Appendix III

Nebraska Long-Range Transportation Plan

A Report on the

Freight Transportation Status in Nebraska

Dr. Aemal Khattak

Associate Professor

Nebraska Transportation Center

University of Nebraska-Lincoln

330E Whittier Research Center

2200 Vine Street, Lincoln, NE 68583-0855

Email: akhattak2@unl.edu

September 13, 2011

Summary

This report was prepared in response to Nebraska Department of Roads' (NDOR) request to provide information on the national and statewide freight trends and issues. NDOR is currently in the process of updating the Nebraska's Long Range Transportation Plan (LRTP; Vision 2032: Mapping Nebraska's Future). The requested information is intended for possible inclusion in the updated LRTP. This report covers the following aspects of freight transportation:

- National freight trends as they relate to Nebraska.
- National estimates of freight transportation and future projections as they relate to Nebraska.
- Changes in port facilities and implications for freight transportation as they relate to Nebraska.
- Nebraska freight trends, issues and estimated tonnage/value moved by different modes of transport.
- Significant freight origination and termination points in Nebraska.
- Implications of trends and issues for Nebraska and future needs.

Based on reviewed statistics, the two most relevant transportation modes in Nebraska are trucks and rails. Nebraska can expect a significant increase in future freight transported via both of these transportation modes. However, changes such as the expansion of the Panama Canal and opening of the Northwest Passage might significantly impact freight transportation patterns in the US. It is difficult to assess the impacts of these changes on the flow of freight in Nebraska at this time but it is worthwhile to keep abreast of these developments and assess their implications for Nebraska in the future. Future needs from NDOR's planning perspective will be accommodating the increasing truck traffic on Nebraska's highways and the resulting wear on highway infrastructure.

Table of Contents

Introduction 1
National freight trends as they relate to Nebraska 1
National estimates of freight transportation and future projections as they relate to Nebraska 3
Changes in port facilities and implications for freight transportation as they relate to Nebraska 3
Nebraska freight trends, issues and estimated tonnage/value moved by different modes of transport 6
Significant origination and termination points 11
Implications of trends and issues for Nebraska and future needs 11
References 12

Introduction

The Nebraska Department of Roads (NDOR) is updating Nebraska's Long Range Transportation Plan (LRTP; Vision 2032: Mapping Nebraska's Future). This LRTP will provide an inventory of all transportation modes and address the need for improvements to Nebraska highways, public transportation, bicycle and pedestrian transportation, marine, aviation, and Intelligent Transportation Systems (ITS). The overall vision is to provide direction for Nebraska's transportation future while the objectives are to plan for improved connectivity between different modes of transportation and more efficient transportation system operation. The LRTP will encompass a 20-year time period: 2012-2032.

An element of the LRTP is freight transportation and NDOR requested the Nebraska Transportation Center (NTC) to provide information on different aspects of freight transportation for possible inclusion in the LRTP. The rest of this document describes the work done to address NDOR needs regarding the status of freight transportation in NE.

National freight trends as they relate to Nebraska

Freight is an important aspect of transportation and efficient freight movement is vital for the economic well-being of the US. The US Department of Transportation (USDOT) estimated that bottlenecks for trucks on highways across the nation caused 226 million hours of delay costing about $7.3 billion in 2006 (*1*). The demand for freight transportation is expected to increase with time, which will tax the existing transportation infrastructure that is already at capacity in many locations. Over the past 20 years, there has been a steady increase in the tonnage of freight shipped across the US. Given the tendency to store lower inventory levels by businesses, less slack production capacities by manufacturers, and a general increase in population (and thus an increase in freight demand), this trend is expected to continue into the future.

Table 1 from the National Commodity Flow Survey (*2*) presents comparative freight information on different modes for 2002 and 2007 in the US. Examination of Table 1 shows that overall freight ton-miles (one ton freight transported for one mile equals one ton-mile) increased by 6.6% and average

miles per shipment increased by 13.8% from 2002 to 2007. Freight transportation by trucks, rails, deep draft water vessels, and by parcel/USPS/courier increased in 2007 compared to 2002 while all other modes showed declines. Table 2 shows top commodities transported in the US based on tonnage and freight value. Overall, it appears reasonable to expect increase in freight transportation by trucks and rails across the US in the future.

Table 1. Shipment characteristics by modal activity for the US: 2007 and 2002 (Source: *2*)

Mode of transportation (1)	Ton-miles (2) 2007 (millions)	Ton-miles (2) 2002 (millions)	Percent change	Average miles per shipment 2007	Average miles per shipment 2002	Percent change
Total	**3,344,663**	**3,137,902**	**6.6**	**610**	**536**	**13.8**
Truck	1,351,531	1,261,813	7.1	203	168	20.7
Rail	1,549,557	1,360,760	13.9	852	893	-4.6
Shallow draft	208,611	258,386	-19.3	217	459	-52.8
Great Lakes	30,835	49,330	-37.5	426	354	20.4
Deep draft	92,060	75,544	21.9	1,431	1,498	-4.5
Air	4,425	5,659	-21.8	1,080	1,866	-42.1
Parcel, U.S.P.S. or courier	27,852	19,004	46.6	971	894	8.7
Other and unknown modes	33,510	44,253	-24.3	112	130	-13.7

(1) Estimates represent activity for a given mode across single and multiple mode shipments.
(2) Ton-miles estimates are based on estimated distances traveled along a modeled transportation network.
(3) Estimates exclude shipments of crude petroleum (SCTG 16).

Estimates are based on data from the 2007 and 2002 Commodity Flow Surveys. Because of rounding, estimates may not be additive.

Table 2. Top commodities transported in the US (Source: *3*)

Millions of Tons		Billions of Dollars	
Total, all commodities	**18,581**	**Total, all commodities**	**16,536**
Gravel	2,263	Machinery	1,762
Cereal grains	1,475	Electronics	1,432
Coal	1,444	Motorized vehicles	1,269
Non-metallic mineral products	1,392	Mixed freight	1,058
Waste/scrap	1,323	Pharmaceuticals	880
Natural gas & related[1]	1,277	Textiles/leather	696
Gasoline	1,005	Gasoline	691
Fuel oils	744	Misecllaneous manufactured products	689
Natural sands	570	Plastics/rubber	579
Crude petroleum	558	Articles of base metal	573

[1]Natural gas, selected coal products, and products of petroleum refining, excluding gasoline, aviation fuel, and fuel oil.

National estimates of freight transportation and future projections as they relate to Nebraska

On average in 2007, the US transportation system moved 51 million tons of freight worth $45 billion per day. Estimates from the Freight Analysis Framework version 3 (FAF^3, a federal program that integrates data from a variety of sources to estimate freight flows, *3*) show that freight tonnage decreased 2.4 percent in 2008 and an additional 11.1 percent in 2009 after many years of growth. However, it also indicates that tonnage started to rebound in 2010, increasing 4.6 percent since 2009 and reaching 91 percent of 2007 tonnage. Between 2010 and 2040, freight tonnage is forecast to increase at 1.6% per year. Annual tons per capita are forecast to increase 27 percent from 55 in 2010 to 70 tons per capita in 2040. According to the 2010 Freight Facts and Figures (*4*), the value of freight moved is expected to increase faster than the weight. The value of $890 per ton in 2007 is expected to increase to $2,145 per ton in 2040 (controlled for inflation). Based on national trends, it appears reasonable that Nebraska will experience increases in both tonnage and value of transported freight. Growth of freight transportation in the US implies an increase in freight transportation in Nebraska and as such NDOR's planning decisions will need to incorporate freight growth.

Changes in port facilities and implications for freight transportation as they relate to Nebraska

There are a couple of international changes related to freight transportation that could likely impact freight transportation in Nebraska. The first is the expansion of the Panama Canal by adding a third set of locks. The main purpose is to increase Panama's ability to benefit from the growing freight demand but any expansion of the Panama Canal will change US freight transportation patterns. Figure 1 shows the main commercial routes using the Panama Canal. The Canal currently has two lanes each with their own sets of locks. The original work on a third set of locks was undertaken by the US in 1939 but suspended in 1942 due to World War II. Since then many efforts were made for expansion without significant fruition until the recent expansion, work on which is ongoing. The location of the third set of locks will utilize a significant portion of the area originally excavated by the US. According to the Panama Canal

Authority (ACP), the ongoing expansion is expected to conclude by 2014 allowing ships almost twice the "Panamax" size (the maximum size of ships that can currently traverse the canal) to navigate the Canal. Detailed information on the expansion project is available at the Panama Canal official website: <www.panamacanal.com/eng/expansion> (accessed: July 21, 2011).

Trade patterns in the US may shift with increased Asian trade moving from the Pacific to the Atlantic ports in the US. In anticipation, the ACP is already forging partnerships with ports along the eastern seaboard of the US. An example is the press release dated 12th July, 2011 titled "Panama Canal and South Carolina Ports Authority Forge Ties" available at <http://www.pancanal.com/eng/pr/press-releases/2011/07/12/pr416.html> (accessed July 21, 2011). Other recent ACP renewals of strategic agreements are with the Maryland Port Administration (press release dated 27th June 2011), the Port of Huston Authority (press release dated 23rd June, 2011), and the Tampa Port Authority (press release dated 21st June, 2011), all available at the aforementioned website. At the same time some of the eastern seaboard ports are planning and investing in infrastructure to accommodate larger cargo vessels that will pass through the expanded Panama Canal. An example is the dredging of the harbor to 50 feet by the Port Authority of New York and New Jersey (*5*).

Figure 1: Main commercial routes using the Panama Canal (Map source: ACP)

The second change is the opening of the so called Northwest Passage, which is a sea route through the Arctic Ocean along the northern coast of North America connecting the Atlantic and Pacific Oceans (Figure 2). Historically, the Arctic pack ice prevented regular shipping but recent changes in the climate has reduced this pack ice and made the waterway more navigable (*6*). The route can be especially useful for ships that are too big to pass through the Panama Canal and must navigate around the tip of South America. While not fully operational, the opening of this route has already led to international disputes. According to Canada, it has full rights over those parts of the Northwest Passage that pass through its territory and that it can bar transit there. This has been disputed by the US and the European Union; they argue that the new route should be an international strait that any vessel can use (*6*). Notwithstanding political disputes, shipping via the Northwest Passage can significantly alter freight transportation patterns in the US.

The implications of these two international changes for Nebraska freight are difficult to ascertain at this time, if at all possible. Nonetheless, these two changes warrant careful monitoring in the future and assessment of likely impacts on Nebraska freight transportation when needed data are available.

Figure 2: Line showing the Northwest Passage (Map source: Google, Inc.)

Nebraska freight trends, issues and estimated tonnage/value moved by different modes of transport

Major freight corridors traverse Nebraska as shown in Figure 3. Some data on freight tonnage and value are available from the National Commodity Survey (CFS) while FAF^3 can be used to generate state profiles using total flows (tonnage or value) between US origins and destinations. Table 3 presents Nebraska freight statistics from the CFS but the CFS does not provide information on future projections. FAF^3 provides Nebraska estimates for 2007 and projections for 2040 by different modes of transportation. Table 4 presents freight flow tonnage (domestic, import, and export) via different transportation modes that originated in Nebraska in 2007 and projection for 2040. From NDOR's perspective it is desirable have information on traffic (e.g., number of trucks per day) rather than tonnage as well as pass-through truck traffic. However, such information was not readily available though it may possibly be obtained from FAF^3 analysis and output.

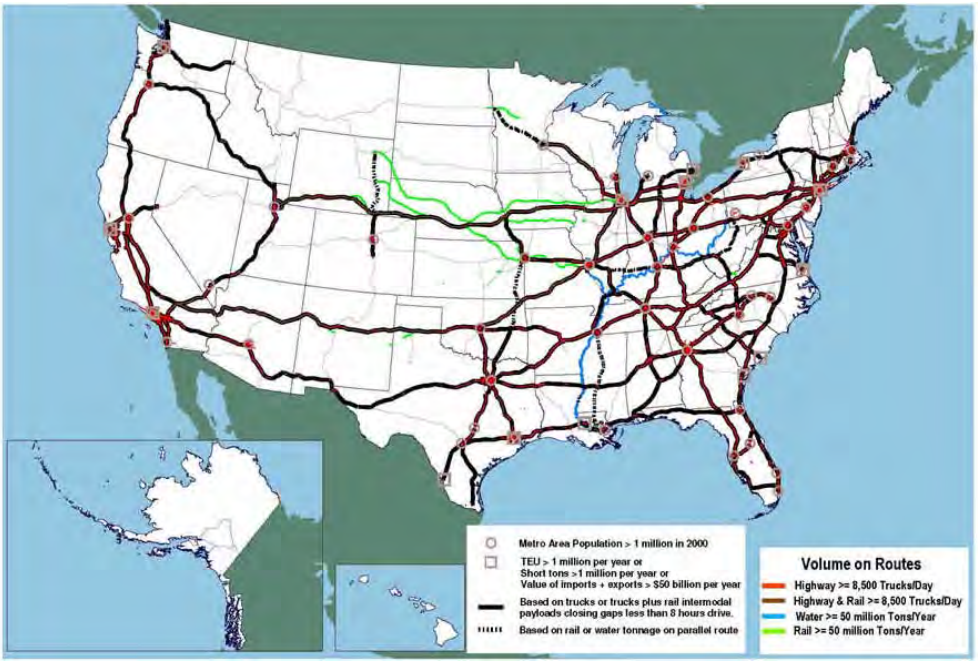

Figure 3. Major Freight Corridors in the US

(Map source: <http://ops.fhwa.dot.gov/freight/freight_analysis/nat_freight_stats/mjrfreightcorridors.htm>, accessed 7/20/2011)

Table 3. CFS shipment characteristics by mode of transportation for Nebraska as state of origin: 2007

Mode of transportation	Value		Tons		Ton-miles[1]		Average miles per shipment	Value		Tons		Ton-miles		Average miles per shipment CV
	2007 (million $)	Percent of total	2007 (thousands)	Percent of total	2007 (millions)	Percent of total		CV[2]	Standard Error of %	CV	Standard Error of %	CV	Standard Error of %	
All modes	**76,148**	**100**	**161,358**	**100**	**50,805**	**100**	**895**	**6.2**	**-**	**28.2**	**-**	**13**	**-**	**10.5**
Single modes	**63,621**	**83.5**	**156,931**	**97.3**	**46,702**	**91.9**	**205**	**6.1**	**2.5**	**28.8**	**1.1**	**14.3**	**2.8**	**13**
Truck[3]	56,836	74.6	131,667	81.6	14,568	28.7	161	6.8	1.9	34.3	3.6	4.5	5.5	15.3
For-hire truck	39,669	52.1	54,361	33.7	11,647	22.9	360	8.3	2.5	14.3	4	5.7	4.9	11.2
Private truck	17,167	22.5	S	S	2,922	5.8	49	13.2	2.5	S	S	14.2	1	12.5
Rail	6,618	8.7	25,212	15.6	32,123	63.2	1,112	12.6	1.2	19	3.9	21.5	7.7	9.2
Air (incl truck and air)	153	0.2	7	-	10	-	1,369	24.6	-	41.1	-	45.1	-	8.8
Pipeline[4]	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Multiple modes	**11,025**	**14.5**	**3,193**	**2**	**3,658**	**7.2**	**1,020**	**16.6**	**2.2**	**19.9**	**0.7**	**18.7**	**2.4**	**5.4**
Parcel, U.S.P.S. or courier	9,858	12.9	818	0.5	789	1.6	1,020	17.4	2	40.6	0.4	42.3	1	5.4
Truck and rail	1,147	1.5	2,372	1.5	2,859	5.6	1,177	15.9	0.2	16.8	0.4	17.6	1.6	10.3
Truck and water	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Other and unknown modes	**1,503**	**2**	**1,234**	**0.8**	**444**	**0.9**	**88**	**41.3**	**0.6**	**44**	**0.8**	**45.8**	**0.7**	**46.5**

KEY: S = Estimate does not meet publication standards because of high sampling variability or poor response quality. - = Zero or Less than half the unit shown; thus, it has been rounded to zero.

[1] Ton-miles estimates are based on estimated distances traveled along a modeled transportation network.

[2] Coefficient of Variation.

[3] "Truck" as a single mode includes shipments that were made by only private truck, only for-hire truck, or a combination of private truck and for-hire truck.

[4] Estimates for pipeline exclude shipments of crude petroleum.

NOTES: Rows are not shown if all cells for that particular row have no values. For example, specific state by mode rows are not shown in this table because there are no data for those rows. Value-of-shipment estimates are reported in current prices. Estimated measures of sampling variability for each estimate known as coefficients of variation (CV) are also provided in these tables. More information on sampling error, confidentiality protection, nonsampling error, sample design, and definitions may be found at http://www.bts.gov/publications/commodity_flow_survey/.

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics and U.S. Department of Commerce, U.S. Census Bureau, 2007 Economic Census: Transportation Commodity Flow Survey, December 2009.

Table 4. FAF[3] prediction for Nebraska freight tonnage

Mode to transportation	Total thousands of tons, 2007	Total thousands of tons, 2040	Increase %
Truck	222,371.7	373,005.5	67.7%
Rail	22,585.9	26,251.1	16.2%
Water	2.9	3.0	1.1%
Air (include truck-air)	19.9	38.1	91.2%
Multiple modes & mail	3,918.5	6,252.4	59.6%
Pipeline	556.8	451.8	-18.9%
Other and unknown	744.1	1,147.6	54.2%

(Data source: <http://faf.ornl.gov/fafweb/Extraction1.aspx>, accessed: 07/24/2011)

Freight tonnage by trucks is expected to increase by 67.7% while rail tonnage is expected to increase by 16.2%. Table 5 presents information on the monetary value of Nebraska freight in 2007 and 2040 projection (adjusted for inflation). The value of freight originating in Nebraska and transported via trucks is expected to increase by 118.6% while rail freight value is expected to increase by 56.5%. It is clear from tables 4 and 5 that significantly more freight tonnage and of greater value will be transported on Nebraska highways and rails in the future. Table 6 shows the top commodities by weight moved in Nebraska in 2002; in total 308.9 million tons of commodities were moved in Nebraska during 2002. Table 7 shows top trading partners in 2002 and 2035 while Table 8 presents Nebraska's top trading partners in 2002 and 2035 based on monetary value. It is clear that Iowa and Kansas are the two top trading partners for Nebraska based both on tonnage and monetary value.

A useful function of FAF^3 is that it assigns freight shipments to a highway network. This allows for the creation of maps that show the volume of traffic on different highways across the US. On the FAF^3 website, there are a number of maps available showing these volumes along with maps showing the peak-period congestion of the national highway system including 2040 counterparts. Figure 4 shows truck traffic volumes on major truck routes of the National Highway System in 2007 and 2040 (the red color indicative of heavy annual average daily truck traffic, greater than or equal to 8,500 trucks per day). Note that the entire portion of I-80 through Nebraska is shown in red for 2040. Figure 5 shows peak period traffic congestion on the National Highway System during 2007 and 2040 (again, the red color indicative of heavy congestion). Major eastern portions of I-80 passing through Nebraska appear heavily congested in 2040 during peak period. Note that it may be possible to obtain estimates of Nebraska truck traffic (i.e., number of trucks per day) and pass-through traffic by running FAF^3 but this was beyond to scope of this research.

Table 5. FAF[3] prediction for Nebraska freight monetary value (millions of 2007 dollars)

Mode of transportation	Total monetary value $, 2007	Total monetary value $, 2040	Increase %
Truck	84,937.4	185,675.7	118.6%
Rail	6,223.5	9,739.0	56.5%
Water	1.3	1.3	2.0%
Air (include truck-air)	536.3	1,216.3	126.8%
Multiple modes & mail	11,245.0	24,614.9	118.9%
Pipeline	396.4	272.0	-31.4%
Other and unknown	1,130.6	2,057.2	82.0%

(Data source: <http://faf.ornl.gov/fafweb/Extraction1.aspx>, accessed: 07/24/2011)

Table 6. Top commodities by weight moved in Nebraska (2002)

Tons (millions) Within State

Total	146.9
Cereal grains	80.9
Gravel	19.6
Other ag prods.	7.6
Live animals/fish	4.7
Animal feed	4.0

Tons (millions) From State

Total	78.4
Coal, n.e.c.[1]	26.9
Cereal grains	20.1
Other ag prods.	5.7
Other foodstuffs	4.0
Animal feed	3.5

[1] Coal and petroleum products, not elsewhere classified

Tons (millions) To State

Total	83.6
Coal, n.e.c.[1]	29.1
Cereal grains	11.0
Coal	9.1
Waste/scrap	5.2
Fertilizers	3.5

[1] Coal and petroleum products, not elsewhere classified

(Source: <http://ops.fhwa.dot.gov/freight/freight_analysis/faf/state_info/faf2/ne.htm>, accessed 07/18/ 2011)

Table 7. Nebraska's top trading partners in 2002 and 2035 based on tonnage (Originating in Nebraska)

Partner	2002 tonnage (millions)	2035 tonnage (millions)	Increase %
Total	162	338.9	109.2%
IA	41.3	80.7	95.4%
KS	23.5	48.1	104.7%
WY	21	38.5	83.3%
CO	16	41.6	160.0%
Foreign	4.2	6.6	57.1%

(Data source: http://www.ops.fhwa.dot.gov/freight/freight_analysis/faf/state_info/faf2/pdfs/ne.pdf>, accessed 07/25/2011)

Table 8. Nebraska's top trading partners in 2002 and 2035 based on monetary value (Originating in Nebraska)

Partner	2002 value ($)	2035 value ($)	Increase %
Total	100,254.4	254,800.5	154.2%
IA	18,048.0	42,837.8	235.8%
KS	9,956.7	24,939.0	137.4%
MO	7,680.6	19,753.3	150.5%
CO	7,340.9	20,229.1	163.4%
Foreign	2,882.0	9,677.0	169.1%

(Data source: http://www.ops.fhwa.dot.gov/freight/freight_analysis/faf/state_info/faf2/pdfs/ne.pdf>, accessed 07/25/2011)

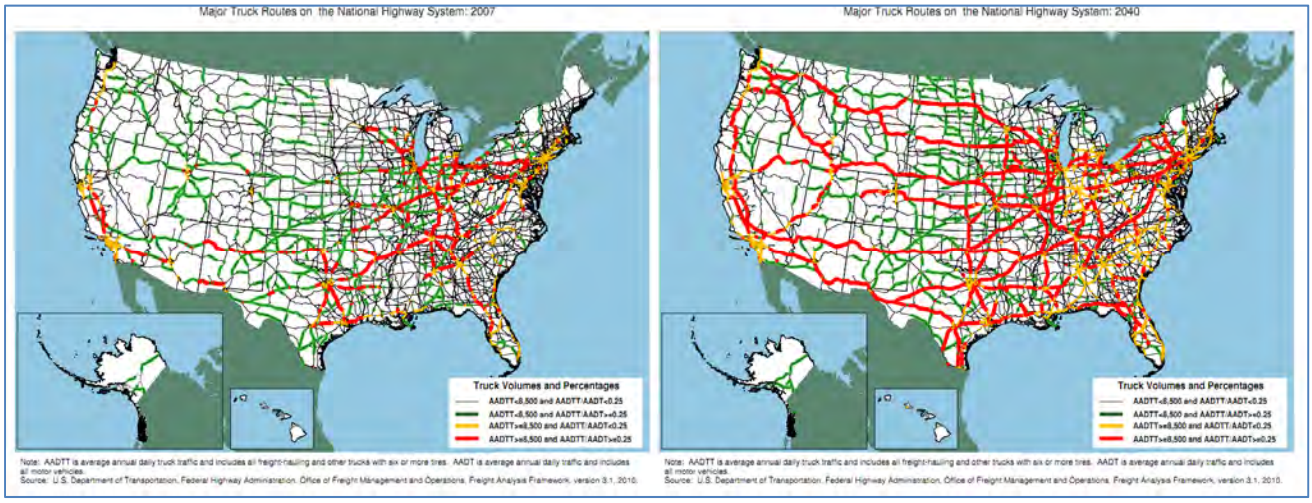

Figure 4. Truck volumes on the National Highway System in 2007 (left) and in 2040 (right)

(Map source: <http://www.ops.fhwa.dot.gov/freight/freight_analysis/nat_freight_stats/index.htm>, accessed 07/24/2010)

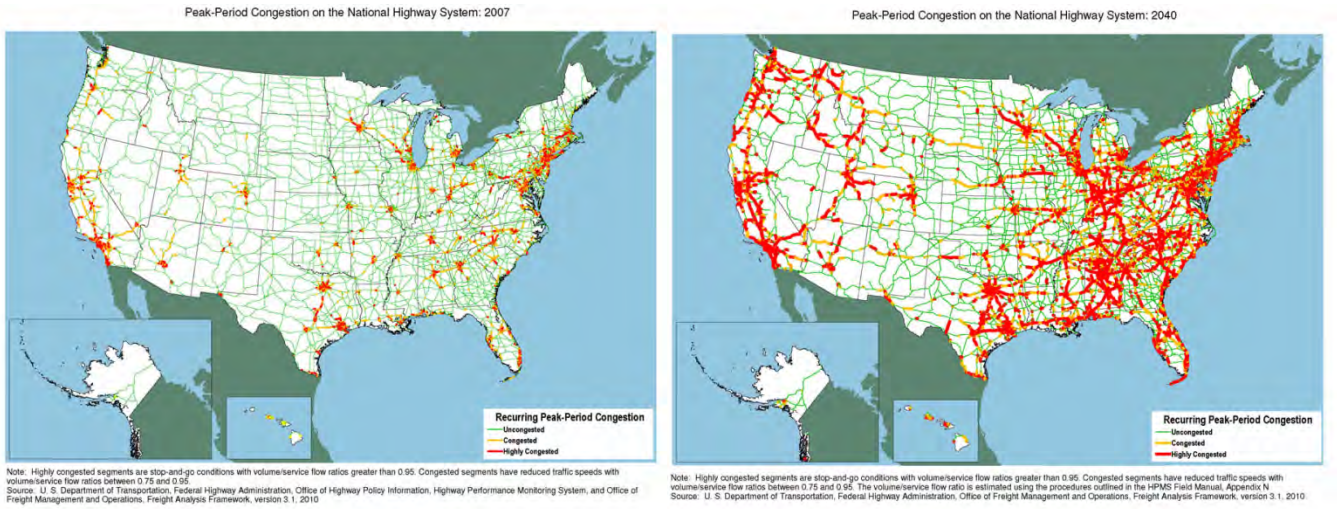

Figure 5. Peak-period congestion on the National Highway System in 2007 (left) and in 2040 (right)
(Source: <http://www.ops.fhwa.dot.gov/freight/freight_analysis/nat_freight_stats/index.htm>, accessed 07/24/2010)

Significant origination and termination points

While Nebraska's top freight trading partners are Iowa and Kansas, this research did not uncover any source of microscopic-level information on Nebraska freight origin and termination points. These are likely locations of intermodal connections, warehouses/storage facilities, and freight transfer stations, among others. Research is needed to identify those locations within and outside of Nebraska to enable more detailed intrastate as well as interstate freight analysis.

Implications of trends and issues for Nebraska and future needs

Trends in both truck and rail freight transportation are most relevant for Nebraska since major truck and rail freight corridors pass through Nebraska. While there has been a slight dip in freight transportation due to the recent economic slowdown, modeling results based on national survey data indicate that freight transportation will increase over the coming years. However, international changes such as the expansion of the Panama Canal and opening of the Northwest Passage are likely to impact freight transportation patterns in the US and in Nebraska. While it is difficult to assess the impacts of these changes on flow of freight in

Nebraska, it is worthwhile to keep abreast of these developments and perhaps assess their impacts sometime in the future when the developments are clearer and relevant data available. Future freight growth predictions indicate a very significant increase in Nebraska truck traffic. As such, future needs from NDOR's planning perspective will be accommodating the increasing truck traffic on Nebraska's highways and effectively dealing with the resulting wear of the highway infrastructure.

References

1. US Department of Transportation, Freight in America - A new national picture, 2006.

2. US Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics and U.S. Department of Commerce, U.S. Census Bureau, 2007 Economic Census: Transportation Commodity Flow Survey, December 2009.

3. US Department of Transportation, Federal Highway Administration, Office of Freight Management and Operations. The Freight Analysis Framework, Version 3. Overview of the FAF^3 National Freight Flow Tables, October 2010.

4. US Department of Transportation, Federal Highway Administration, Office of Freight Management and Operations, Freight Facts and Figures, 2010.

5. The Port Authority of New York and New Jersey. The Port Authority Strategic Plan—Transportation for Regional Prosperity. August 2006.

6. British Broadcasting Corporation (BBC) News, "Warming Opens Northwest Passage." Published September 14, 2007, available at: <http://news.bbc.co.uk/2/hi/americas/6995999.stm> (accessed: July 10, 2011).