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IMPACT OF KANSAS ETHANOL PRODUCTION ON KANSAS TRANSPORTATION

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16 Abstract

The rapid expansion of the biofuel industry has driven the Kansas agricultural transportation market into a new era. Nationally, fuel alcohol production increased 452 percent in the 2000-2008 period. The number of ethanol production plants rose 215 percent in the same time frame. These national trends have occurred in Kansas as well. As of May 2009, there were 10 operational ethanol plants with a combined annual capacity of 438 million gallons.

Many factors have contributed to the growth of the ethanol industry both in the U.S. and Kansas. Energy security and energy independence from unstable foreign countries has increased ethanol output. Global warming, caused in part by combustion of fossil fuels, has encouraged consumption of ethanol. Rural economic development related to corn and ethanol production has contributed to biofuel expansion. Federal energy policies require gasoline refineries to use 15 billion gallons of ethanol by 2015 and 36 billion by 2022.

The growth of the ethanol industry in Kansas affected the Kansas corn and sorghum markets in unknown ways with resulting implications for Kansas agricultural transportation. Will local markets develop for ethanol or will the major markets continue to be the east and west coasts? The answer could impact the demand for truck and rail transport of Kansas ethanol. Distillers' grain is a co-product of ethanol production and is used as livestock feed. To what extent will distillers' grain be exported or substituted for corn as livestock feed, and what will be the effect on the demand for truck and rail transport in Kansas? Expansion of ethanol production will increase motor carrier use of county roads in the vicinity of ethanol plants, and thus the rate of deterioration of these roads. The purpose of this research is to begin to answer these questions and others raised by increased ethanol production in Kansas.

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A Report on Research Sponsored By

THE KANSAS DEPARTMENT OF TRANSPORTATION
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PREFACE

The Kansas Department of Transportation's (KDOT) Kansas Transportation Research and New-Developments (K-TRAN) Research Program funded this research project. It is an ongoing, cooperative and comprehensive research program addressing transportation needs of the state of Kansas utilizing academic and research resources from KDOT, Kansas State University and the University of Kansas. Transportation professionals in KDOT and the universities jointly develop the projects included in the research program.

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EXECUTIVE SUMMARY

The rapid expansion of the biofuel industry has driven the Kansas agricultural transportation market into a new era. Nationally, fuel alcohol production increased 452 percent in the 2000-2008 period. The number of ethanol production plants rose 215 percent in the same time frame. These national trends have occurred in Kansas as well. As of May 2009, there were 10 operational ethanol plants with a combined annual capacity of 438 million gallons.

Many factors have contributed to the growth of the ethanol industry both in the U.S. and Kansas. Energy security and energy independence from unstable foreign countries has increased ethanol output. Global warming, caused in part by combustion of fossil fuels, has encouraged consumption of ethanol. Rural economic development related to corn and ethanol production has contributed to biofuel expansion. Federal energy policies require gasoline refineries to use 15 billion gallons of ethanol by 2015 and 36 billion by 2022.

The growth of the ethanol industry in Kansas affected the Kansas corn and sorghum markets in unknown ways with resulting implications for Kansas agricultural transportation. Will local markets develop for ethanol or will the major markets continue to be the east and west coasts? The answer could impact the demand for truck and rail transport of Kansas ethanol. Distillers' grain is a co-product of ethanol production and is used as livestock feed. To what extent will distillers' grain be exported or substituted for corn as livestock feed, and what will be the effect on the demand for truck and rail transport in Kansas? Expansion of ethanol production will increase motor carrier use of county roads in the vicinity of ethanol plants, and thus the rate of deterioration of these

roads. The purpose of this research is to begin to answer these questions and others raised by increased ethanol production in Kansas.

In order to address agricultural transportation issues related to increased ethanol production, the research project has the following objectives:

A. Investigate the transportation impact of Kansas ethanol production from the ethanol production industry point of view.
B. Investigate the transportation impact of Kansas ethanol production from the grain elevator industry point of view.
C. Measure the transportation impact of Kansas ethanol production from the Class I and shortline railroad perspective.
D. Investigate the impact of incremental truck traffic increases on state and county roads utilized by trucks serving Kansas ethanol plants.

Objective A was accomplished through personal interviews with managers of Kansas ethanol production plants. The managers were also asked to complete a questionnaire designed to measure the transportation impacts of ethanol production in Kansas.

The Kansas grain elevator industry supplies corn and sorghum to ethanol production plants. The research team conducted personal interviews of 21 managers of Kansas grain companies that collectively account for 227 grain elevators and nearly 200 million bushels of storage capacity. The managers were asked to complete a questionnaire to accomplish Objective B.

Objective C was accomplished by interviewing personnel of the two Class I railroads, Union Pacific and Burlington Northern Santa Fe, and the two shortline

railroads, Kansas and Oklahoma and Kyle Railroad, serving Kansas ethanol plants. Representatives of the four railroads were asked to complete a detailed questionnaire.

Objective D was accomplished by interviewing the County Engineer or County Road Supervisor of counties that have ethanol plants. Objective D was to investigate the impact of truck traffic in the vicinity of the ethanol plant on county road conditions. Accordingly, the county representative was asked to complete a questionnaire on this and other road condition issues.

The major conclusions are as follows:

1. In 2008, Kansas ethanol plants processed 156.2 million bushels of corn and sorghum. Truck shipments accounted for 91 percent of total inbound feedstock (corn and sorghum), with railroads accounting for the other 9 percent. With respect to inbound truck shipments, nearly 98 percent were delivered in five axle, 80,000 pound semi-tractor trailer trucks. In a typical five day business week, the 10 Kansas ethanol plants unloaded 3,358 semi-tractor trailer loads of corn and sorghum with 82 percent of the shipments from grain elevators and the other 18 percent from farmers.
2. Outbound Transportation of Kansas Ethanol

   The outbound transportation of Kansas ethanol includes shipments of ethanol and co-products DDG (dry distiller's grain) and WDG (wet distillers' grain). DDG is dry pellets that can be shipped longer distances, while WDG contains moisture and is shipped a short distance. Rail is the dominant mode for transport of ethanol, accounting for 60 percent of shipments. California and Texas were cited by the most ethanol plant

managers as destinations for rail ethanol shipments. In general, rail was the preferred mode for long distance ethanol shipments.

Population centers in the states bordering Kansas were the principal destination markets for truck shipments of ethanol. Six plants shipped ethanol by truck to Oklahoma (mainly Oklahoma City), and four plants had truck shipments to Colorado (primarily Denver). Five ethanol plants shipped by truck to Kansas refineries, fuel blending stations, and retail outlets. Three plants had ethanol truck shipments to Texas population centers including Dallas-Fort Worth, Houston and Amarillo. In general, motor carrier was the preferred mode for relatively short distance ethanol shipments.

Kansas feedlots and feed mills were named by all 10 Kansas ethanol plants as a primary market for DDG and WDG. All these deliveries were by motor carrier.

3. Impact of Ethanol Production on the Kansas Grain Industry

The effects of Kansas ethanol plants on the Kansas grain industry were measured by obtaining data from 21 Kansas grain companies who collectively own and operate 227 grain elevators, and had 2007 corn receipts of 106 million bushels and 83.5 million bushels of sorghum. In 2007, the 21 companies shipped 21.2 percent of their corn receipts and 26.5 percent of their sorghum receipts to Kansas ethanol plants. All these deliveries were by motor carrier.

The increased role of ethanol plants in the Kansas corn and sorghum markets has altered shipments to non-ethanol plant markets, primarily Kansas feed yards and feed mills. Nearly all these shipments were by motor carrier as only 4 of 21 sample companies shipped corn by rail to non-ethanol plant locations, mainly livestock feeding locations in California, Arizona, New Mexico, Oklahoma and Texas.

Unlike corn, a large percentage of the sample grain company's outbound sorghum shipments to non-ethanol plant locations were by rail (47 percent). Texas Gulf of Mexico ports were the only sorghum destinations for rail shipments. The principal destination markets for truck shipments were Kansas feed yards and feed mills.

4. Summary of Impacts of Ethanol Production on the Kansas Corn and Sorghum Markets

The consensus opinion of the 21 Kansas grain company representatives is that the growth of Kansas ethanol production has affected the traditional markets for Kansas corn and sorghum. In the corn market, the percent of shipments from country elevators to feedlots has declined and the percent shipped to ethanol plants has increased. However, as before, nearly all these shipments are by motor carrier. The impact in the sorghum market has been to increase the percent of truck shipments from country elevators to Kansas ethanol plants, and decrease the percent of rail shipments to distant livestock feeding locations and

Texas Gulf of Mexico export ports. The percent of sorghum truck shipments to feed yards and mills has also declined.

5. Ethanol Plants and Railroad Transportation

In 2008, Class I railroads delivered 2,470 carloads of corn to Kansas ethanol plants. Iowa was the origin state for nearly all of these shipments. Railroads play a much larger role in the outbound shipments from Kansas ethanol plants than the inbound shipments of feedstock (corn and sorghum). In 2008, Class I railroads shipped 8,199 cars from Kansas ethanol plants. Two shortline railroads shipped a combined total of 1,028 cars of ethanol which they subsequently interlined to a Class I railroad for shipment to the final destination. Thus, the 1,028 cars are part of the nearly 8,200 cars shipped by Class I railroads.

The West region (California, Oregon, and Washington) and the South region (Texas, Oklahoma, and Louisiana) accounted for the largest percentage of rail ethanol shipments from Kansas with 30.8 percent and 29.5 percent of the total, respectively. The region east of the Mississippi River and the state of Arizona accounted for 19.1 percent and 16.1 percent of total ethanol rail shipments from Kansas.

6. Impacts of Ethanol Plant-Related Truck Traffic on Kansas County Roads

The county engineers or road supervisors said the current condition of their county's roads is reasonably good. About 60 percent of the concrete roads were rated good or Very Good. With Sedgwick County included in the eight county sample, about 62 percent of the asphalt roads

were rated Good or Very Good. When Sedgwick County is excluded from the sample this percentage falls to about 39 percent. For the unpaved roads, the respondents rated 48 percent of the miles as Good or Very Good. The county representatives were divided in their opinions of whether the overall condition of the county's roads was worse, better, or unchanged compared to five years ago. Four of the eight respondents said there was no change while the other four were evenly divided between the worse or better categories.

Six of the eight county engineers/road supervisors said truck traffic entering and leaving the ethanol plants has had an impact on the condition of the county's roads. However, the respondents were divided on the question of whether ethanol plant-related truck traffic had affected the county's annual expenditure for road and bridge maintenance. Three county representatives responded "Yes," three said "No," and two were not sure. Also, seven of the eight respondents said that incremental truck traffic had not impaired the ability of the county to maintain an adequate level of service on the county's roads. However, some respondents indicated that the ethanol plant had opened recently and that it was too soon to tell what the longer run impact would be on the condition of the county's roads.

7. The Future of Ethanol Production in Kansas

To gain perspective on the future transportation requirements of ethanol and its co-products, the ethanol plant managers were asked their

opinions regarding the future of ethanol production in Kansas. The consensus opinion is that the number of Kansas ethanol plants is not likely to increase, but that those that are established will be able to increase production in the future.

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This research project could not have been completed without the assistance and cooperation of many people, John Rosacker of the Kansas Department of Transportation was helpful in obtaining funding for the research project and managed the project in a professional manner. Jamie Stewart typed the final report. Special thanks go to representatives of Kansas ethanol plants, Kansas grain companies, Class I and shortline railroads, and county engineers and road supervisors. Without their cooperation and assistance, this study would not have been possible.

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CHAPTER 1 - INTRODUCTION

1.1 The Research Problem

The rapid expansion of the biofuel industry has driven the Kansas agricultural transportation market into a new era. Nationally, fuel alcohol production increased from 1,630 million gallons in 2000 to 9,000 million gallons in 2008, a 452 percent increase. The number of ethanol production plants rose from 54 in January 2000 to 170 in January 2009, a 215 percent increase. In addition, there are currently 24 plants under construction or expanding nationwide. The number of farmer owned plants rose from 18 in January 2000 to 49 currently, accounting for 28 percent of total U.S. ethanol production capacity.

Many factors have contributed to the growth of the U.S. ethanol industry. Energy security and energy independence from unstable foreign countries has increased U.S. ethanol output. Global warming caused in part by combustion of fossil fuels has encouraged consumption of ethanol. Rural economic development related to corn and ethanol production has contributed to biofuel expansion. Federal energy policies require gasoline refineries to use 15 billion gallons of ethanol by 2015 and 36 billion gallons by 2022. The record high prices of oil in the first half of 2008 contributed to ethanol production growth. However, the substantial decline in oil prices which began in the fall of 2008 has contributed to a slowdown in the demand for ethanol.

These national trends have occurred in Kansas as well. As of May 2009, there were 10 operational ethanol plants with a combined annual capacity of 438 million gallons, with one additional plant under construction with a projected capacity of 20 million gallons.

The growth of the ethanol industry in Kansas affected the Kansas corn and sorghum markets in unknown ways with resulting implications for Kansas agricultural transportation. One of the impacts of increased ethanol production is increased corn production. In the period from 1990-2000 Kansas corn production increased from 188.5 million to 412.1 million bushels, a 119 percent gain. Corn production has exceeded wheat production since 2000 (except 2003), and in 2008 was 37 percent greater than wheat output (486.4 vs. 356 million bushels). In 2007 about 54 percent of the Kansas corn crop was produced in the three western Kansas crop reporting districts (CRD) with the southwest CRD alone accounting for 29 percent of the state total. Other major Kansas corn production areas are the South Central (about 12 percent) and the Northeast (about 13 percent).

Kansas corn is delivered by motor carrier at harvest to the nearest country elevator. Prior to the expansion of ethanol production in Kansas, the primary destination corn markets of country elevators were Kansas, Oklahoma, and Texas livestock feedlots with motor carriers accounting for all of these shipments. In Kansas, most of these corn shipments went to the three western Kansas CRDs which account for 77 percent of the feedlots in Kansas. Some corn was shipped from country elevators by truck to alcohol plants. About 15 to 20 percent of the corn was shipped from country elevators by truck to large terminal elevators in Hutchinson, Wichita, Salina, Topeka, and Kansas City and then subsequently shipped by railroad to the Texas Gulf of Mexico ports for export or to livestock feed locations in other states.

The growth of ethanol production in Kansas has the potential to alter, in unknown ways, the traditional Kansas corn logistics system. It seems likely that Kansas corn

production will continue to increase given the trend of the last 10 years. The grain elevator system will need to adapt to changes in corn receipts. The outbound corn shipments to feedlots, ethanol production plants, and other markets have changed in unknown ways. Will local markets develop for ethanol or will the main markets continue to be the east and west coasts? The answer will impact the demand for truck and rail transport of Kansas ethanol. Distillers' grain is a co-product of ethanol production and is used as livestock feed. To what extent will distillers' grain be exported or substituted for corn as livestock feed, and what will be the effect on the demand for truck and rail transport in Kansas? The expansion of ethanol production will affect motor carrier road use of state and county roads in the vicinity of ethanol plants, and thus the rate of deterioration of these roads. The purpose of this research is to begin to answer these questions and others raised by increased ethanol production in Kansas.

1.2 Research Objectives

In order to address the agricultural transportation issues related to increased ethanol production and inform Kansas transportation policymakers of potential highway impacts of increased truck traffic, the research project has the following objectives.

Objective A – Investigate the transportation impact of Kansas ethanol production from the ethanol production industry point of view.

Objective B – Investigate the transportation impact of Kansas ethanol production from the grain elevator industry point of view.

Objective C – Measure the transportation impact of Kansas ethanol production from the Kansas Class I and shortline railroad perspective.

Objective D – Investigate the impact of incremental truck traffic on state and county road condition in the vicinity of Kansas ethanol plants.

1.3 Kansas Ethanol Plants

As of May 2009, there were 10 ethanol plants operating in Kansas (Table 1.1). Most of the plants are located in the western half of Kansas with East Kansas Agri-Energy being the lone exception. The plants vary widely in terms of production capacity with Arkalon Energy, LLC the largest (110 million gallons per year) and NESIKA Energy, LLC (the smallest 10 million gallons per year). The total production capacity of the 10 Kansas ethanol plants is 438 million gallons per year, and they collectively use 156.2 million bushels of grain annually. Four of the plants are served by the Union Pacific Railroad and one by the BNSF Railway. The Kansas and Oklahoma Railroad serves two plants and the Kyle Railroad serves Prairie Horizon Agri Energy. Reeve Agri Energy and NESIKA Energy are not located on a railroad. Abengoa Bioenergy Corp and Reeve Agri Energy have been in operation the longest (since 1982). White Energy began operation in 2001. The rest of the plants started production in the period from 2004-2008.

1.4 U.S. Ethanol Demand and Supply

The demand for ethanol is concentrated in high population density states where most of the people and vehicles are located. Table 1.2 contains the top dozen ethanol consumption states, which account for 84.4 percent of the total U.S. ethanol consumption. The top two states are California (17.54 percent) and New York (13.82 percent) which together consume 31.4 percent of the U.S. total. Texas accounts for 8.19 percent and a group of Midwestern states (Illinois, Ohio, Michigan, Minnesota, and

Wisconsin) collectively account for 29.12 percent of total consumption. Four eastern states (North Carolina, Pennsylvania, Virginia, and Connecticut) together account for 15.7 percent of total U.S. ethanol consumption.

Table 1.1: Kansas Ethanol Plants

KANSAS ETHANOL PLANTS
(PRODUCTION CAPACITY IN MILLIONS OF GALLONS PER YEAR)

Production Plant	Location	Production Capacity	Starting Date	Bushels of Grain Used	Originating Railroad
Abengoa Bioenergy Corp	Colwich	25	1982	8.9 million	Kansas & Oklahoma
Arkalon Energy, LLC	Hayne (near Liberal)	110	2007	39 million	Union Pacific
Bonanza Energy, LLC	Garden City	55	2007	19.6 million	Burlington Northern Santa Fe
East Kansas Agri-Energy	Garnett	40	2005	12.5 million	Union Pacific
Kansas Ethanol, LLC	Lyons	55	2008	19.6 million	Kansas & Oklahoma
Prairie Horizon Agri-Energy	Phillipsburg	40	2006	14.3 million	Kyle Railroad
Reeve Agri Energy	Garden City	13	1982	5.4 million	None
Western Plains Energy, LLC	Campus (near Oakley)	45	2004	16.1 million	Union Pacific
White Energy	Russell	45	2001	17.2 million	Union Pacific
NESIKA Energy, LLC	Scandia	10	2008	3.6 million	None
Total Capacity and Grain Used		438		156.2 million	

Source: (Location, Production Capacity, and Bushels of Grain Used) *Kansas Ethanol Production*, Kansas Corn Commission, Kansas Corn Growers Association, and Kansas Grain Sorghum Producers Association (http://www.ksgrains.com/ethanol, accessed February 2009).

Figure 1.1: Location of Kansas Ethanol Plants

Table 1.2: Top Dozen Ethanol Consumption States 2006

TOP DOZEN ETHANOL CONSUMPTION STATES 2006

Rank	State	Thousands of Gallons	Percent of Total U.S. Consumption
1	California	906,089.5	17.54%
2	New York	714,068.9	13.82
3	Illinois	435,156.9	8.42
4	Texas	422,881.2	8.19
5	Ohio	400,395.8	7.75
6	Michigan	275,413.7	5.33
7	Minnesota	263,045.4	5.09
8	North Carolina	225,837.2	4.37
9	Pennsylvania	218,721.5	4.23
10	Virginia	209,150	4.05
11	Connecticut	157,201.9	3.04
12	Wisconsin	130,444.7	2.53

Source: U.S. Department of Energy, Energy Information Administration, State Energy Data System (www.eia.doe.gov/emeu/states).

Table 1.3: Major Ethanol Production States, 2008

MAJOR ETHANOL PRODUCTION STATES, 2008

State	Number of Operating Plants	Number of Plants Under Construction/Expansion	Total Plants
Iowa	30	10	40
Nebraska	19	4	23
Minnesota	17	3	20
South Dakota	16	0	16
Kansas	10	1	11
Indiana	7	4	11
Illinois	7	3	10
Wisconsin	7	2	9
Total	113	27	140

Source: Renewable Fuels Association. *Changing the Climate: Ethanol Industry Outlook 2008*. pp 10-13 (http://www.ethanolrfa.org).

Most of the U.S. ethanol production is concentrated in the eight Midwestern states in Table 1.3. These states collectively account for 81.3 percent of the operating ethanol plants in the U.S. Iowa is the leading ethanol production state accounting for 21.6 percent of the national total of operating ethanol plants. Other leading ethanol producing states are Nebraska (13.7 percent), Minnesota (12.2 percent) and South Dakota (11.5 percent) and Kansas ranks fifth in terms of operational ethanol plants, accounting for 7.2 percent of U.S. total ethanol plants.

1.5 Methodology

Objective A was accomplished through personal interviews with the managers of Kansas ethanol production plants listed in Table 1.1. The managers were also asked to complete a questionnaire designed to measure the transportation impacts of ethanol production in Kansas. The questionnaire contained the following sections.

A. Production and Capacity
B. Inbound Transportation
C. Outbound Transportation
D. Carrier Choice Decisions
E. Kansas Transportation Infrastructure.
F. The Future

The Kansas grain elevator industry supplies the corn and sorghum to the ethanol production plants. The research team conducted personal interviews with 21 managers of Kansas grain companies that collectively account for 227 elevators and 199.6 million bushels of storage capacity. The managers were also requested to complete a questionnaire with the following sections to accomplish Objective B.

A. Grain Receipts

B. Outbound Transportation (corresponds to inbound transportation of ethanol plants)

C. Carrier Choice Selection

D. Summary (how have your markets for corn and sorghum changed as a result of increased ethanol production in Kansas).

Objective C was accomplished by interviewing personnel of the two Class I railroads, Union Pacific and Burlington Northern Santa Fe, and the two shortline railroads Kansas and Oklahoma, and Kyle Railroad serving Kansas ethanol plants. Representatives of the four railroads were requested to complete a questionnaire covering the following topics:

A. General Questions

B. Corn Shipments to Kansas Ethanol Plants

C. Outbound Ethanol Shipments from Kansas

D. Outbound DDG Shipments from Kansas Ethanol Plants

E. Summary (expected ethanol car loadings in the next five years)

Objective D was accomplished by interviewing the County Engineer or County Road Supervisor of counties that have ethanol plants. These counties are Sedgwick, Seward, Finney, Anderson, Rice, Phillips, Russell, and Republic. Objective D is to investigate the impact of truck traffic in the vicinity of the ethanol plant on county roads. Accordingly, a questionnaire for the county representative to complete was designed containing the following areas.

A. Current Condition of the County Roads

B. Revenue and Expenses

C. Impact of Ethanol Plant on County Roads

CHAPTER 2 - LITERATURE REVIEW

Yu and Hart, in "The 2006/07 Iowa Grain and Biofuel Flow Study: A Survey Report," (2008) analyze transportation flow patterns of crops and biofuels in order to understand what new logistical issues, resulting from the changing biofuel markets, will need to be dealt with to best manage Iowa's transportation system resources in the future. They accomplish this goal by surveying grain marketers, grain handlers, corn/ethanol processors, and biodiesel producers concerning their grain, biofuels, and biofuel co-product transport flows in the 2006-2007 marketing year.

From these surveys they learn that 62 percent of Iowa grain is shipped to country grain elevators, though this market share has been steadily declining in recent years, due to increasing direct sales from farms to grain processors. Corn sales to livestock feeders have also declined recently. However, Iowa livestock feeders have remained the primary end users of corn thus far. Competition for corn will increase due to the increasing market for biofuels. Farms have increasingly been switching to the use of semi-trucks to haul their grain, which will change road maintenance and infrastructure requirements.

Most of the corn used for Iowa ethanol production came from instate producers, but ethanol and DDG's produced by Iowa firms was purchased by buyers in other states. The most significant buyers of Iowa ethanol were Western, Midwestern, and Southern Plains states. During the 2006 marketing year most ethanol plants only extracted soybean oil. They are expected to diversify with corn oil because of the strong vegetable oil market. This diversification would generate extra revenue for ethanol plants, and provide extra feedstock to Iowa biodiesel refineries. The biggest

transportation infrastructure problems identified in the surveys were unimproved gravel roads, while the biggest marketing problem was transportation costs.

Marina Denicoff, in “Ethanol Transportation Backgrounder: Expansion of U.S. Corn-based Ethanol from the Agricultural Transportation Perspective,” (2007) examines the changes in corn-based ethanol transportation requirements and grain transportation caused by growth in the ethanol industry. Denicoff accomplishes this task by analyzing surveys taken by USDA personnel.

Denicoff arrives at several conclusions from this study. In the first six months of 2007, ethanol production was 32 percent higher than it was in the first six months of 2006. The higher demand for ethanol has caused corn prices and production to increase. Increased corn production is affecting grain transportation; corn is being used less as feed or for export and more for ethanol production. Most ethanol is produced in the Midwest, while most of the demand for ethanol is on the coasts. The capacity of the U.S. transport system for moving ethanol production inputs and outputs and limitations on ethanol plant location will be issues to consider as ethanol production expands.

Denicoff also analyzes two models that predict future ethanol production growth and finds that railroad usage will be affected by a decrease in grain rail shipments and an increase in ethanol and DDG rail shipments. Barge shipments may decrease due to a decrease in exports of corn.

Denicoff found that in 2005 that 60 percent of ethanol was shipped by rail, 30 percent by trucks, and 10 percent by barge. Currently ethanol production expansion has not been limited by logistics; from 2006 to 2007 ethanol production increased by 26

percent, while railroad shipments of alcohol, which consists mostly of ethanol, grew by 28 percent.

Wu and Markham, in “Opportunity for Class II and III Railroads in Ethanol and Its Co-product Transportation: A Survey Study in Minnesota,” (2008) suggest strategies that will ensure that ethanol growth in Minnesota is not hampered by logistical problems. In order to identify the key logistics factors that may cause problems in the future, Wu and Markham evaluate Minnesota Department of Agriculture surveys of Minnesota ethanol plant managers.

Some of the logistics issues that the ethanol plant managers were concerned about are railroad turn-around time, the amount of ethanol purchasers who are able to receive ethanol in large amounts, the poor condition of rail track, the lack of funds to improve the rail track, and costly and unreliable transportation. The transportation capacity for ethanol, DDG’s, and the railroad’s reluctance to accept public funding, due to the increased government oversight of the railroads that this would create, also worries plant managers. A larger local market for DDG’s and more pipelines available to transport denatured ethanol would allow ethanol plants to avoid some of the limitations of railroads. The limited amount of containers for exporting DDG’s may also become a problem in the future.

Wu and Markham’s strategy for addressing these issues consists of an educational program, public-private partnership, and policy support. An educational program would ensure unimpeded ethanol growth by letting stakeholders know what potential logistics problems there are and what negative consequences will come about if nothing is done. It would help to distribute information about federal and state loans

and funding to guarantee that there is adequate funds available for investment in the rail and pipeline improvements.

Public-private partnerships are key in accumulating enough investment in railroad infrastructure, and forming public-private partnerships complies with Minnesota's Statewide Freight Plan. Policy support can also aid in finding investment funds for the railroads. The Freight Rail Infrastructure Capacity Expansion Act gives a tax credit for freight rail investment. Antitrust laws applied to railroads may keep transportation costs down for ethanol plants by increasing railroad competition; however, these laws should be used wisely, since they have potential to decrease railroad profits and decrease rail investment in the long run.

Brown and Westhoff, in "The Food, Conservation and Energy Act of 2008: Preliminary Analysis of Selected Provisions," (2008) examines the biofuel and agricultural market impacts of the 2008 Food Conservation and Energy Act as well as a few other biofuel related policies. In order to ascertain the effects of these policies the authors analyze a stochastic baseline for U.S. agricultural markets created by the Food and Agricultural Policy Research Institute (FAPRI) in the beginning of 2008. In particular, Brown and Westhoff are concerned about the market effects of ethanol tariffs and tax credits under binding and nonbinding mandates, caused by the Energy Independence and Security Act of 2007 (EISA), on the levels of different classes of biofuels used in the U.S.

The authors find that tariffs on ethanol will significantly affect ethanol imports. However, the effect on domestic producer prices and production and on agricultural markets of a tariff on ethanol will be negligible. If the mandates caused by EISA are

binding, all effects of an ethanol tariff may be mostly negated. Assuming binding EISA mandates, market effects of ethanol tax credits will be limited despite their consumer and tax payer costs. Without binding EISA mandates, tax credits will cause a considerable increase in biofuel use and production. This increase in biofuel production will cause higher agricultural commodity prices.

In “Derivation of Crop Residue Feedstock Supply Curves Using Geographic Information Systems” (2009), Khachatryan, Jessup, and Casavant explore the economic feasibility of cellulosic ethanol production in Washington State by presenting the availability, transportation and collection costs of crop residue (one of nine feedstocks for cellulosic ethanol production).

The authors assume crop residue will be transported to the refineries by truck. They estimate feedstock availability for each county by using census feature classification codes to assign speed limits to roads in the 12 counties studied in order to calculate haul times to various refineries within each county. The authors used GIS Network Analyst extension, software used for network-based georeferenced data analyses, to examine the geographical differences in crop residue availability of the 12 counties sampled in this study. Khachatryan et al. (2009) chose these counties because they produce 93.5 percent of Washington’s crop residue. Next the authors use information on farm gate costs, transportation costs, physical availability, and geographic distribution to obtain crop residue supply curves. The authors also conduct a sensitivity analysis of feedstock delivery costs to diesel prices.

From analyzing the feedstock supply curves derived, the authors conclude that transportation costs considerably influence the delivered cost of the feedstock, however

the magnitude of this influence depends on the size capacities of the processing plants and transportation distances to them. The sensitivity analysis the authors perform shows that processing plants of small capacity, relative to those of large capacity, have delivered feedstock costs that are less sensitive to increasing diesel prices.

Thompson and Meyer simulate consumer demand for ethanol together with ethanol transportation costs with respect to changes in benchmark oil and ethanol prices in "Simulated Ethanol Transportation Patterns and Costs" (2009). The authors produce ethanol output by using a simulation model. In order to calibrate the model, the authors use recent data on the consumption of E10 and E85; however they worry that this consumption data will not be very representative of the future consumption of ethanol due to recent market changes such as the substitution of methyl tertiary butyl ether (MTBE), with ethanol as the main additive to fuel. To account for this the authors used a stylized representation of demand and transportation costs. The authors assume that ethanol transportation services supply is perfectly elastic but also affected by changes in oil prices.

The authors find that the relationship between ethanol and oil benchmark prices and ethanol transportation costs is a non-linear one. This relationship depends on how widely used ethanol is within a state and how close local ethanol prices are to the price of corresponding types of energy. For states with widespread use of ethanol, the authors find that the amount of ethanol shipped to that state is insensitive to fuel prices, but, of course, an increase in transportation prices for ethanol will increase transportation expenditures. The authors also find that states where ethanol is less widely used as an additive have a more price sensitive demand for ethanol. This price

sensitivity is increased if fuels with different levels of additives are locally priced the same. The authors also note that the difference in energy values between ethanol and the fuel it is replacing will cause an increase in each state's transportation services used because a larger volume of gasoline with an ethanol additive will be required to meet the same energy requirement as gasoline with a MTBE additive.

CHAPTER 3 - TRANSPORTATION OF KANSAS ETHANOL PLANTS

3.1 Kansas Ethanol Plant Capacity and Production

As noted in Chapter 1, the traditional markets for Kansas corn and sorghum are livestock feedlots in Kansas, Oklahoma, and Texas, and large grain terminals located in Hutchinson, Wichita, Salina, Topeka, and Kansas City. Most of the latter were subsequently shipped to Texas Gulf of Mexico ports for export. The growth of ethanol production in Kansas has provided an additional market for Kansas corn and sorghum, and the transportation impacts of this new market is the subject of this chapter. As indicated in Table 1.1, the combined production capacity of the 10 operational ethanol plants is 438 million gallons. When the 2007 production of six of the plants is combined with the 2008 production of two plants, and the April 2008 to May 2009 production of two other plants the total is approximately 438 million gallons annually.

Ethanol plants also produce co-products- Dry Distillers Grain (DDG) and Wet Distillers Grain (WDG). The 10 Kansas Ethanol plants collectively produced 2.35 million tons of DDG plus WDG. Both DDG and WDG are used as livestock feed.

To annually produce 438 million gallons of ethanol and 2.35 million tons of co-products, the 10 Kansas ethanol plants used 156.2 million bushels of grain (corn plus sorghum). The combined Kansas corn and sorghum production in 2008 was 700.9 million bushels. Thus the 10 Kansas ethanol plants absorbed 22.3 percent (156.2/700.9 x 100) of the combined Kansas production of corn and sorghum in 2008.

3.2 Inbound Transportation

The Kansas ethanol plants processed 156.2 million bushels of corn and sorghum in 2008. Truck shipments accounted for 91 percent of total inbound feedstock with railroads accounting for the remaining 9 percent. With respect to inbound truck shipments, 97.5 percent was delivered by semi-tractor trailer trucks with the other 2.5 percent being delivered in either single axle or tandem axle trucks. In a typical five day business week, the 10 Kansas ethanol plants unloaded 3,358 semi-tractor trailer loads of corn or sorghum, with 82 percent of the shipments from grain elevators and the other 18 percent from farmers.

Most of the corn and sorghum truck shipments originate in the local area of the ethanol plants with 56.7 percent of the shipments originating within 50 miles of the plant and 91 percent within 100 miles of the plant. The remaining 9 percent are rail shipments originating in Iowa and Minnesota. Since the Kansas ethanol plants rely on the local area for corn and sorghum supply, the great majority of the truck shipments originate in Kansas (87 percent) with 8 percent from Nebraska and minor amounts from Missouri locations. The rail shipments are predominantly from Iowa with a minor amount originating in Minnesota.

3.3 Outbound Transportation

The outbound transportation of Kansas ethanol plants includes shipments of ethanol and co-products (DDG and WDG). Shipments occur by both rail and truck; however, rail is the dominant mode for outbound shipment of ethanol, accounting for 60 percent of the volume of shipments. Five plants shipped ethanol by rail to population centers in California, and four plants shipped ethanol to Texas by rail. Other rail

shipment destinations include population centers in Illinois, New Mexico, Arizona, New York, Washington, and Oklahoma. In general, rail was the preferred mode for long distance ethanol shipments.

Population centers in the states bordering Kansas were the principal destination markets for truck shipments of ethanol. Four Kansas plants shipped ethanol by truck to Colorado (primarily Denver), while six plants had ethanol truck shipments to Oklahoma (primarily Oklahoma City). Five ethanol plants shipped by truck to a wide variety of Kansas locations including Kansas City, Topeka, Wichita, Salina, Coffeyville, Great Bend, and El Dorado. These locations include refineries, fuel blending locations, and retail outlets. Three plants had ethanol truck shipments to Texas population centers including Dallas-Ft. Worth, Houston, and Amarillo. Other states that were truck shipment destinations for Kansas ethanol plants include Missouri, Arkansas, and New Mexico. In general, motor carrier was the preferred mode for relatively short distance ethanol shipments.

In the 2006-2008 period about 400 to 500 rail carloads (40,000 to 50,000 tons) of DDG and WDG was shipped from Kansas locations (primarily to California), but most of the transportation of DDG and WDG is handled by motor carrier. DDG and WDG are high protein livestock feed ingredients and both are shipped relatively short distances by truck to livestock feeding locations. Kansas feedlots (mainly cattle and hogs) were named by all 10 Kansas ethanol plants as a primary market for DDG and WDG. Other truck destinations of DDG and WDG mentioned by at least one Kansas ethanol plant include Oklahoma, Texas, Colorado, and Missouri.

3.4 Kansas Transportation Infrastructure Ratings

Inbound transport of corn and sorghum and outbound transport of ethanol and co-products are essential to Kansas ethanol plants. Accordingly managers of Kansas ethanol plants were asked to rate Kansas transportation infrastructure (rail lines and roads). The ratings were a Likert scale ranging from 1 (poor) to 5 (excellent) with 3 representing an average rating. Kansas roads as a whole were rated as well as four road types which included Interstate highways, primary state highways, paved county roads and unimproved county roads. The average rating for each is:

- Rail Lines 2.83
- Roads 3.75
- Interstate Highways 3.75
- Primary State Highways 3.83
- Paved County Roads 3.33
- Unimproved County Roads 2.83

Thus, rail lines scored below average while Kansas roads as a whole were rated above average. The only road type rated as below average was unimproved county roads.

3.5 The Future of Ethanol Production in Kansas

To gain perspective on future transportation requirements of ethanol and co-products, the ethanol plant managers were asked their opinions regarding the future of ethanol production in Kansas. The following are representative comments.

“Overall I think the future of ethanol production in Kansas is good. It would be better if more refineries had the capacity to handle ethanol unit trains.”

“Currently, Kansas ethanol production is stable (not growing) due to relatively high grain prices and low gasoline prices, but Kansas production has the potential to grow.”

“The future of ethanol production in Kansas is good, but would improve if there was faster turnaround time for rail cars on ethanol shipments.”

“I think overall production of ethanol will be stable in the future. There may not be many additional plants built in Kansas, but those that are established will grow. I expect more grain to come into ethanol plants by rail and more outbound shipment of ethanol by rail since railroads are more energy efficient per ton-mile.”

“I expect Kansas ethanol production to increase in the future mainly due to expansion of established Kansas ethanol plants, rather than growth in the number of plants.”

“Ethanol production is limited by the size of the cow herd since you need a market for DDG and WDG to make a profit producing ethanol. I think Kansas ethanol production has reached its limit.”

CHAPTER 4 - GRAIN SUPPLIERS OF KANSAS ETHANOL PLANTS

4.1 The Grain Company Sample

Objective B is to investigate the transportation impact of Kansas ethanol production from the grain elevator industry point of view. More specifically the principal concern is to document how the Kansas grain industry's markets for corn and sorghum have changed as a result of Kansas ethanol production, and what have been the associated transportation impacts. The managers of the ethanol plants indentified their principal feed stock suppliers so the research team subsequently interviewed managers of 21 Kansas grain companies who own and operate 227 grain elevators with a total storage capacity of 199.6 million bushels. The grain elevator managers also completed a questionnaire regarding outbound shipment destinations of their corn and sorghum, along with volumes shipped by rail and truck.

The 21 grain companies in the sample collectively had 2007 corn receipts of 106.2 million bushels and 83.5 million bushels of sorghum (total of two crops receipts, 189.7 million). All the elevator receipts were delivered by truck, with semi-tractor trailers accounting for 67.5 percent of the total receipts. Tandem axle trucks and single axle trucks were used to deliver 16.2 percent and 16.3 percent respectively of the total corn and sorghum receipts.

4.2 Outbound Transportation of Corn and Sorghum

4.2.1 Shipments to Kansas Ethanol Plants

The 21 Kansas grain companies delivered 22.5 million bushels of corn to Kansas ethanol plants in 2007. All these deliveries were by motor carrier. Thus 21.2 percent of

the total corn receipts (106.2 million bushels) of the sample grain companies were shipped to Kansas ethanol plants [(22.5/106.2) x 100=21.2%]. There were no corn shipments from the 21 grain companies to ethanol plants outside the state of Kansas.

In 2007, the sample grain companies shipped 22.1 million bushels of their sorghum receipts to Kansas ethanol plants. All these deliveries were by motor carrier. Thus the 21 grain companies shipped 26.5 percent of their total sorghum receipts (83.5 million bushels) to the 10 Kansas ethanol plants [(22.1/83.5) x 100=26.5%].

It is interesting to note that the total percent of Kansas corn plus sorghum production absorbed by Kansas ethanol plants in the period from 2007-2008 (22.1 percent) is nearly identical to the corresponding percentage of the sample grain companies. As noted previously the 10 ethanol Kansas plants absorbed 156.2 million bushels. The average Kansas combined production of corn and sorghum for 2007 and 2008 is 709.1 million bushels. Thus the percent of total combined Kansas production of corn and sorghum absorbed by Kansas ethanol plants is 22 percent [(156.2/709.1) x 100=22%]. The total combined receipts of corn and sorghum of the 21 grain companies was 189.7 million bushels. The total shipments of corn and sorghum of the sample grain companies to Kansas ethanol plants was 44.6 million bushels. Thus the percent of total receipts of corn and sorghum shipped to ethanol plants is 23.5 percent [(44.6/189.7) x 100=23.5%]. Also, the 44.6 million bushels represents 28.6 percent of the 156.2 million bushels of corn and sorghum absorbed by Kansas ethanol plants.

4.2.2 Shipments to Other (Non-Ethanol) Markets

In 2007 the 21 sample grain companies shipped 77.6 million bushels of corn to markets other than Kansas ethanol plants. Hereafter referred to as non-ethanol plant

locations. Nearly all (76.4 million bushels) of these corn shipments were by motor carrier, with only 1.2 million bushels shipped by rail. Most of the truck corn shipments were to Kansas feedlots and feed mills. Much smaller truck shipments went to Kansas terminal elevator locations (primarily Kansas City and Topeka), Kansas pet food manufacturing plants, and poultry feeding locations in Arkansas and Missouri.

Only four of the 21 sample grain companies shipped corn by rail to non-ethanol plant locations. Rail shipment destinations included livestock feeding locations in California, Arizona, New Mexico, Oklahoma, and Texas. Other shipments of corn by rail were to Texas Gulf of Mexico export ports, Wichita and Hutchinson terminal elevators, and poultry feeding locations in Arkansas and Missouri.

The 21 sample grain companies shipped 56.8 million bushels of sorghum to non-ethanol plant locations in 2007. Unlike corn, a large percentage of outbound sorghum shipments were by rail. The rail shipments were classified in two categories; rail and truck-rail. The rail category is shipments from one of the country elevators of the grain company sample. The truck-rail category involves a short haul truck movement from a country elevator location to a shuttle (train loader) train location, from which the sorghum is subsequently shipped by rail to final destination. Of the total 56.8 million bushels of sorghum shipped by the 21 grain companies, 30 million (53 percent) bushels were shipped by truck, 3.8 million (7 percent) by rail and 22.9 million (40 percent) by truck-rail. Thus the total sorghum shipments by rail and truck were about equal (53 percent vs. 47 percent).

The principal destination markets for the truck shipments of sorghum were Kansas feed yards and feed mills. Much smaller shipments went to Oklahoma feedlots,

Kansas pet food companies, Hutchinson terminal elevators, and poultry feeding locations in Arkansas and Missouri.

Texas Gulf of Mexico export ports were the only sorghum destination market for rail shipments from country elevator locations of the sample grain companies. Nine of the 21 grain companies had truck-rail sorghum shipments to Kansas shuttle train locations with subsequent rail shipment to Gulf ports for export.

The results of the preceding discussion are summarized in Tables 4.1 and 4.2. The data in Table 4.1 indicate that 21.2 percent of the corn receipts of the 21 companies went to Kansas ethanol plants and 73.1 percent was shipped to non-ethanol locations, together accounting for 94.3 percent of the total corn receipts of the sample grain companies. The remaining 5.7 percent of the corn receipts were likely used by local farmers to feed their livestock.

Table 4.1 data reveal that 26.5 percent of the 21 grain company sorghum receipts were shipped to Kansas ethanol plants, with 68 percent going to non-ethanol plant locations. Together the corn and sorghum shipments accounted for 94.4 percent of the total sample grain company receipts

[(179/189.7) x 100=94.4%] Equation 4.1

Table 4.1: 2007 Shipments of Sample Grain Companies by Crop and Market Destination

Market Destination	Corn Bushels (Millions)	Percent of Total Receipts
Ethanol Plants	22.5	21.2%
Non-ethanol Plant Locations	77.6	73.1%
Total	100.1	94.3%
Market Destination	Sorghum Bushels (Millions)	Percent of Total Receipts
Ethanol Plants	22.1	26.5%
Non-ethanol Plant Locations	56.8	68.0%
Total	78.9	94.5%

Table 4.2 data indicate that motor carriers shipped 100 percent of the corn going to Kansas ethanol plants and nearly all of the corn shipments to non-ethanol plant locations. Motor carriers accounted for all the sorghum shipments to Kansas ethanol plants, but only 53 percent of the sorghum shipments to non-ethanol plant locations.

Table 4.2: 2007 Shipments of Sample Grain Companies by Crop, Market Destination, and Mode of Transportation

	Corn		
Market Destination	Truck (Millions of Bushels)	Rail (Millions of Bushels)	Truck Percent of Total
Ethanol Plants	22.5	0	100%
Non-ethanol Plant Locations	76.4	1.2	98.5%
Total	98.9	1.2	98.8%
	Sorghum		
Market Destination	Truck (Millions of Bushels)	Rail (Millions of Bushels)*	Truck Percent of Total
Ethanol Plants	22.1	0	100%
Non-ethanol Plant Locations	30.0	26.8	52.8%
Total	52.1	26.8	66.0%

*Includes Rail Only and Truck-Rail

4.3 Modal Choice Selection

Previous discussion indicates that both railroads and motor carriers are employed to ship corn, sorghum, ethanol, WDG, and DDG. Managers of the 21 sample grain companies were asked to rank eight variables in terms of importance to the carrier selection decision. The managers were asked to rank the characteristics from the most important to the least important, where the most important is number 1 and the least important is number 8. The results are in Table 4.3. The table indicates that the transportation rate and equipment availability are the two most important modal selection factors, while lost or damaged goods and shipment tracing capability are the least important.

Table 4.3: Modal Choice Selection Factors

Transportation Characteristic	Mean Importance Rank
1. The transportation rate	2.6
2. Equipment Availability	2.6
3. Ability to ship to many markets	3.0
4. Amount of time to deliver my freight from origin to destination	4.1
5. Predictability of the time it takes to ship my freight to destination	4.6
6. Amount of weekly service provided by the carrier	4.7
7. Lost or damaged goods	6.3
8. Shipment tracing capability	6.6

4.4 Impact of Increased Ethanol Production on Corn and Sorghum Markets and Transportation

On the questionnaires administered to the managers of the sample grain companies they were asked to describe how their markets have changed as a result of increased ethanol production in Kansas, and what have been the resulting changes in their transport of corn and sorghum. The following are not exact quotes in some cases but have been modified for clarity and editing.

"Transportation of corn from northwest Kansas hasn't changed with increased ethanol production. The corn market for us has been local. However, dryland corn production in the area has been increasing. Thus in the future we expect to ship more corn to feedlots and ethanol plants."

"We ship sorghum predominantly to ethanol plants in Kansas and Nebraska by truck. At times in the last five years we have shipped sorghum to the Gulf of Mexico export market. The sorghum is trucked from our facility to a shuttle train station and then is transported by rail to the Gulf."

"The ethanol plants haven't increased the demand for corn in this area by a great amount. However, it is better to have another source of demand (ethanol plants) than to not have it. We have shipped some more trucks to ethanol plants and less to feedlots."

"Our sorghum receipts are 5-7 times larger than our corn receipts. In 2007 about 20 percent of the corn was shipped to ethanol plants, but only 1 percent of the much larger milo receipts. In the period from 2005-2006 about 60 percent of the corn was shipped by rail to the Gulf of Mexico for export and the other 40 percent went by truck to

Kansas feedlots. However, in 2007 there were no rail shipments of corn with 80 percent going to feedlots by truck and 20 percent going to ethanol plants by truck."

In the period from 2005-2007, 91 percent of the sorghum was shipped by rail to the Gulf export market with the rest shipped by truck to Kansas feedlots. In 2008 we have shipped more corn to ethanol plants, primarily to a new plant that just opened. However, our stations are on the fringes of the supply areas for two other ethanol plants that has limited shipments to Kansas ethanol plants."

"The ethanol plant in the area has had a very large impact on our corn markets and transportation modes. Prior to the ethanol plant locating in the area we shipped 45 percent of our corn by rail to Arkansas, California, Arizona, New Mexico, Oklahoma and Texas. The other 55 percent was shipped by truck to Arkansas poultry feeding locations, pet food plants in Lawrence and Topeka, and grain terminals in Kansas City and Topeka. Since the ethanol plant located in the area, 40 percent of the corn is shipped by truck to the ethanol plant. Rail shipments have been reduced from 45 percent of the shipments to 30 percent while the truck shipments to non-ethanol plant locations declined from 55 percent to 30 percent. A similar shift has occurred in milo markets and transportation. Prior to the ethanol plant locating in the area, 100 percent of the sorghum was shipped by truck to pet food plants and grain terminals. After the ethanol plant opened, 45 percent of the sorghum was shipped by truck to the ethanol plant."

"It is too early to determine how ethanol plants will affect our corn shipments since one of the two ethanol plants we ship to has only been operating a few months.

However, we anticipate a large increase in our corn shipments to ethanol plants in the next few years."

"Ethanol production hasn't affected our corn marketing most of which is shipped by truck to local feeders and feedlots. However, the ethanol plants to the north and south of our stations have opened new markets for our sorghum. We shipped 40 percent of our sorghum to ethanol plants in 2007, all of which was delivered by truck. Ethanol plants provide an alternative market for our sorghum, resulting in higher demand and a higher bid price."

"Our corn markets and associated transport haven't been affected much by Kansas ethanol production. Only about 10 percent of our corn was shipped by truck to ethanol plants in 2007, while 90 percent went to Kansas feedlots by truck. However 72 percent of our milo went to ethanol plants by truck. The existence of ethanol plants has only marginally affected the bid price for grain."

"Ethanol plants have increased the demand for our corn and increased the bid price by an average of 10¢ per bushel. In our northern stations we have seen milo move north by truck to ethanol plants for the first time. We shipped 22.6 percent of our corn receipts to ethanol plants by truck in 2007."

"Ethanol production is the most beneficial event to happen to rural areas in a generation. Ethanol plants have increased the demand for feed grains resulting in higher crop production and higher bid prices for grain. We shipped 40 percent of our 2007 corn receipts by truck to ethanol plants and 52 percent of the sorghum receipts. The remainder of our feed grain receipts were shipped by truck to area feedlots."

“We have always shipped close to 100 percent of our corn and milo by truck. In the past, most of the corn was shipped long distances to feedlots in southwest Kansas. However, with the advent of an ethanol plant both to the south and the north of our stations, our delivery area for corn has shrunk to a 35 mile radius. In 2007 we shipped 50 percent of our corn receipts and 25 percent of our milo by truck to Kansas ethanol plants.”

“We shipped about one-third of our sorghum to ethanol plants in 2008, but all the corn was shipped to Kansas feedlots.”

“Ethanol plants have given us a new end user in our trade area. It’s too early to tell what the long term impact of ethanol plants will be on our feed grain markets and associated transportation since the ethanol plant we ship to has been operating for less than a year. However, so far in 2008 we have shipped all our sorghum and half the corn to an ethanol plant.”

“We shipped 95 percent of our 2007 sorghum receipts to ethanol plants. Ethanol production has increased sorghum prices to the producer by 10 to 15 cents per bushel. Ethanol plants have increased short haul truck traffic and changed the flow of cross county truck traffic. We have purchased trucks to move our milo to ethanol plants.

Kansas ethanol production has dramatically altered our sorghum markets and associated transportation. Before the ethanol plants, we shipped all the sorghum by truck to a large grain terminal where it was subsequently shipped by rail to Gulf of Mexico ports for export. Now 95 percent of our milo is shipped by truck to ethanol plants.”

“The ethanol plants haven’t impacted our markets for corn and associated transport. All our corn receipts are shipped by truck to local area feed yards. However, the ethanol plant that opened in the area has had a dramatic impact on our sorghum markets and transport. Prior to the opening of the ethanol plant, we shipped all the sorghum by rail to Mexico for export or poultry feeding locations in New Mexico. Now, about 73 percent of our sorghum receipts are shipped by truck to the ethanol plant.”

“Our sorghum receipts are much larger than our corn receipts. The small amount of corn receipts are shipped by truck to southwest Kansas feedlots. However, increased ethanol production in Kansas has shifted sorghum transport from primarily rail to almost entirely truck. Prior to the opening of the ethanol plant in the area, sorghum was shipped by rail to the Gulf of Mexico export market. In 2008, about 90 percent of our milo was shipped by truck to the ethanol plant.”

“Ethanol plants haven’t impacted our markets for corn, nearly all of which is shipped to Kansas feed yards by truck. However ethanol plants opened more markets for sorghum. We currently ship about 20-25 percent of our sorghum to ethanol plants.”

“We ship 90 percent of our corn receipts and 40 percent of our sorghum by truck to ethanol plants. Ethanol plants have increased the competition for our grain and raised bid prices. Most of our feed grains used to go by truck to Arkansas poultry feeding operations, but now we are shipping most of our corn and sorghum to ethanol plants.”

“We ship about two-thirds of our corn and sorghum by truck to area ethanol plants.”

“Prior to the ethanol plant locating in the area, we shipped most of our corn and sorghum by truck to poultry feeding locations in Missouri and Arkansas, with some

being shipped by truck to Kansas City and Topeka grain terminals. However, the ethanol plant in the area has shifted corn and sorghum shipments from the previous markets to the ethanol plant. Currently, 30 percent of our corn and sorghum receipts are shipped by truck to the ethanol plants. Due to the ethanol plant, bid prices have increased 12 cents per bushel."

CHAPTER 5 - KANSAS ETHANOL PLANTS AND RAILROAD TRANSPORTATION

5.1 Kansas Railroad Transportation

Objective C is to measure the transportation impact of Kansas ethanol production from the Kansas Class I and shortline railroad perspective. To achieve this objective, the research team conducted interviews with representatives of the Class I and shortline railroads serving Kansas ethanol plants. The Class I railroads are the Union Pacific (UP) and the BNSF Railway, and the shortline railroads are the Kyle Railroad (Kyle) and the Kansas and Oklahoma Railroad (K&O). Three of the four railroads also completed detailed questionnaires.

Rail transportation is important for Kansas ethanol plants. In some cases corn was delivered to these firms by rail and railroads supply outbound transportation of ethanol and distillers grain. In Kansas UP has 1,566 mainline miles and 154 branch line miles. The corresponding figures for BNSF are 1,237 mainline miles and 443 trackage rights miles. Thus the two Class I railroads combined have 3,400 miles of track in Kansas.

Some Kansas ethanol plants are served by shortline railroads. The K&O Railroad road has 840 track miles in Kansas and serves two Kansas ethanol plants. The other shortline serving a Kansas ethanol plant is the Kyle Railroad that has 425 track miles in Kansas and 85 in Colorado. Thus the two shortlines that serve Kansas ethanol plants have a combined total of 1,350 track miles.

The two Class I and two shortline railroads serving Kansas ethanol plants have several interchange locations in Kansas resulting in an integrated system of 4,750

(3400 + 1350) track miles. Table 5.1 contains the interchange locations of the two Class I railroads with the two shortline railroads. The Union Pacific interlines with the Kansas and Oklahoma Railroad at Salina, Wichita, McPherson, and Hutchinson, Kansas and interchanges with the Kyle Railroad at Salina, Kansas and Limon, Colorado. The BNSF interlines with the Kyle Railroad at Concordia and Courtland, Kansas and with the K&O at Abilene, Hutchinson, Newton, and Wichita, Kansas.

Table 5.1: Kansas Interchange Locations of UP, BNSF, K&O and Kyle Railroads

Shortline Railroad	Class I Railroad	Interchange Location
Kansas & Oklahoma Railroad	UP	Salina, Wichita, McPherson, Hutchinson, Kansas
Kansas & Oklahoma Railroad	BNSF	Abilene, Hutchinson, Newton, Wichita, Kansas
Kyle Railroad	UP	Salina, Kansas and Limon, Colorado
Kyle Railroad	BNSF	Concordia and Courtland, Kansas

5.2 Railroad Corn Shipments to Kansas Ethanol Plants

In 2008, Class I railroads delivered 2,470 carloads of corn to Kansas ethanol plants, using both 263,000 and 286,000 pound GVW (gross vehicle weight) covered hopper rail cars. The typical shipment size was 100 car unit trains. Iowa was the origination state for 96 percent of the corn shipments with Minnesota accounting for the other 4 percent. One of the shortlines delivered 14 carloads of sorghum to a Kansas ethanol plant in 263,000 pound GVW covered hopper cars.

5.3 Railroad Shipments of Ethanol and Distillers Grain from Kansas Ethanol Plants

Railroads play a much larger role in the outbound shipments from Kansas ethanol plants than the inbound shipments of feedstock. In 2008, the two Class I railroads shipped a combined total of 8,199 cars of ethanol from Kansas ethanol plants. The two shortline railroads shipped a combined total of 1,028 cars of ethanol which they subsequently interlined to a Class I railroad for shipment to the final destination. Thus, the 1,028 cars are part (12.5 percent) of the 8,199 cars shipped by Class I railroads.

There is very little seasonality in railroad ethanol shipments. One of the Class I railroads provided 2008 ethanol shipments by month. Table 5.2 data indicated that April had the fewest ethanol shipments (6.2 percent) and December had the largest (10.2 percent). When the data are aggregated into quarterly ethanol shipments the first quarter has the least shipments (22.6 percent) and the fourth quarter the greatest (26.9 percent).

Table 5.2: 2008 Percent Distribution of Railroad Shipments of Ethanol from Kansas by Month and Quarter

Month	Percent of Shipments
January	9.64%
February	8.00%
March	6.94%
April	6.17%
May	7.69%
June	8.73%
July	9.11%
August	7.69%
September	9.12%
October	8.81%
November	7.92%
December	10.18%
Quarter	Percent of Shipments
First	24.58%
Second	22.59%
Third	25.92%
Fourth	26.91%

Table 5.3 displays data on the 2008 Class I railroad shipments from Kansas ethanol plants by destination market. The West region (California, Oregon, and Washington) and the South region (Texas, Oklahoma, and Louisiana) accounted for the largest percentage of ethanol shipments with 30.8 percent and 29.5 percent respectively. The East of the Mississippi River region and the state of Arizona accounted for 19.1 percent and 16.1 percent of the total ethanol rail shipments from Kansas. Relatively minor amounts of 3.2 percent and 1.3 percent were shipped to the Midwest region (Illinois, Missouri, and Wisconsin) and the Mountain region (Colorado, Nevada, and Utah).

Table 5.3: 2008 Class I Railroad Ethanol Shipments from Kansas by Destination Market

Destination Market	Percent of Shipments
West (California, Oregon, Washington)	30.8%
South (Texas, Oklahoma, Louisiana)	29.5%
East of Mississippi River	19.1%
Arizona	16.1%
Midwest (Illinois, Missouri, Wisconsin)	3.2%
Mountain (Colorado, Nevada, Utah)	1.3%

All of the ethanol shipments of both Class I railroads were shipped in multi-car units in 263,000 pound GVW tank cars. The shortlines shipped ethanol in five to 10 car units in 263,000 pound GVW tank cars.

Rail shipments of distillers' grain are relatively minor since most of it is shipped by truck to Kansas feedlots. In 2008, about 450 cars of DDG (dried distillers grain) were shipped from Kansas ethanol plants by Class I railroads in 286,000 pound covered hopper rail cars. The typical shipment size was one to five cars. The primary destination was California with lesser amounts shipped to the Texas panhandle and Arizona. The K&O and the Kyle have no shipments of distillers' grain.

5.4 Summary

The railroads serving Kansas ethanol plants were asked what they expect to happen to their Kansas ethanol carloadings in the next five years, and whether there are any obstacles or limitations in their ethanol logistics systems that limit the amount of ethanol shipments from Kansas. The following are not exact quotes but rather have been edited for clarity and brevity.

“We are optimistic about the growth of ethanol carloadings in Kansas. We have a new, efficient ethanol plant on our railroad that we expect to grow in the future. We also have another plant on our railroad that is planning an expansion.”

“The main obstacle to increased shipments is lack of capacity in the railroad network. If we had bigger yards and better quality track we could collect cars from the ethanol plants on our railroad into 75 car units which we could interline to another railroad for shipment to final destination.”

“The ethanol plant on our railroad has plans to expand their production over the next five years, but has not provided us with any specific information concerning how many additional ethanol carloadings will occur or when additional ethanol traffic will be forthcoming.”

“If prices of oil and corn stabilize, the economies for 10 percent ethanol blends will be good. Ethanol plants and ethanol logistics will become more efficient. Thus in the next five years moderate growth of ethanol shipments from Kansas will occur with more emphasis on improving the efficiency of both ethanol production and the transportation of ethanol.”

“Currently, logistics inefficiency is an obstacle to growth of ethanol shipments from Kansas on our railroad. There are only two facilities on our railroad that can unload ethanol unit trains.”

“We expect ethanol carloadings in Kansas to remain relatively flat to slightly increasing over the next five years. We do not have many more plants being built in Kansas with connection to our railroad, and the plants currently in operation are producing at or near capacity.”

CHAPTER 6 - IMPACTS OF ETHANOL PLANT-RELATED TRUCK TRAFFIC ON COUNTY ROADS

6.1 Current Condition of County Roads

Objective D of the research project is to document the effects of ethanol plant-related inbound (grain) and outbound (ethanol, WDG, DDG) truck traffic on county road conditions in the Kansas counties that have ethanol plants. This was accomplished by interviewing the county engineer or road supervisor for all of the counties that have ethanol plants which are Anderson, Finney, Phillips, Republic, Rice, Russell, Sedgwick, and Seward. All the people that were interviewed also completed detailed questionnaires.

Collectively the eight counties are responsible for 6,882 miles of county roads and 1,805 bridges. Of the 6,882 miles, 34 are concrete (0.5 percent), 1,551 are asphalt (22.5 percent), and the majority (5,297 or 77 percent) are unpaved (gravel or dirt). The county representatives were asked to rate the condition of the county roads on a five category scale ranging from Very Poor to Very Good. The results are displayed in Table 6.1. For the 34 miles of concrete road, none were rated Very Poor, 8.9 percent Poor, 35.3 percent Fair, 38.2 percent Good, and 17.6 percent Very Good. Thus 55.8 percent of the concrete roads were rated Good or Very Good.

The representatives of the counties rated the condition of their asphalt roads as well. According to data in Table 6.1, of the 1,551 miles of asphalt road the ratings were Very Poor (2.3 percent), Poor (8.6 percent), Fair (27.6 percent), Good (21.7 percent), and Very Good (39.8 percent). Thus 61.5 percent of the asphalt road miles were rated Good or Very Good.

Sedgwick County accounts for 37 percent of the 1,551 miles of asphalt road in the eight county samples. Sedgwick County representatives rated all 575 miles of the asphalt roads as being in Very Good condition. Sedgwick County is the most urbanized in the state with a large tax base. When Sedgwick County is removed from the eight county sample, a different picture of asphalt road conditions emerges in the other seven counties. According to Table 6.1, the ratings are Very Poor (3.6 percent), Poor (13.6 percent), Fair (43.9 percent), Good (34.4 percent), and Very Good (4.5 percent). Thus the percentage of asphalt miles rated as Very Poor and Poor rises from 10.9 percent (including Sedgwick County) to 17.2 percent (without Sedgwick County). The percent rated as Fair and Good rose from 43.9 percent to 78.3 percent, while the percent rated as Very Good fell from 39.8 percent to only 4.5 percent. Thus, the percent of county roads of the seven counties rated as Good or Very Good was 38.9 percent compared to 61.5 percent with Sedgwick County in the sample.

Table 6.1: Ratings of the Current Condition of County Roads

Road Surface Type	Very Poor % (Miles)	Poor % (Miles)	Fair % (Miles)	Good % (Miles)	Very Good % (Miles)
Concrete	-------	8.9 (3)	35.3 (12)	38.2 (13)	17.6 (6)
Asphalt	2.3 (35)	8.6 (133)	27.6 (428)	21.7 (336)	39.8 (619)
Unpaved	-------	3.7 (196)	48.3 (2,555)	45.7 (2,423)	2.3 (123)

Ratings of the Current Condition of Asphalt County Roads (Exc. Sedgwick County)

Very Poor % (Miles)	Poor % (Miles)	Fair % (Miles)	Good % (Miles)	Very Good % (Miles)
3.6 (35)	13.6 (133)	43.9 (428)	34.4 (336)	4.5 (44)

Table 6.1 contains the condition ratings of the county respondents for unpaved roads. The ratings were as follows: Very Poor (zero), Poor (3.7 percent), Fair (48.3 percent), Good (45.7 percent), and Very Good (2.3 percent). Thus 48 percent of the unpaved roads were rated as Good or Very Good.

Thus, the current condition of the roads in the eight counties is reasonably good for all road surface types with very few miles in Very Poor and Poor categories.

The county representatives were asked if the number of paved roads in the county had changed in the last five years as well as the overall condition of the county roads compared to five years ago. For the eight counties as a group, the number of paved miles increased only 1 percent. Two of the county respondents said the condition of the county's roads was worse than five years ago, four said there was no change, and two said the overall condition was better.

6.2 County Revenue and Expense

Table 6.2 contains the 2008 expenditure for maintenance of roads and bridges by county. Sedgwick County accounts for about 41 percent of the total eight county expenditure of $18.7 million. The average maintenance expenditure per county is $2,339,212. Excluding Sedgwick County, the average 2008 expenditure is $1,584,866; 32 percent less.

Table 6.2: 2008 County Road and Bridge Maintenance Expense

County	Expense
Anderson	$1,651,963
Finney	2,731,045
Phillips	1,044,203
Republic	1,733,760
Rice	406,221*
Russell	2,400,000
Sedgwick	7,619,639
Seward	1,126,868
Total	$18,713,699

*Doesn't include $1,283,514 expense for maintenance of township roads

The county representatives were asked if the current road and bridge maintenance budget was sufficient to maintain an adequate level of service on the county's roads. Seven of the eight county engineers/road supervisors responded "No" to this question. Then the respondents were asked to estimate the budget shortfall for road and bridge maintenance. Thus, if the current maintenance budget is 90 percent of what is needed to maintain adequate service, then the budget shortfall is 10 percent. The representative of one county said the budget shortfall was 10 percent, another estimated the shortfall at 11-20 percent, two respondents said the shortfall was 21-30 percent, and three said it was 31 percent or more.

A variety of revenue sources are utilized by the sample counties to fund the county road and bridge program. The county property tax is the primary revenue source for all of the sample counties. Other revenue sources include motor vehicle taxes, special city/county/highway fund, grants from the state, and FEMA flood damage assistance. Sedgwick County also has a sales tax as a revenue source to fund the road and bridge program.

6.3 Impact of Ethanol Plant-Related Truck Traffic on County Roads

The county engineers/road supervisors were asked if truck traffic entering and leaving the ethanol plant has had an impact on the condition of the county roads. Six of the eight county representatives responded in the affirmative to this question, while the other two county representatives said they weren't sure if there had been an impact.

Those representatives that answered "Yes" to the previous question were asked to describe the impact of ethanol plant-related truck traffic on the county's roads and bridges. The following are not direct quotes but rather have been edited for clarity and brevity.

"We rebuilt the shale road going north-south past the ethanol plant since the truck traffic was too heavy for a shale road, so the road was rebuilt at a cost of $625,277. The east-west road that connects with the north-south road is quickly wearing out due to heavy truck traffic."

"The impact of the ethanol plant on our county roads is minimal due to the bypass and the location of the ethanol plant."

"The county provided financial assistance for the turn lane off the state highway on to the city street leading to the ethanol plant. The turn radius was widened as well. Both projects were to accommodate traffic into and out of the ethanol plant.

The county also accelerated our chip-seal maintenance rotation to provide an overlay on a county road used heavily by ethanol plant-related truck traffic.

A large impact comes from area farmers who haul semi-loads of corn to the ethanol plant on wet days when they can't get into the fields. These farm trucks put ruts in the county's gravel roads, creating more expensive maintenance."

“We have had to blade three-fourths of a mile of road to the ethanol plant at least once a week.”

“There is heavy truck traffic on the county’s roads going into the ethanol plant. County roads south of the ethanol plant are asphalt and carry the heaviest truck traffic into the ethanol plant. Since the plant has been open only a short time the asphalt hasn’t deteriorated yet. In a few years we will be more able to discern the impact of increased heavy truck traffic on the county’s roads.”

“The city and the county paid $150,000 each to construct turn lanes into the ethanol plant and widen the road. Grain comes into the ethanol plant on state highways so the ethanol-plant related truck traffic hasn’t impacted the county’s roads much.”

“The ethanol plant has caused an increase in numbers and weights of trucks into and out of the county road system.”

“The ethanol plant is located on a state highway so there hasn’t been an impact on the county road system. However, if the ethanol plant were to expand it would require significant investment in county roads estimated to be $3 million for 3 miles (8 inches of sub-based and 8 inches of asphalt).”

The representatives of the eight counties were asked if truck traffic entering or leaving the ethanol plant had caused a bottleneck or congestion problem on the county’s roads. Six of the eight respondents replied “No” to this question, one answered in the affirmative, and one wasn’t sure. Thus congestion doesn’t seem to be a significant problem.

Many miles of county roads are not built to withstand a large amount of heavy truck traffic for a sustained period of time. The county engineers were asked to estimate

what percent of the trucks entering and leaving the ethanol plant are five axle, 80,000 pound GVW (gross vehicle weight) semis. All eight of the county representatives said that over 90 percent of the inbound trucks are 80,000 pound GVW semis. Responses were similar for outbound trucks with five of the eight county respondents indicating that over 90 percent of the outbound shipments were in 80,000 pound GVW trucks. Two of the engineers said the percentage was 71-90 percent, and the other was not sure.

The county representatives were asked if ethanol plant-related truck traffic had affected the county's annual expenditure for road and bridge maintenance. The respondents were divided on this question with three replying that maintenance expenditure had been affected, while three said there had been no impact, with the other two representatives not sure if an impact had occurred. One of the respondents that said there was no impact of the ethanol plant on total maintenance expenditure modified this response by stating that although total maintenance expenditure was unaffected, the county was redirecting maintenance resources to ethanol plant-related maintenance.

Although the majority of the eight county engineers revealed that ethanol plant-related truck traffic had affected the condition of the county's roads, the majority (seven of the eight) said that the incremental truck traffic had not impaired the ability of the county to maintain an adequate level of service on the county's roads. However, several respondents indicated that the ethanol plant had opened recently and that it was too soon to tell what the longer run impact would be on the condition of the county's roads.

CHAPTER 7 - CONCLUSION

7.1 Conclusions

The rapid expansion of the Kansas ethanol industry has driven Kansas agricultural transportation into a new era. As of May 2009 there were 10 operational ethanol plants in Kansas with combined annual capacity of 438 million gallons, with one additional plant under construction with a projected capacity of 20 million gallons. The growth of ethanol production in Kansas has the potential to alter, in unknown ways, the traditional Kansas corn and sorghum logistics systems. How will the end use markets for Kansas corn and sorghum change and what will be impact of these changes on Kansas rail and truck transport? To begin to answer these questions and other issues, this study investigated the transportation impact of Kansas ethanol production from the point of view of the ethanol production industry, the grain industry, and the railroad industry. In addition, the study measured the impact of incremental truck traffic on county road conditions in the vicinity of Kansas ethanol plants.

7.1.1 Kansas Ethanol Inbound and Outbound Transportation

In 2008 Kansas ethanol plants processed 156.2 million bushels of corn and sorghum. Truck shipments accounted for 91 percent of total inbound feedstock (corn and sorghum) with railroads accounting for the remaining 9 percent. With respect to inbound truck shipments, nearly 98 percent was delivered by five axle semi-tractor trailer trucks. In a typical five day business week the 10 Kansas ethanol plants unloaded 3,358 semi-tractor trailer loads of corn or sorghum with 82 percent of the shipments from grain elevators and the other 18 percent from farmers.

Most of the corn and truck shipments originated in the local area of the ethanol plant with 48 percent of the shipments originating within 50 miles of the plant and 91 percent within 100 miles of the plant. The remaining 9 percent are rail shipments originating primarily in Iowa. The great majority of the truck shipments originate in Kansas (87 percent) with 9 percent from Nebraska and minor amounts from Missouri.

The outbound transportation of Kansas ethanol plants includes shipments of ethanol and co-products DDG and WDG. Shipments of ethanol occur by both rail and truck; however, rail is the dominant mode accounting for 60 percent of the volume of shipments. Five plants shipped ethanol by rail to population centers in California and four plants shipped ethanol to Texas by rail. Other rail shipment destinations include population centers in Illinois, New York, New Mexico, Arizona, and Oklahoma. In general, rail was the preferred mode for long distance ethanol shipments.

Population centers in the states bordering Kansas were the principal destination markets for truck shipments of ethanol. Six plants shipped ethanol by truck to Oklahoma, and four plants had truck shipments to Colorado (primarily Denver). Five ethanol plants shipped by truck to a wide variety of Kansas locations including refineries, fuel blending stations, and retail outlets. Three plants had ethanol truck shipments to Texas population centers including Dallas-Fort Worth, Houston and Amarillo. In general, motor carrier was the preferred mode for relatively short distance ethanol shipments.

Kansas feedlots and feed mills were named by all 10 Kansas ethanol plants as a primary market for DDG and WDG.

7.1.2 Impact of Ethanol Production on the Kansas Grain Industry

The Kansas ethanol plants provide a new market for the Kansas grain industry. The markets for corn and sorghum have changed and there have been associated transportation impacts. The effects were measured by obtaining data from 21 Kansas grain companies who collectively own and operate 227 grain elevators, and had 2007 corn receipts of 106 million bushels and 83.5 million bushels of sorghum.

In 2007, the 21 companies shipped 21.2 percent of their corn receipts and 26.5 percent of their sorghum receipts to Kansas ethanol plants. All these deliveries were by motor carrier. It is interesting to note that the percent of corn and sorghum receipts of the 21 grain companies shipped to ethanol plants (23.5 percent) is nearly identical to the percent of total combined Kansas corn and sorghum production absorbed by ethanol plants (22 percent).

The increased role of ethanol plants in the Kansas corn and sorghum markets has altered shipments to non-ethanol plant markets, primarily Kansas feed yards and feed mills. Nearly all of these shipments were by motor carrier as only 4 of the 21 sample grain companies shipped corn by rail to non-ethanol plant locations. Rail shipment destinations were to livestock feeding locations in California, Arizona, New Mexico, Oklahoma and Texas. Other shipments of corn by rail were to Texas Gulf of Mexico ports, Wichita, Hutchinson, and poultry feeding locations in Arkansas and Missouri.

Unlike corn, a large percentage of the sample company's outbound sorghum shipments to non-ethanol plant markets were by rail (47 percent). Texas Gulf of Mexico export ports were the only sorghum destination market for rail shipments. The principal

destination markets for truck shipments of sorghum were Kansas feed yards and feed mills.

7.1.3 Opinions of Grain Company Representatives on the Impact of Ethanol Production on the Corn and Sorghum Markets

The consensus opinion is that the growth of Kansas ethanol production has affected the traditional markets for Kansas corn and sorghum. In the corn market the percent of shipments from country elevators to feedlots has declined and the percent shipped to ethanol plants has increased. However, as before, nearly all these shipments are by motor carrier. The impact in the sorghum market has been to increase the percent of truck shipments from country elevators to Kansas ethanol plants, and decrease the percent of rail shipments to distant livestock feeding locations and Texas Gulf ports. The percent of truck shipments of sorghum to feed mills and feed yards has also declined.

Several of the representatives of the 21 grain companies said that ethanol plants increased the demand for Kansas corn and sorghum, resulting in higher bid prices.

7.1.4 Ethanol Plants and Railroad Transportation

Rail transportation is important for most Kansas ethanol plants. In some cases corn was delivered to these firms by rail and railroads supply outbound transport of ethanol and distillers grain. In 2008, Class I railroads delivered 2,470 carloads of corn to Kansas ethanol plants. Iowa was the origin state for nearly all of these shipments.

Railroads play a much larger role in the outbound shipments from Kansas ethanol plants than the inbound shipments of feedstock. In 2008, Class I railroads shipped 8,199 cars of ethanol from Kansas ethanol plants. Two shortline railroads

shipped a combined total of 1,028 cars of ethanol which they subsequently interlined to a Class I railroad for shipment to the final destination. Thus, the 1,028 cars are part of the 8,199 cars shipped by Class I railroads.

The West region (California, Oregon, and Washington) and the South region (Texas, Oklahoma, and Louisiana) accounted for the largest percentage of rail ethanol shipments from Kansas with 30.8 percent and 29.5 percent of the total, respectively. The East of the Mississippi River region and the state of Arizona accounted for 19.1 percent and 16.1 percent of the total ethanol rail shipments from Kansas.

Rail shipments of distillers' grain are relatively minor since most of it is shipped by truck to Kansas feedlots. In 2008, about 450 cars of DDG were shipped from Kansas ethanol plants by Class I railroads. The primary destination market was California.

7.1.5 Impacts of Ethanol Plant-Related Truck Traffic on County Roads

County engineers or road supervisors of all the counties that have ethanol plants were asked to evaluate the impact of ethanol plant-related truck traffic on the condition of county roads. As noted above, nearly all the deliveries of grain to Kansas ethanol plants are by five axle, 80,000 pound semi-tractor trailer trucks.

The representatives of the counties said the current condition of their county's roads is reasonably good. About 60 percent of the concrete roads were rated Good or Very Good. With Sedgwick County included in the sample, about 62 percent of the asphalt roads were rated Good or Very Good. When Sedgwick County is excluded from the sample this percentage falls to about 39 percent. For the unpaved roads the respondents rated 48 percent of the miles as Good or Very Good. The county representatives were divided in their opinions of whether the overall condition of the

county's roads was worse, better, or unchanged compared to five years ago. Four of the respondents said there was no change while the other four divided evenly between the worse or better categories.

The county engineers/road supervisors said that the financial ability of the county to maintain its roads has been declining. When asked if the current road and bridge maintenance budget was sufficient, seven of the eight representatives responded "No." The estimated revenue shortfall for maintenance ranged from 10 percent to more than 30 percent.

Six of the eight county engineers/road supervisors said the truck traffic entering and leaving ethanol plants has had an impact on the condition of the county's roads. However, the respondents were divided on the question of whether ethanol plant-related truck traffic had affected the county's annual expenditure for road and bridge maintenance. Three county representatives responded "Yes," three said "No," and two were not sure. Also seven of the eight respondents said that the incremental truck traffic had not impaired the ability of the county to maintain an adequate level of service on the county's roads. However, some respondents indicated that the ethanol plant had opened recently and that it was too soon to tell what the longer run impact would be on the condition of the county's roads.

7.1.6 The Future of Ethanol Production in Kansas

To gain perspective on future transportation requirements of ethanol and co-products, the ethanol plant managers were asked their opinions regarding the future of ethanol production in Kansas. The consensus opinion is that the number of Kansas

ethanol plants will not increase, but those that are established will be able to increase production in the future.

7.1.7 Recommendations

It is difficult to identify recommendations for Kansas transportation policy given the uncertainties that exist in the ethanol market. At this time the critical determinants of the demand and supply of ethanol are unknown. Will the demand for Kansas ethanol emerge from the current downturn and increase in the future? Will corn supply in Kansas increase enough to supply the ethanol market as well as the other non-ethanol corn markets? The answers to these and other questions will be partly determined by national agricultural and energy policy. Another source of uncertainty is the fact that half of the Kansas ethanol plants have been in operation less than three years. Thus the long run impact of Kansas ethanol plants on Kansas transportation is unknown at this time. Motor carriers and railroads are both involved in the transportation of grain and sorghum to Kansas ethanol plants and the transportation of ethanol and distillers grain from these plants. Therefore, it seems prudent for Kansas to maintain its current transportation programs of maintaining a high quality state transportation highway system, state aid to county roads, and aid programs for Class II and III railroads.

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APPENDIX A - IMPACT OF ETHANOL PRODUCTION ON KANSAS TRANSPORTATION, KANSAS ETHANOL PRODUCTION PLANTS

IMPACT OF ETHANOL PRODUCTION ON KANSAS TRANSPORTATION
KANSAS ETHANOL PRODUCTION PLANTS

Company Name _____

PART A: PRODUCTION AND CAPACITY

1. What year and month did your plant begin operations? _____

2. What is the annual capacity of the plant to produce ethanol?
Designed Capacity (millions of gallons) _____
Actual Capacity (millions of gallons) _____

3. What is the annual capacity of the plant to produce dried distillers grain (DDG)?
Designed Capacity (tons) _____
Actual Capacity (tons) _____

4. What was the annual ethanol production of your plant for the previous three years? If not available for calendar years, please specify your fiscal year.

2006 million gallons _____
2007 million gallons _____
2008 (to date) million gallons _____

5. What was the annual DDG production of your plant for the previous three years? If not available for calendar years, please specify your fiscal year.
2006 tons _____
2007 tons _____
2008 (to date) tons _____

6. What was the annual amount of corn (and sorghum if applicable) processed at your plant in the past three years? If not available for calendar years, please specify your fiscal year.

	Corn	Sorghum
(a) 2006 bushels	_____	_____
(b) 2007 bushels	_____	_____
(c) 2008 (to date) bushels	_____	_____

7. What percent of the plant's total revenue is derived from sales of ethanol and DDG in the past three years (2006-2008)?

	Percent
(a) ethanol	_____
(b) DDG	_____
(c) other(specify)	_____

PART B: INBOUND TRANSPORTATION

8. In the past 12 months, what percent of your total corn (and sorghum if applicable) were delivered to your plant in the following types of trucking equipment? Sum of percents must add to 100.

	Percent
(a) single axle truck	_____
(b) tandem axle truck	_____
(c) semi-tractor trailer	_____
(d) other(please specify)	_____

9. In a typical business week, how many trucks of each of the types listed below deliver grain to your plant?

	Number of Trucks
(a) single axle truck	_____
(b) tandem axle truck	_____
(c) semi-tractor trailer	_____
(d) other(please specify)	_____

10. Please provide your inbound corn (and sorghum if applicable) receipts by truck and railroad (if applicable) for the 2006-2008 period.

	Inbound Corn Bushels	
Year	Truck	Rail
2006	_____	_____
2007	_____	_____
2008 (to date)	_____	_____

	Inbound Sorghum Bushels	
Year	Truck	Rail
2006	_____	_____
2007	_____	_____
2008 (to date)	_____	_____

11. In the past 12 months what percent of your total inbound corn (and sorghum if applicable) receipts originate in the following miles from your plant? Percents must add to 100.

	Percent
(a) 1 to 10 miles from plant	_____
(b) 11 to 30 miles from plant	_____
(c) 31 to 50 miles from plant	_____
(d) 51 to 100 miles from plant	_____
(e) over 100 miles from plant	_____

12. In the past 12 months what percent of your corn (and sorghum if applicable) originated in the following states? Percents must add to 100.

	Percent
(a) Kansas	_____
(b) Nebraska	_____
(c) Missouri	_____
(d) Iowa	_____
(e) Other (please specify)	_____

13. In the last 12 months, what percent of your corn or milo receipts have been obtained from farmers (farmer-owned trucks) and country elevators? Percents must add to 100.

From Receipts	Percent of Total Corn Receipts	Percent of Total Milo
Farmers	_____	_____
Country Elevators	_____	_____
Other (please specify)	_____	_____

PART C: OUTBOUND TRANSPORTATION

14. Please list the most important destinations (markets) for your outbound ethanol shipments during the last 12 months. Also estimate the percent shipped by rail and truck to each destination market. Percents should add to 100 for each market.

Outbound Ethanol
Current Markets(previous 12 months)

	Market Name (City, State)	Percent Shipped by Truck	Percent Shipped by Rail
1.	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____
4.	_____	_____	_____
5.	_____	_____	_____
6.	_____	_____	_____
7.	_____	_____	_____

15. Please list the most important destinations (markets) for your outbound DDG shipments during the last 12 months. Also estimate the percent shipped by rail and truck to each destination market. Percents should add to 100 for each market. Please include any exports to foreign markets.

Outbound DDG
Current Markets(previous 12 months)

Market Name (City, State)	Percent Shipped by Truck	Percent Shipped by Rail
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____
5. _____	_____	_____
6. _____	_____	_____
7. _____	_____	_____

PART D: CARRIER CHOICE QUESTIONS

16. Is your plant's location on a railroad?

Yes __
No __

If answer is No, skip to Part E.

17. What type of railroad is your plant located on?

(a) Class I __
(b) Class II or III __

If answer is (b), skip to question 19.

18. What is the primary reason the plant is located on a Class I railroad? Pick the primary reason from among the group listed below and put a 1 next to it, then put a 2 next to the second most important reason and 3 next to the third most important factor.
(a) transportation cost ___
(b) equipment availability ___
(c) ability to ship to many markets ___
(d) reliable transit time ____
(e) fast transit time ___
(f) shipment tracing capability ___
(g) amount of weekly service ____
(h) other, please specify ___

19. What is the primary reason the plant is located on a Class II or Class III railroad? Select the primary reason from the group listed below and put a 1 next to it, put a 2 next to the second most important reason, and a 3 next to the third most important factor:
(a) reliable transit times _____
(b) fast transit times _____
(c) transportation cost _____
(d) equipment availability _____
(e) amount of weekly service ____
(f) ability to ship to many markets_____
(g) other, please specify _____

PART E: KANSAS TRANSPORTATION INFRASTRUCTURE

20. How would you rate Kansas transportation infrastructure? Circle one answer per row:

	Poor		Average		Excellent	N/A
(a) Rail lines	1	2	3	4	5	N/A
(b) Roads	1	2	3	4	5	N/A
1. Interstate highways	1	2	3	4	5	N/A
2. Primary State highways	1	2	3	4	5	N/A
3. Paved county roads	1	2	3	4	5	N/A
4. Unimproved county roads	1	2	3	4	5	N/A

21. What are the most important transportations issues for your company? Are there any constraints or problems in the logistics system for either ethanol or DDGs?

PART F: THE FUTURE

22. What changes do you see occurring in your transportation requirements in the next five years? Check all of the following that apply.

(a) an increase in ethanol shipments_____
(b) a decrease in ethanol shipments_____
(c) an increase in DDG shipments _____
(d) a decrease in DDG shipments _____
(e) a change in the sources of corn supply _____
(f) a change in principal transportation mode _____
(g) a change in ethanol markets _____
(h) a change in DDG markets _____

23. In your opinion what is the future of ethanol production in Kansas?

APPENDIX B - IMPACT OF ETHANOL PRODUCTION ON KANSAS TRANSPORTATION, GRAIN ELEVATORS

IMPACT OF ETHANOL PRODUCTION ON KANSAS TRANSPORTATION
GRAIN ELEVATORS

Company Name _____

PART A: GRAIN RECEIPTS

1. Please provide corn and sorghum receipts from farmers for the 2005-2007 period. If there is more than one elevator station in the company, simply provide grain receipts for all of the elevators in the company as a single total. If possible provide grain receipts on a calendar year basis. If not possible, please specify your fiscal year.

	Grain Receipts (bushels)	
Year	Corn	Sorghum
2005	_____	_____
2006	_____	_____
2007	_____	_____

2. In the past 12 months, what percent of your total grain receipts were delivered to your elevators in the following types of trucking equipment. Sum of percent must add to 100.

	Percent
(a) single axle truck	_____
(b) tandem axle truck	_____
(c) semi-tractor trailer	_____
(d) other (please specify)	_____

PART B: OUTBOUND TRANSPORTATION

3. Please provide outbound corn and sorghum shipments to ethanol production plants in Kansas by truck and rail for 2006-2008 period. If there is more than one elevator station in the company simply provide corn and sorghum shipments for all the elevators in the company as a single total. If possible provide shipments on a calendar year basis. If not possible, please specify your fiscal year.

Outbound Corn-Bushels
Kansas Ethanol Plants

Year	Truck	Rail
2006	_____	_____
2007	_____	_____
2008 (to date)	_____	_____

Outbound Sorghum-Bushels
Kansas Ethanol Plants

Year	Truck	Rail
2006	_____	_____
2007	_____	_____
2008 (to date)	_____	_____

4. Please provide outbound corn and sorghum shipments to ethanol production plants outside Kansas by truck and rail for the 2006-2008 period. If there is more than one elevator station in your company please provide corn and sorghum shipments for all elevators in the company as a single total.

Outbound Corn-Bushels
Non-Kansas Ethanol Plants

Year	Truck	Rail
2006	_____	_____
2007	_____	_____
2008 (to date)	_____	_____

Outbound Sorghum-Bushels
Non-Kansas Ethanol Plants

Year	Truck	Rail
2006	_____	_____
2007	_____	_____
2008 (to date)	_____	_____

5. Please list the most important markets (destinations) for your outbound corn and sorghum shipments to ethanol plants outside Kansas during the last 12 months. Also please estimate the percent shipped by rail and truck to each destination market. If there is more than one elevator station in the company, please provide the data for the elevators in the company as a group.

Outbound Corn Bushels
Non-Kansas Ethanol Plants
Current Markets - Previous 12 Months

Market Name (City, State)	Percent Shipped by Truck	Percent Shipped by Rail
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____

Outbound Sorghum Bushels
Non-Kansas Ethanol Plants
Current Markets – Previous 12 Months

Market Name (City, State)	Percent Shipped by Truck	Percent Shipped by Rail
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____

6. Please provide outbound corn and sorghum shipments to other markets, other than ethanol plants, by truck and rail for the 2006-2008 period. If there is more than one elevator station in the company please provide corn and sorghum shipments for all the elevators in the company as a single total. If possible provide shipments on a calendar year basis. If not possible, please specify your fiscal year.

Outbound Corn-Bushels
Non-Ethanol Plant Market

Year	Truck	Rail
2006	_____	_____
2007	_____	_____
2008 (to date)	_____	_____

Outbound Sorghum-Bushels
Non-Ethanol Plant Market

Year	Truck	Rail
2006	_____	_____
2007	_____	_____
2008 (to date)	_____	_____

7. Please list the most important destinations (markets) other than ethanol plants for your outbound corn and sorghum during the last 12 months. Also please estimate the percent shipped by rail and truck to each destination market. If there is more than one elevator station in the company, please provide the data for all the elevators in the company as a group. For each destination (market) percents have to add to 100.

Outbound Corn
Non-Ethanol Plant Markets
Current Markets(previous 12 months)

Market Name (City, State)	Percent Shipped by Truck	Percent Shipped by Rail
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____
5. _____	_____	_____

Outbound Sorghum
Non-Ethanol Plant Markets
Current Markets(previous 12 months)

Market Name (City, State)	Percent Shipped by Truck	Percent Shipped by Rail
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____
5. _____	_____	_____

PART C: CARRIER CHOICE SELECTION

8. Below is a list of transportation carrier characteristics that may influence your selection of one type of transportation over another (i.e., truck or rail). Please rank these characteristics from the most important to the least important. The most important is number 1, and the least important is number 8. Only one characteristic can be ranked number 1, and only one characteristic can be ranked number 2, etc. Be sure to give all 8 characteristics a ranking number.

Transportation Characteristic	Importance Rank
Ability to ship to many markets	_____
Amount of time to deliver my freight from origin to destination	_____
The transportation rate	_____
Predictability of the Time it takes to ship my freight to destination	_____
Shipment tracing capability	_____
Amount of weekly service provided by the carrier	_____
Lost or damaged goods	_____
Equipment availability	_____

9. If you have recently (past 12 months) increased the percent of total corn shipments that you ship by truck, which of the following are reasons for shipping more by truck? Check all that apply.

(a) increased ethanol production in Kansas _____
(b) truck rates are lower than rail rates _____
(c) railcar shortages _____
(d) truck service is more frequent and dependable than rail service _____
(e) construction of rapid load out (shuttle train) facilities on railroads _____
(f) other (please specify) _____

10. If you have recently (past 12 months) increased the percent of total sorghum shipments that you ship by truck, which of the following are reasons for shipping more by truck? Check all that apply.

(a) increased ethanol production in Kansas _____
(b) truck rates are lower than rail rates _____
(c) railcar shortages _____
(d) truck service is more frequent and dependable than rail service _____
(e) construction of rapid load out (shuttle train) facilities on railroads _____
(f) other (please specify) _____

PART D: SUMMARY

11. Please describe how your markets for corn and sorghum have changed as a result of increased ethanol production in Kansas. What have been the resulting changes in your transport of corn and/or sorghum?

APPENDIX C - IMPACT OF ETHANOL PRODUCTION ON KANSAS TRANSPORTATION, CLASS I RAILROADS

IMPACT OF ETHANOL PRODUCTION ON KANSAS TRANSPORTATION
CLASS I RAILROADS

Railroad Name: _____

PART A: GENERAL QUESTIONS

1. How many mainline and branchline miles does the railroad operate in the state of Kansas?

(a) Mainline miles _____
(b) Branchline miles _____

2. Please list the shortline railroads in Kansas that connect with your railroad in Kansas. Also please list the junction location for each connection.

Kansas Shortline Railroad	Junction Location(s)
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

PART B: CORN SHIPMENTS TO KANSAS ETHANOL PLANTS

3. Does your railroad deliver corn to Kansas ethanol plant locations?

Yes _____
No _____

4. If the answer to the previous question is Yes, how many bushels and carloads were delivered to Kansas ethanol plants in the state of Kansas in the 2005-2008 period? If the answer to the previous question is No, skip this question.

Year	Bushels	Carloads
2005	_____	_____
2006	_____	_____
2007	_____	_____
2008	_____	_____

5. If the answer to question 3 is Yes, what is the type and gross vehicle weight of railcars used to ship corn to Kansas ethanol plants? If the answer to question 3 is No, skip this question.

(a) Car Type _____
(b) Gross Vehicle Weight _____

6. If the answer to question 3 is Yes, what is the typical shipment size (number of carloads) delivered to Kansas ethanol plants? If the answer to question 3 is No, skip this question.

Number of carloads per shipment _____

7. If the answer to question 3 is Yes, in what state(s) did the corn originate in the previous 12 months? If the answer to question 3 is No, skip this question.

Corn Origin State	Carloads Originated
_____	_____
_____	_____
_____	_____
_____	_____

PART C: OUTBOUND ETHANOL SHIPMENTS FROM KANSAS

8. Please provide the number of ethanol carloads originated from Kansas ethanol plants as a group by month for the 2005-2008 period.

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
2005	____	____	____	____	____	____	____	____	____	____	____	____
2006	____	____	____	____	____	____	____	____	____	____	____	____
2007	____	____	____	____	____	____	____	____	____	____	____	____
2008	____	____	____	____	____	____	____	____	____	____	____	____

9. What are the destination markets for ethanol shipped from Kansas ethanol plants as a group during the previous 12 month period? If actual carloads shipped to each market are unavailable, please estimate the percent of the total shipments going to each market. Percents must add to 100.

Market Name (City, State)	Number of Ethanol Carloads Shipped From Kansas	Percent of Ethanol Carloads Shipped From Kansas
1._____	_____	_____
2._____	_____	_____
3._____	_____	_____
4._____	_____	_____
5._____	_____	_____

10. What type and gross vehicle weight of railcar is used to transport Kansas ethanol?

(a) Car Type _____
(b) Gross Vehicle Weight (GVW) _____ pounds

11. What is the shipment size (number of cars) of ethanol typically shipped from Kansas ethanol plant locations on your railroad?

Number of carloads per shipment _____

PART D: OUTBOUND DDG SHIPMENTS FROM KANSAS ETHANOL PLANTS

12. Does your railroad transport DDG from Kansas ethanol plants?

(a) Yes_____ (b) No_____

13. If the answer to the previous question is Yes, how many carloads of DDG were shipped from Kansas ethanol plants as a group during the 2005-2008 period? If the answer to the previous question is No, skip this question.

Year	Carloads of DDG
2005	_____
2006	_____
2007	_____
2008	_____

14. If the answer to question 12 is Yes, what are the current destination markets for DDG shipped from Kansas ethanol plants as a group during the previous 12 month period? If the answer to question 12 is No, skip this question.

Market Name (City, State)	DDG Carloads Shipped From Kansas
1._____	_____
2._____	_____
3._____	_____
4._____	_____
5._____	_____

15. What is the type and gross vehicle weight of railcar used to transport DDG from Kansas ethanol plants?

(a) Car Type _____
(b) Gross Vehicle Weight _____

16. What is the shipment size (number of cars) of DDG typically shipped from Kansas ethanol plant locations on your railroad? _____

PART E: SUMMARY

17. What do you expect to happen to your ethanol carloadings in Kansas in the next five years? Please explain the amount of increase (decrease) you expect and the reasons why you expect an increase (decrease).

18. Are there any obstacles or limitations in your ethanol logistics system that limit the amount of ethanol shipments from Kansas ethanol plants on your railroad? If so, please explain.

APPENDIX D - IMPACT OF ETHANOL PRODUCTION ON KANSAS TRANSPORTAION, SHORT LINE RAILROADS

IMPACT OF ETHANOL PRODUCTION ON KANSAS TRANSPORTATION
SHORT LINE RAILROADS

Railroad Name: _____

PART A: GENERAL QUESTIONS

1. How many miles of track does the railroad operate in the state of Kansas and other states?

(a) Kansas track miles _____
(b) Non-Kansas track miles _____

2. Please list the Class I railroads that connect to your railroad in Kansas. Also please list the junction location for each connecting railroad

Class I Railroad	Junction Location(s)
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

PART B: CORN SHIPMENTS TO KANSAS ETHANOL PLANTS

3. Does your railroad deliver corn to Kansas ethanol plant locations?

Yes _____
No _____

4. If the answer to the question 3 is Yes, how many bushels and carloads were delivered to Kansas ethanol plants in the state of Kansas in the 2006-2008 period? If the answer to the question 3 is No, skip this question.

Year	Bushels	Carloads
2006	_____	_____
2007	_____	_____
2008(to date)	_____	_____

5. If the answer to question 3 is Yes, what is the type and gross vehicle weight of railcars used to ship corn to Kansas ethanol plants? If the answer to question 3 is No, skip this question.

(a) Car Type _____
(b) Gross Vehicle Weight _____

6. If the answer to question 3 is Yes, what is the typical shipment size (number of carloads) delivered to Kansas ethanol plants? If the answer to question 3 is No, skip this question.

Number of carloads per shipment _____

7. If the answer to question 3 is Yes, in what state(s) did the corn originate in the previous 12 months? If the answer to question 3 is No, skip this question.

Corn Origin State	Carloads Originated
_____	_____
_____	_____
_____	_____
_____	_____

PART C: OUTBOUND ETHANOL SHIPMENTS

8. Please provide the number of ethanol carloads originated from Kansas ethanol plants as a group by month for the 2006-2008 period.

Year	Carloads
2006	_____
2007	_____
2008 (to date)	_____

9. Please provide the following information for the ethanol shipped from Kansas ethanol plants as a group during the previous 12 months. Please provide the connecting Class I railroad (if any) and the final destination of the ethanol carloads your railroad originated, if known.

Market Name (City, State)	Number of Ethanol Carloads Originated In Kansas	Connecting Class I Railroad
1._____	_____	_____
2._____	_____	_____
3._____	_____	_____
4._____	_____	_____
5._____	_____	_____

10. What type and gross vehicle weight of railcar is used to transport Kansas ethanol?

(a) Car Type _____
(b) Gross Vehicle Weight (GVW) _____

11. What is the shipment size (number of cars) of ethanol typically shipped from Kansas ethanol plant locations on your railroad?

Number of carloads per shipment _____

PART D: OUTBOUND DDG SHIPMENTS FROM KANSAS ETHANOL PLANTS

12. Does your railroad transport DDG from Kansas ethanol plants?

(a) Yes_____ (b) No_____

13. If the answer to the previous question is Yes, how many carloads of DDG were shipped from Kansas ethanol plants as a group during the 2006-2008 period? If the answer to the previous question is No, skip this question.

Year	Carloads of DDG
2006	_____
2007	_____
2008 (to date)	_____

14. If the answer to question 12 is Yes, what are the current destination markets for DDG shipped from Kansas ethanol plants as a group during the previous 12 month period? If the answer to question 12 is No, skip this question.

Market Name (City, State)	DDG Carloads Shipped From Kansas
1._____	_____
2._____	_____
3._____	_____
4._____	_____
5._____	_____

15. What is the type and gross vehicle weight of railcar used to transport DDG from Kansas ethanol plants?

(a) Car Type _____
(b) Gross Vehicle Weight _____

16. What is the shipment size (number of cars) of DDG typically shipped from Kansas ethanol plant locations on your railroad? _____

PART E: SUMMARY

17. What do you expect to happen to your ethanol carloadings in Kansas in the next five years? Please explain the amount of increase (decrease) you expect and the reasons why you expect an increase (decrease).

18. Are there any obstacles or limitations in your ethanol logistics system that limit the amount of ethanol shipments from Kansas ethanol plants on your railroad? If so, please explain.

APPENDIX E - IMPACT OF KANSAS ETHANOL PRODUCTION ON KANSAS TRANSPORTATION, COUNTY ROADS AND BRIDGES

IMPACT OF KANSAS ETHANOL PRODUCTION ON KANSAS TRANSPORTATION
COUNTY ROADS AND BRIDGES

County_____

Respondent Name_____

PART A: CURRENT CONDITION OF COUNTY ROADS

1. How many miles of road and how many bridges is the county responsible for?
   (a) Miles of road _____
   (b) Number of bridges _____

2. How many miles of the county's roads are in the following categories?
   (a) Concrete _____
   (b) Asphalt _____
   (c) Unpaved _____

3. For the county's concrete roads, what percent of the miles are in the following categories?
   Total must add to 100 percent.
   (a) very poor _____
   (b) poor _____
   (c) fair _____
   (d) good _____
   (e) very good_____

4. For the county's asphalt roads, what percent of the miles are in the following categories?
   Total must add to 100 percent.
   (a) very poor _____
   (b) poor _____
   (c) fair _____
   (d) good _____
   (e) very good_____

5. For the county's unpaved roads, what percent of the miles are in the following categories?
   Total must add to 100 percent.
   (a) very poor _____
   (b) poor _____
   (c) fair _____
   (d) good _____
   (e) very good_____

6. Has the number of paved miles of the county's roads declined in the last five years?

(a) Paved miles in 2003 _____

(b) Paved miles in 2008 _____

7. Which of the following best describes the overall condition of the county's roads compared to five years ago?

(a) Much Worse _____

(b) Worse _____

(c) Unchanged _____

(d) Better _____

(e) Much better _____

PART B: REVENUE AND EXPENSE

8. What was the county's annual expenditure for road and bridge maintenance in the following years?

(a) 2008 _____

(b) 2007 _____

(c) 2006 _____

9. Is the current budget for road and bridge maintenance sufficient to maintain an adequate level of service on the county roads?

(a) Yes _____

(b) No _____

10. If the answer to the previous question is no, put a checkmark for the response that best describes the maintenance budget shortfall. For example if the budget is 90% of what is needed to provide adequate service, the budget shortfall is 10%.

(a) 10 percent or less _____

(b) 11 percent to 20 percent _____

(c) 21 percent to 30 percent _____

(d) 31 percent or more _____

11. What are the sources of revenue for the county's road and bridge maintenance budget? Please specify dollar amounts for the most recent year available.

(a) Local property tax _____

(b) Motor vehicle tax _____

(c) Grants from the state _____

(d) Special City/County Highway Fund _____

(e) Other _____

PART C: IMPACT OF ETHANOL PLANT ON COUNTY ROADS

12. Has the truck traffic entering and leaving the ethanol plant had an impact on the condition of the county roads?

(a) Yes _____
(b) No _____
(c) Not sure _____

13. If the answer to question 12 is yes, please describe the impact of ethanol-related truck traffic on the county's road and bridges.

14. Has the truck traffic entering or leaving the ethanol plant caused a bottleneck or congestion problem on your county's roads?

(a) Yes _____
(b) No _____
(c) Not sure _____

15. What percent of the trucks bringing corn or milo to the ethanol plant are 80,000 pound semi's?

(a) 50-70% _____
(b) 71-90% _____
(c) Over 90% _____
(d) Not sure _____

16. What percent of the trucks leaving the ethanol plant are 80,000 pound semi's?

(a) 50-70% _____
(b) 71-90% _____
(c) Over 90%_____
(d) Not sure _____

17. Has the ethanol-related plant truck traffic affected the county's annual expenditure for road
and bridge maintenance?

(a) Yes _____
(b) No _____
(c) Not sure _____

18. If the answer to question 17 is yes, what is your best estimate of the percent increase in
maintenance spending due to inbound and outbound truck traffic of the ethanol plant?

(a) 0-10% _____
(b) 11-20% _____
(c) 21-30% _____
(d) Over 30%_____

19. Has the inbound and outbound heavy truck (80,000 pound semi's) traffic of the ethanol plant
impaired the ability of the county to maintain an adequate level of service on the county's
roads?

(a) Yes_____
(b) No _____

16. What percent of the trucks leaving the ethanol plant are 80,000 pound semi's?

(a) 50-70% _____
(b) 71-90% _____
(c) Over 90%_____
(d) Not sure _____

17. Has the ethanol-related plant truck traffic affected the county's annual expenditure for road
and bridge maintenance?

(a) Yes _____
(b) No _____
(c) Not sure _____

18. If the answer to question 17 is yes, what is your best estimate of the percent increase in
maintenance spending due to inbound and outbound truck traffic of the ethanol plant?

(a) 0-10% _____
(b) 11-20% _____
(c) 21-30% _____
(d) Over 30%_____

19. Has the inbound and outbound heavy truck (80,000 pound semi's) traffic of the ethanol plant
impaired the ability of the county to maintain an adequate level of service on the county's
roads?

(a) Yes _____
(b) No _____

K-TRAN

KANSAS TRANSPORTATION RESEARCH
AND
NEW - DEVELOPMENTS PROGRAM

A COOPERATIVE TRANSPORTATION RESEARCH PROGRAM BETWEEN:

KANSAS DEPARTMENT OF TRANSPORTATION

THE UNIVERSITY OF KANSAS

KANSAS STATE UNIVERSITY