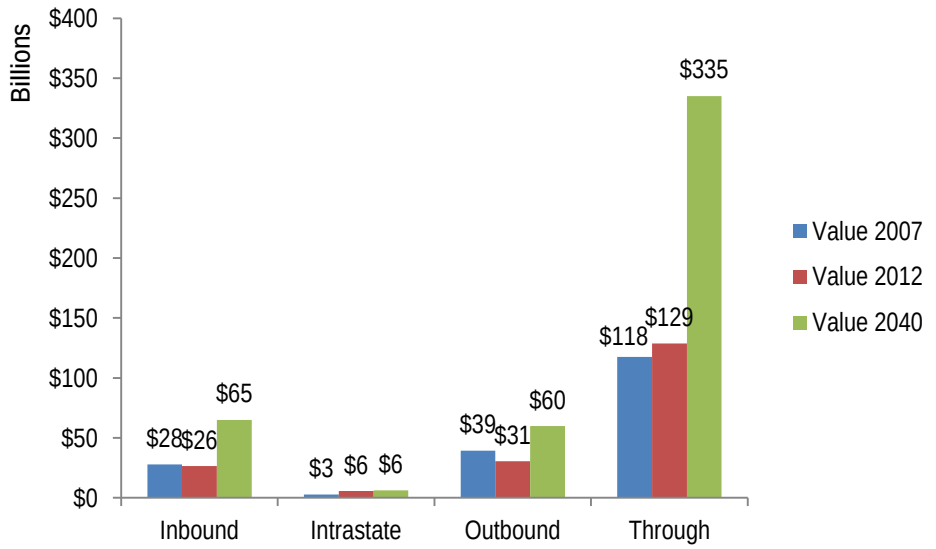
When measured by value (see Table B.2, Figure B.7 and Figure B.8), through traffic represented the largest share of the total statewide rail freight flows – 67 percent in 2012, and expected to increase to 72 percent by 2040. Outbound rail freight is the second largest component when measured by value accounting for 16 percent in 2012. By 2040, this share is expected to decrease to 13 percent. Inbound freight was the third largest component, representing 14 percent in 2012, and projected to remain constant through 2040. Intrastate or local freight accounted for 3 percent of the rail freight value in 2012. Slower growth vis á vis through, inbound and outbound flows will result in a decline to 1 percent by 2040.

Table B.2 Total Value by Direction
2012-2040, Value in Millions

DIRECTION	2007	2012	2040	%CHANGE 2012-2040
Inbound	$27,947	$26,395	$64,985	146%
Intrastate	$2,753	$5,578	$6,198	11%
Outbound	$39,205	$30,622	$59,805	95%
Through	$117,577	$128,786	$335,122	160%
TOTAL	$187,481	$191,381	$466,110	144%

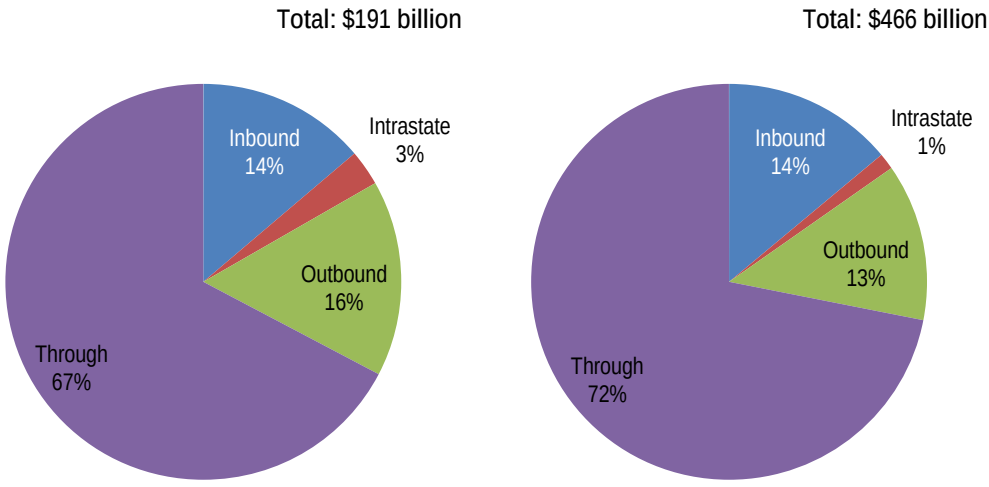
Source: STB 2012 Confidential Carload Waybill Sample and FHWA FAF 3.5 forecast for 2040 processed by Cambridge Systematics; and, Minnesota Comprehensive Statewide Freight and Passenger Rail Plan for 2007 rail data.

Figure B.3: Freight Value Growth by Direction
2007, 2012 and 2040



Source: STB 2012 Confidential Carload Waybill Sample and FHWA FAF 3.5 forecast for 2040 processed by Cambridge Systematics; and, Minnesota Comprehensive Statewide Freight and Passenger Rail Plan for 2007 rail data.

Figure B.4: Direction of Total Freight Flows by Value
2012 (right) and 2040 (right)



Source: STB 2012 Confidential Carload Waybill Sample and FHWA FAF 3.5 forecast for 2040 processed by Cambridge Systematics.

Analysis by Commodity

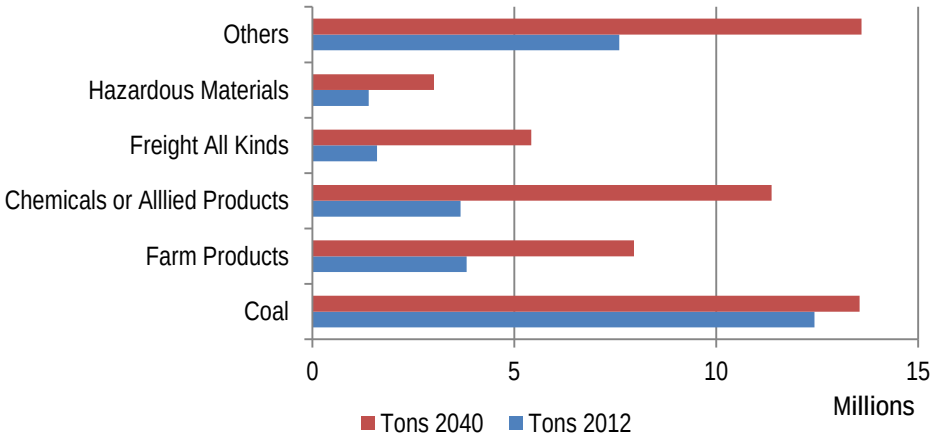
TOP INBOUND COMMODITIES

A summary of the top inbound rail commodities moving in Minnesota by weight and their projections for 2040 is provided in Figure B.9. The top five commodities in 2012 were coal; farm products; chemicals and allied products; freight-all-kinds (i.e. miscellaneous mixed shipments moving as intermodal shipments); and, hazardous materials (e.g., chemicals, petroleum and coal products, and crude petroleum, natural gas and gasoline). Combined they

accounted for more than 75 percent of the inbound rail freight in 2012, and are projected to account for 79 percent of the inbound rail freight in 2040.

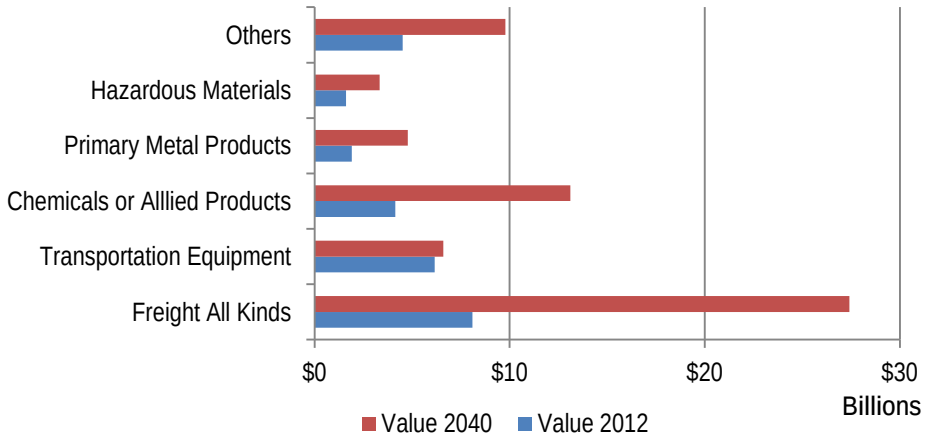
The top inbound commodities by value transported into the State via rail are shown in Figure B.10. The top five commodities in 2012 constituted freight-all-kinds (e.g. intermodal shipments); transportation equipment; chemicals and allied products; primary metal products; and, hazardous materials. These shipments accounted for more than 83 percent of the total inbound freight rail value moved in the State in 2012 and in 2040 this share is expected to increase to 85 percent.

Figure B.1: Top 5 Inbound Commodities by Weight
2012-2040



Source: STB 2012 Confidential Carload Waybill Sample and FHWA FAF 3.5 forecast for 2040 processed by Cambridge Systematics.

Figure B.2: Top 5 Inbound Commodities by Value
2012-2040

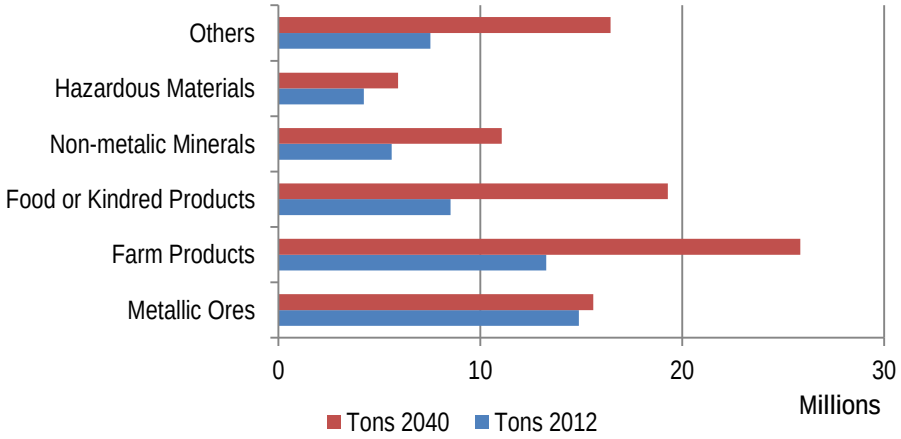


Source: STB 2012 Confidential Carload Waybill Sample and FHWA FAF 3.5 forecast for 2040 processed by Cambridge Systematics.

TOP OUTBOUND COMMODITIES

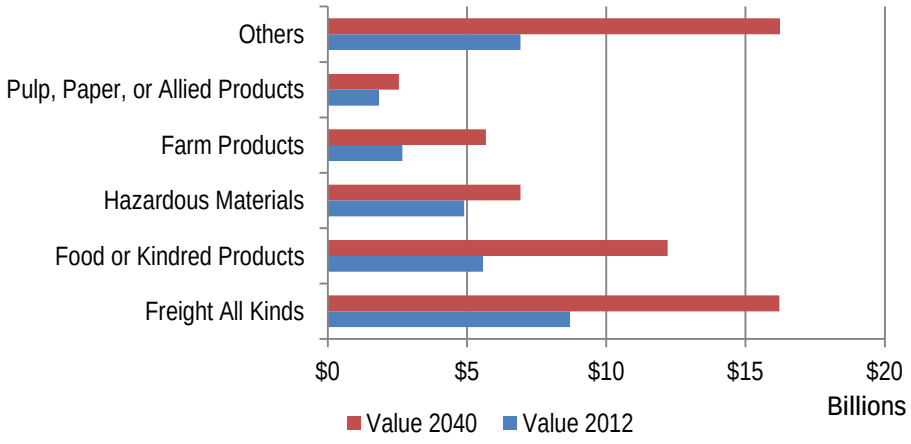
Figures B.11 and B.12 illustrate the top outbound rail commodities by weight and value respectively. In 2012, the top commodities by weight shipped from Minnesota by rail were metallic ores; farm products; food and kindred products; non-metallic minerals; and hazardous materials. Together these commodities accounted for 86 percent of the total tonnage shipped from Minnesota. By 2040 these shipments are projected to account for 83 percent of the outbound rail freight. The top five outbound commodities by value in 2012 were freight-all-kinds; food and kindred products; hazardous materials; farm products; and, pulp, paper and allied products. These shipments accounted for 77 percent of the rail value in 2012 and projected to account for 73 percent in 2040.

Figure B.1: Top 5 Outbound Commodities by Weight
2012-2040



Source: STB 2012 Confidential Carload Waybill Sample and FHWA FAF 3.5 forecast for 2040 processed by Cambridge Systematics.

Figure B.2: Top 5 Outbound Commodities by Value
2012-2040



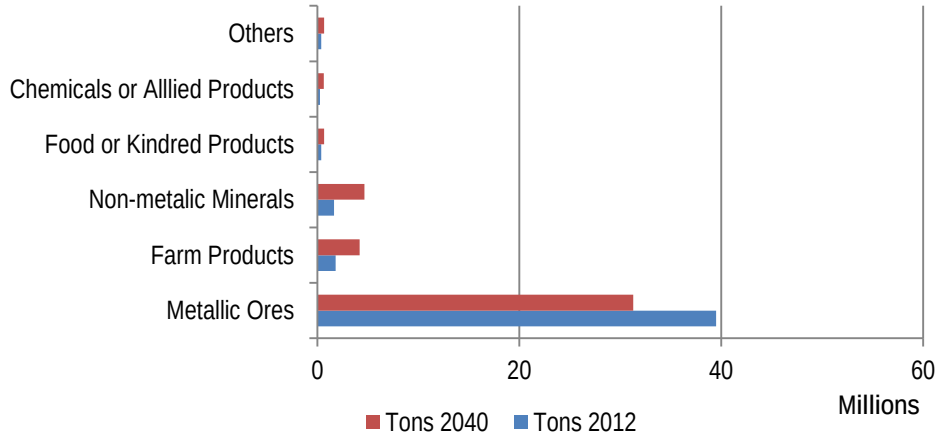
Source: STB 2012 Confidential Carload Waybill Sample and FHWA FAF 3.5 forecast for 2040 processed by Cambridge Systematics.

TOP INTRASTATE COMMODITIES

The top rail intrastate commodities by weight and value are summarized in Figures B.13 and B.14 respectively. The top commodity in 2012 was metallic ores, accounting for 90 percent of the intrastate rail tonnage and 77 percent of the intrastate rail value. The intrastate metallic ore shipments are expected to decline and by 2040 the share is projected to decline to 74 percent of the intrastate rail tonnage and 55 percent of the intrastate rail value.

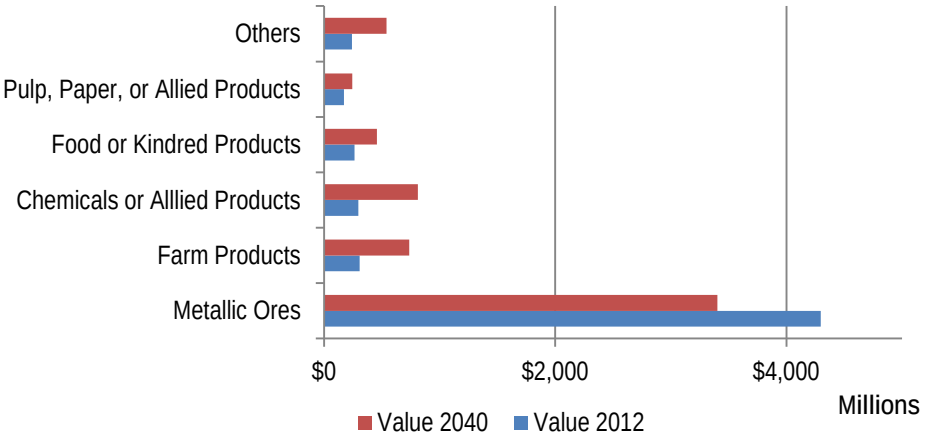
The remaining top intrastate rail commodities are farm products; non-metallic minerals; food and kindred products; chemicals and allied products; and pulp, paper and allied products. Together these shipments accounted 9 percent of the intrastate rail tonnage and 19 percent of the rail value. By 2040, these shares are expected to increase to 24 percent of the intrastate rail tonnage and 36 percent of the rail value. This growth is driven by a significant increase in farm products, chemicals, and non-metallic minerals.

Figure B.1: Top 5 Intrastate Commodities by Weight
2012-2040



Source: STB 2012 Confidential Carload Waybill Sample and FHWA FAF 3.5 forecast for 2040 processed by Cambridge Systematics.

Figure B.2: Top 5 Intrastate Commodities by Value
2012-2040



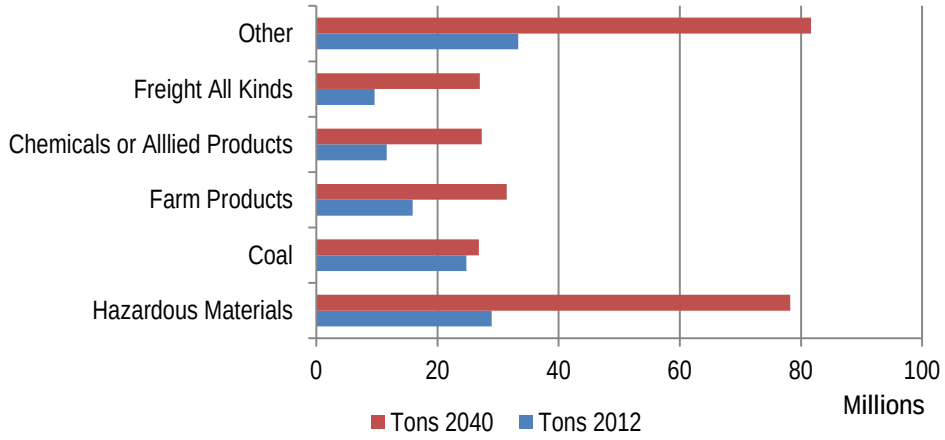
Source: STB 2012 Confidential Carload Waybill Sample and FHWA FAF 3.5 forecast for 2040 processed by Cambridge Systematics.

TOP THROUGH COMMODITIES

A summary of the top through rail commodities moving in the State by weight and their future projections by 2040 is provided in Figure B.15. The top commodities by value transported through the State via rail are shown in Figure B.16. In 2012, the top five commodities by weight were hazardous materials (e.g., crude petroleum); coal; farm products; chemicals and allied products; and, freight-all-kinds (i.e., miscellaneous mixed shipments moving as intermodal shipments). Combined these commodities accounted for more than 73 percent of the through rail tonnage in 2012, and are expected to account for 70 percent of the rail tonnage in 2040.

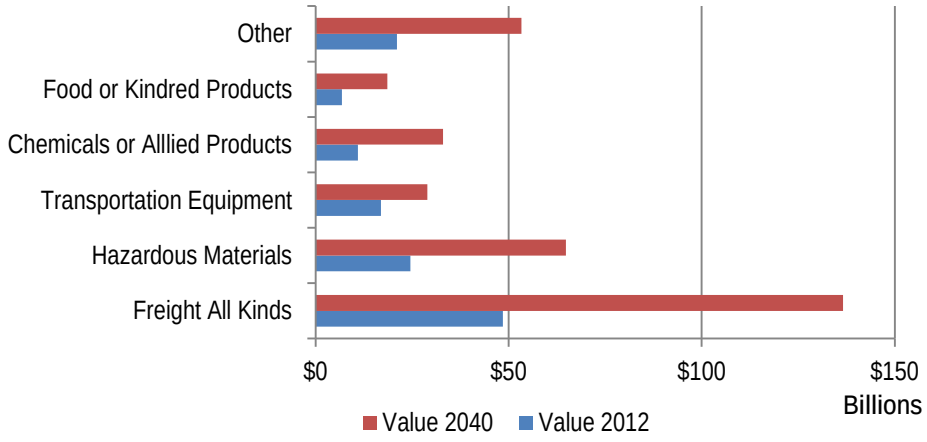
The top commodities by value in 2012 were freight-all-kinds (i.e., miscellaneous mixed shipments moving as intermodal shipments); hazardous materials (e.g., crude petroleum); transportation equipment; chemicals and allied products; and, food and kindred products. Together they accounted for 84 percent of the through rail value in 2012 and expected to remain constant through 2040.

Figure B.1: Top 5 Through Commodities by Weight
2012-2040



Source: STB 2012 Confidential Carload Waybill Sample and FHWA FAF 3.5 forecast for 2040 processed by Cambridge Systematics.

Figure B.2: Top 5 Through Commodities by Value
2012-2040



Source: STB 2012 Confidential Carload Waybill Sample and FHWA FAF 3.5 forecast for 2040 processed by Cambridge Systematics.

Analysis by Trading Partner

The "trading partners" (external to Minnesota) have been defined as consisting of the U.S. States, and the neighboring countries of Canada and Mexico. Key trading partners are identified by combining the inbound and outbound freight rail flows between Minnesota and the trading partner region. Figure B.17 displays the current and future tonnage for each of the top trading partners.

Illinois, Wisconsin, Wyoming, Washington, Canada, Texas, and North Dakota, were the top rail trading partners in 2012, accounting for 70 percent (59 million tons) of total inbound and outbound rail flows by weight. By 2040 these trading partners are projected to represent 68 percent of Minnesota's rail trade, exhibiting growth of 72 percent to 101 million tons.

Illinois was Minnesota's top rail trading partner in 2012 accounting for 16 percent or 14 million tons of freight, a position that is expected to remain unchanged through 2040. Minnesota's trade with Illinois is projected to grow 69 percent to 23 million tons (15 percent) of Minnesota's inbound and outbound freight. Most of these are outbound shipments to Illinois with metallic ores, food and kindred products, farm products, hazardous materials (e.g., chemicals and allied products, and non-metallic minerals), and freight-all-kind (i.e., miscellaneous mixed shipments moving as intermodal shipments).

Wisconsin's trade with Minnesota in 2012 accounted for 11 million tons or 13 percent of the inbound and outbound rail tonnage. By 2040, Minnesota's trade with Wisconsin is expected to grow 25 percent to 14 million tons (9 percent). The top commodity traded between Minnesota and Wisconsin by rail was metallic ores from Minnesota, accounting for 78 percent of the trade in 2012. By 2040, metallic ore shipments are expected to grow merely 2 percent and account for 64 percent of the future trade between the two states.

Trade with Wyoming represented 11 percent or 9 million tons in 2012, of which the vast majority – 92 percent - of traffic consisted of utility coal. By 2040, trade with Wyoming is expected to increase 32 percent to 12 million tons (8 percent) with coal representing 92 percent of this volume. This growth is a result of the economic recovery from the low volumes of the 2009 recession.

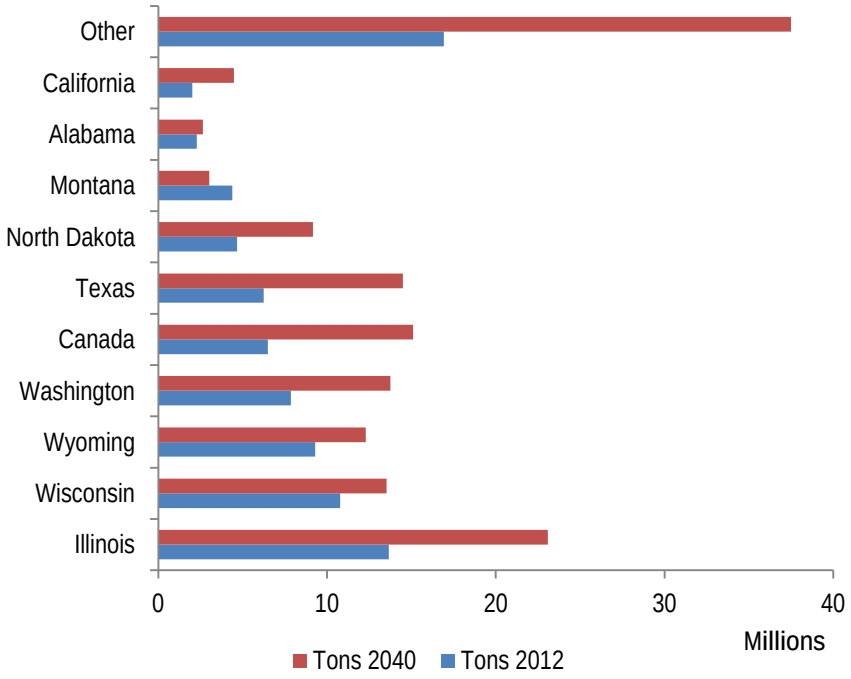
Washington represented 9 percent (8 million tons) of the total inbound and outbound trade in 2012. By 2040 these shipments are expected to grow by 75 percent to 14 million tons maintaining its share of 9 percent of the inbound and outbound trade. Farm products (i.e., dried soybeans and shelled corn) shipped from Minnesota to Washington by rail accounted for 75 percent of the trade in 2012. By 2040, these shipments are projected to grow 46 percent and account for 62 percent of the future trade between the two states.

The trade between Minnesota and Canada represented 6.5 million tons (8 percent) of the inbound and outbound rail tonnage in 2012. By 2040 these rail shipments are expected to grow 133 percent to 15 million tons Most of the trade consisted of chemicals and allied products, farm products, lumber and wood products (excluding furniture), food and kindred products, hazardous materials (e.g., petroleum and coal products, chemicals and allied products, crude petroleum, and non-metallic minerals), primary metal products, and freight-all-kinds.

Texas accounted for 7 percent (6 million tons) of the inbound and outbound rail trade in 2012. By 2040, shipments to/from Texas are expected to grow 132 percent and account for 10 percent (14 million tons) of the future trade. Most of these shipments are outbound non-metallic minerals, metallic ores, food and kindred products, farm products, and hazardous materials (e.g., chemicals and allied products, crude petroleum, natural gas and gasoline, and petroleum and coal products).

Minnesota's seventh rail trading partner in 2012 was North Dakota. In 2012, rail shipments between these two states represented 5 million tons (6 percent) of the inbound and outbound total. It is projected that these shipments will grow 97 percent to 9 million tons (6 percent) through 2040. This trade consists mostly of farm products, and non-metallic minerals.

Figure B.1: Top 10 Rail Trading Partners by Weight
2012-2040



Source: STB 2012 Confidential Carload Waybill Sample and FHWA FAF 3.5 forecast for 2040 processed by Cambridge Systematics.

Railroad Class

Table B.3 presents the tons and units carried by class of railroad in Minnesota. In 2012, traffic originating, terminating or going through Minnesota's Class I railroads accounted for 251 million tons carried in 3.9 million rail units – over a 99.5 percent share of the State's rail volume. Traffic on the short lines accounted for 1 percent (2.9 million tons carried in 24 thousand rail units). By 2040, the Class I traffic is projected to grow faster than the short line traffic accounting for 99.4 percent of the tonnage and 99.8 percent of the rail units.

Table B.3 Rail Freight Volumes by Minnesota Railroad (2012-2040, in Thousands)

RAILROAD CLASS	TONS 2012	TONS 2040	%CHANGE 2012-2040	UNITS 2012	UNITS 2040	%CHANGE 2012-2040
Class I	251,349	460,613	83%	3,898	8,106	108%
Short Line	2,867	5,051	76%	24	38	56%
TOTAL	252,591	463,426	83%	3,904	8,118	108%

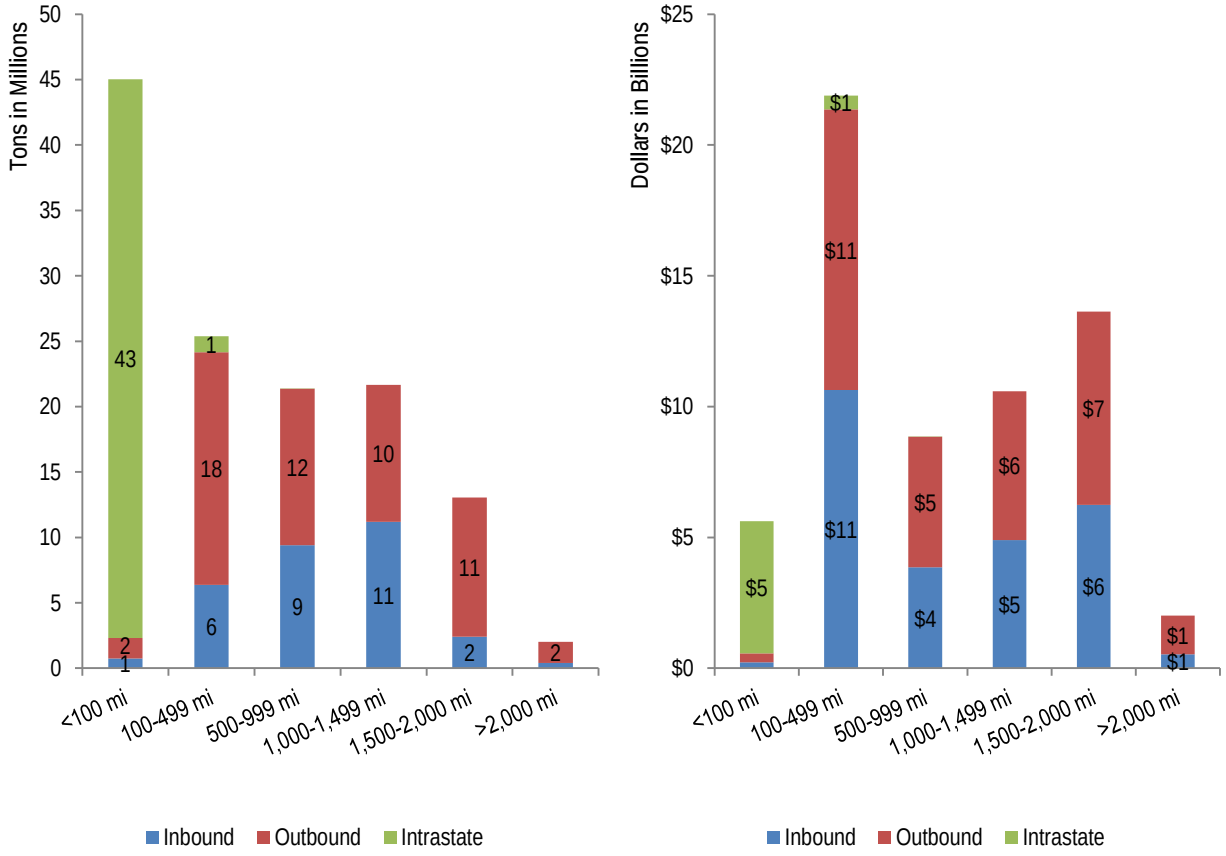
Source: STB 2012 Confidential Carload Waybill Sample and FHWA FAF 3.5 forecast for 2040 processed by Cambridge Systematics.

Note: *Numbers do no add up to the totals because there is tonnage that can go on both Class I railroads and Short Line railroads.

Analysis by Distance

Figure B.18 shows the distribution of rail tonnage and value by direction and distance travelled. Approximately 35 percent of rail tonnage shipped to/from/within the State travelled less than 100 miles. However when measured in value, only 9 percent of the rail value originating and/or terminating in the State travelled less than 100 miles. 35 percent of the rail value originating or terminating in the State travelled within 100 and 499 miles. Over 45 percent of the rail tonnage and 56 percent of the rail value shipped to/from the State travelled more than 500 miles.

Figure B.1: Rail Volume by Miles Travelled and Direction
2012, Weight (Left) and Value (Right)



Source: STB 2012 Confidential Carload Waybill Sample.