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APPROXIMATION OF THE ECONOMIC IMPACTS OF THE KANSAS COMPREHENSIVE TRANSPORTATION PROGRAM

Michael W. Babcock
Kansas State University



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16 Abstract <p>In 1999 the Kansas legislature approved a 10 year transportation program called the Comprehensive Transportation Program (CTP) that contains billions of dollars for Kansas road and bridge projects. It is appropriate and important to measure the construction economic impacts of the program to facilitate an evaluation of the state's investment in highways, and the cost if highway expenditures are reduced.</p> <p>The approximated economic impacts of the CTP during the analysis period are as follows: (a) output impact, \$7.1 billion (2.6 times the value of highway contracts); (b) income impact, \$1.4 billion (2.4 times greater than direct wages and salaries) and (c) employment impact, 114,635 jobs (41 jobs per \$1 million of highway contract value). It is emphasized that these approximate impacts are conservative estimates. The approximated economic impact of the Kansas CTP (K-jurisdiction) highway construction contracts as measured by output is \$7.1 billion (2.6 times the value of highway construction contracts) distributed by highway improvement type. The approximated economic impact of the Kansas CTP (K-jurisdiction) highway construction contracts as measured by income is \$1.4 billion (2.4 times greater than the value of wages and salaries paid in the road construction industry) distributed by highway improvement type. The approximated economic impact of the Kansas CTP (K-jurisdiction) highway construction contracts as measured by employment is 114,635 full time equivalent (FTE) jobs distributed by highway improvement type.</p>			
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Final Report

Prepared by

Michael W. Babcock
Kansas State University

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THE KANSAS DEPARTMENT OF TRANSPORTATION
TOPEKA, KANSAS

KANSAS STATE UNIVERSITY
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EXECUTIVE SUMMARY

The Economics Department of Kansas State University conducted two economic impact studies of the Kansas Comprehensive Highway Program (CHP) in the 1990s. The first study titled *Employment Impact of Highway Construction and Maintenance Activities in Kansas* was published in February 1996, and examined economic impacts of CHP K-jurisdiction contracts completed between July 1, 1991 and May 19, 1994. The second study titled *Economic Impacts of the Kansas Comprehensive Highway Program* published in June 1997 measured economic impacts of \$2.86 billion spent on K-jurisdiction CHP projects between July 1, 1989 and June 30, 1997.

In 1999 the Kansas legislature approved a 10 year transportation program that contains billions of dollars for Kansas road and bridge projects. It is appropriate and important to measure the construction economic impacts of the Kansas road and bridge program to facilitate an evaluation of the state's investment in highways, and the cost if highway expenditures are reduced.

Given the need for measuring the construction impacts of the Kansas Comprehensive Transportation Program (CTP), the objectives of the study are:

Objective 1. Approximate *direct* output, income, and employment impacts by highway improvement type for CTP projects let between July 1, 1999 and October 31, 2004.

Objective 2. Approximate *indirect* and *induced* output, income, and employment impacts by highway improvement type for CTP projects let between July 1, 1999 and October 31, 2004.

The *output* impact is the increase in Kansas production as a result of the expenditure for CTP highway and bridge construction projects. The *income* impact is the

increase in Kansas wages and salaries in response to an increase in the income of workers employed on CTP road and bridge construction projects. The *employment* impact is the gain in Kansas employment attributable to CTP highway and bridge construction projects.

The *direct* impact is CTP program induced output, income, and employment within the highway construction industry itself, while the *indirect* impact is the CTP induced output, income, and employment of the industries that supply the construction industry with goods, services, and materials. The *induced* impact is the additional output, income, and employment in various consumer markets produced by the increased consumer spending of people employed on CTP construction projects.

Economic impacts were calculated for the same highway improvement categories as the previous studies of the CHP program.

<u>Category</u>	<u>Highway Improvement Type</u>
1	Resurfacing
2	Restoration and Rehabilitation; Reconstruction and Minor Widening
3	New Bridges and Bridge Replacement
4	Major and Minor Bridge Rehabilitation
5	New Construction; Relocation; Major Widening
6	Safety/Traffic Operations/Traffic System Management; Environmentally Related; Physical Maintenance; Traffic Services

The research objectives were accomplished by utilizing output, income, and employment multiplier data from the June 1997 study referred to above. Therefore, the measured impacts are *approximations* since they are based on the assumption that the

multipliers and other data measured in the 1997 study have not changed.

The major findings of this study include the following:

1. The approximated economic impacts of the CTP during the analysis period are as follows:

- (a) output impact, \$7.1 billion (2.6 times the value of highway contracts)
- (b) income impact, \$1.4 billion (2.4 times greater than direct wages and salaries)
- (c) employment impact, 114,635 jobs (41 jobs per \$1 million of highway contract value)

It is emphasized that these approximate impacts are conservative estimates. In the June 1997 study, it wasn't possible to obtain input data for highway work that was subcontracted. As a result, the estimated impacts omit the economic impact of the inputs that highway contractors purchased from each other.

2. The approximated economic impact of the Kansas CTP (K-jurisdiction) highway construction contracts as measured by output is \$7.1 billion (2.6 times the value of highway construction contracts) distributed by highway improvement type as follows:

<u>Highway Improvement Type</u>	<u>Value of Highway Contracts (Millions of Dollars)</u>	<u>Output Multiplier</u>	<u>Output Impact (Millions of Dollars)</u>
Category 1	\$639.8	2.671768	\$1,709.4
Category 2	\$1,263.1	2.587211	\$3,267.9
Category 3	\$248.2	2.374471	\$589.3
Category 4	\$108.3	2.518010	\$272.7
Category 5	\$476.0	2.468194	\$1,174.9
Category 6	\$57.5	2.159928	\$124.2
Total	\$2,792.9		\$7,138.4

The output impact for each highway improvement type is obtained by multiplying the value of highway contracts by the output multiplier.

3. The approximated economic impact of the Kansas CTP (K-jurisdiction) highway

construction contracts as measured by income is \$1.4 billion (2.4 times greater than the value of wages and salaries paid in the road construction industry) distributed by highway improvement type as follows:

<u>Highway Improvement Type</u>	<u>Direct Wages and Salaries (Millions of Dollars)</u>	<u>Income Multiplier</u>	<u>Income Impact (Millions of Dollars)</u>
Category 1	\$90.2	2.990495	\$269.7
Category 2	\$279.1	2.346804	\$655.0
Category 3	\$62.3	2.087858	\$130.1
Category 4	\$41.9	1.725710	\$72.3
Category 5	\$104.7	2.240519	\$234.6
Category 6	\$10.8	2.123587	\$22.9
Total	\$589.0		\$1,384.6

The direct wages and salaries are the payments to workers in the construction industry attributable to the CTP. The income impact for each highway improvement type is obtained by multiplying the direct wages and salaries by the income multiplier.

4. The approximated economic impact of the Kansas CTP (K-jurisdiction) highway construction contracts as measured by employment is 114,635 full time equivalent (FTE) jobs distributed by highway improvement type as follows:

<u>Highway Improvement Type</u>	<u>Value of Highway Contracts (Millions of Dollars)</u>	<u>Employment Multiplier</u>	<u>Employment Impact (FTE Jobs)</u>
Category 1	\$639.8	37.68	24,107.7
Category 2	\$1,263.1	42.26	53,378.6
Category 3	\$248.2	41.74	10,359.9
Category 4	\$108.3	54.44	5,895.9
Category 5	\$476.0	39.77	18,930.5
Category 6	\$57.5	34.12	1,961.9
Total	\$2,792.9		114,634.5

The employment impact of 114,635 FTE jobs is obtained by multiplying the

employment multiplier (employment per million of dollars of output) by the value of highway contracts in each highway improvement type and then summing all six categories. The CTP during the analysis period generated an average of 41 jobs per million dollars of contract value ($114,635/\$2,792.9 = 41$ jobs per \$1 million).

Despite large differences in the percentage composition of expenditures by highway improvement type for the June 1997 CHP study and the CTP study, the results of the two studies are virtually identical. The ratio of output impact to value of highway construction contracts is about 2.6 for both studies. The ratio of income impact to direct wages and salaries is about 2.4 in both studies. The jobs per \$1 million of highway contract value is 41 in both cases.

CHAPTER 1

INTRODUCTION

1.1 Highway Construction Economic Impacts Revisited

The Economics Department at Kansas State University conducted two economic impact studies of the Kansas Comprehensive Highway Program (CHP) in the 1990s. The first study titled *Employment Impact of Highway Construction and Maintenance Activities in Kansas* was published in February 1996, and examined economic impacts of CHP K-jurisdiction contracts completed between July 1, 1991 and May 19, 1994. The second study titled *Economic Impacts of the Kansas Comprehensive Highway Program* published in June 1997 measured economic impacts of \$2.86 billion spent on K-jurisdiction CHP projects between July 1, 1989 and June 30, 1997.

In 1999 the Kansas legislature approved a 10 year transportation program that contains billions of dollars for Kansas road and bridge projects. It is appropriate and important to measure the construction economic impacts of the Kansas road and bridge program to facilitate an evaluation of the state's investment in highways, and the cost if highway expenditures are reduced.

1.2 Research Objectives

Given the need for measuring the construction impacts of the Kansas Comprehensive Transportation Program (CTP), the objectives of the study are:

Objective 1. Approximate *direct* output, income, and employment impacts by highway improvement type for CTP projects let between July 1, 1999 and October 31, 2004.

Objective 2. Approximate *indirect* and *induced* output, income, and employment impacts by

highway improvement type for CTP projects let between July 1, 1999 and October 31, 2004.

The *output* impact is the increase in Kansas production as a result of the expenditure for CTP highway and bridge construction projects. The *income* impact is the increase in Kansas wages and salaries in response to an increase in the income of workers employed on CTP road and bridge construction projects. The *employment* impact is the gain in Kansas employment attributable to CTP highway and bridge construction projects.

The *direct* impact is CTP program induced output, income, and employment within the highway construction industry itself, while the *indirect* impact is the CTP induced output, income, and employment of the industries that supply the construction industry with goods, services, and materials. The *induced* impact is the additional output, income, and employment in various consumer markets produced by the increased consumer spending of people employed on CTP construction projects.

The research will examine the economic impacts of KDOT expenditures on K-jurisdiction projects. These are typically those projects on the state highway system outside of cities except for interstate roads, which are classified as K-jurisdiction projects regardless of location.

The study will not examine the economic impacts of other aspects of the Kansas CTP program such as preliminary engineering by consultants which includes surveys, environmental clearances, permits, and preparation of design plans. The study also excludes the impact of utility adjustments which provide for payment of funds to affected utility companies to move utilities on KDOT right-of-way. The research project will not measure the economic impact of right-of-way acquisitions which involve payments to property owners to obtain land for construction of new bridges or pavements. The study will omit the economic impact of

construction engineering which includes surveys for bridge and pavement construction, inspection of construction materials, and other project administrative activities.

Economic impacts were calculated for the same highway improvement categories as the previous studies of the CHP program.

<u>Category</u>	<u>Highway Improvement Type</u>
1	Resurfacing
2	Restoration and Rehabilitation; Reconstruction and Minor Widening
3	New Bridges and Bridge Replacement
4	Major and Minor Bridge Rehabilitation
5	New Construction; Relocation; Major Widening
6	Safety/Traffic Operations/Traffic System Management; Environmentally Related; Physical Maintenance; Traffic Services

These categories are combinations of Federal Highway Administration categories of highway improvement projects (see Appendix A).

1.3 Input-Output Model

The methodology employed in the June 1997 CHP study was input-output analysis. An input-output model is a quantitative framework of analysis for examining the complicated interdependence within the production system of an economy. There are four components to the standard input-output model: an interindustry transactions matrix; a direct requirements matrix; a direct and indirect requirements matrix; and a direct, indirect, and induced requirements matrix. Each of these can be explained with the aid of a simple illustrative example drawn from Emerson (1989).

The transactions matrix describes the flows of goods and services between all individual

sectors of the economy in a given year. The columns show purchases by a particular industry from all other industries. For example, in the highly simplified example of an input-output transactions matrix appearing in Table 1, the data in the Farming sector column show that, in order to produce its \$30 million output, that sector purchased \$4 million from farm enterprises, \$7 million from manufacturing firms, \$6 million from trade establishments, and made \$13 million of payments to the final payments sectors (households, gross saving, government, and imports). The data in the Farming sector row indicate that Farming sold \$4 million to farm enterprises, \$8 million to manufacturing, \$2 million to trade, and \$16 million to final demand (households, investment, government, and exports).

The direct requirements matrix indicates the input requirements from each industry for a particular industry to produce \$1 of output. These purchase coefficients are obtained by dividing purchase data in each industry column of the transactions matrix by the corresponding output value for that industry. The resulting purchase coefficients, or input ratios, may be thought of as production recipes for a particular sector. From the data in the simplistic transactions matrix in Table 1, a direct requirements matrix can be calculated (Table 2). As an example, the first column (Farming) shows that to produce an average \$1 of output, the Farming sector buys \$.13 from farming enterprises, \$.23 from manufacturing firms, \$.20 from trade firms, and makes \$.44 of payments to the final payment sectors.

The direct and indirect requirements matrix is one of two matrixes that measures the interaction among industries. The other, the direct, indirect, and induced requirements matrix, is similar but includes the effects of household income and spending in addition to the interindustry interaction. The data in the columns of Table 3 for each industry indicate the direct and indirect requirements of all industries necessary for that industry to deliver \$1 of output to final demand.

Table 1**Illustrative Input-Output Transactions Matrix**

	Farming	Manufacturing	Trade	Final Demand	Total Output
Farming	4	8	2	16	30
Manufacturing	7	15	6	22	50
Trade	6	5	4	10	25
Final Payments	13	22	13	0	48
Total Inputs	30	50	25	48	153

Table 2**Illustrative Direct Requirements Matrix**

	Farming	Manufacturing	Trade
Farming	.13	.16	.08
Manufacturing	.23	.30	.24
Trade	.20	.10	.16
Final Payments	.44	.44	.52
Total	1.00	1.00	1.00

Table 3**Illustrative Direct and Indirect Requirements Matrix**

	Farming	Manufacturing	Trade
Farming	1.2844	.3242	.2149
Manufacturing	.5493	1.6360	.5174
Trade	.3712	.2710	1.3031

As an example, for the Farming sector to increase output to final demand by \$1, it must increase its overall output by \$1.2844 (including the initial \$1 increase), the Manufacturing sector must increase its output \$.5493, and the Trade sector must increase its output \$.3712. The total output increase of agriculture in this simplistic economy is the sum of these three values or 2.2049 times larger than the initial output expansion in agriculture. The corresponding values for Manufacturing and Trade are 2.2312 and 2.0354 respectively. This is the concept of an output multiplier.

Employment multipliers can be obtained by combining the information in Table 3 with industry employment/output ratios. Suppose we have the following information.

<u>Sector</u>	<u>Employment</u>	<u>Output</u>	<u>Employment/Output Ratio</u>
Farming	30,000	\$10,000,000	0.003
Manufacturing	50,000	\$12,500,000	0.004
Trade	100,000	\$50,000,000	0.002

To obtain the direct and indirect employment multiplier for Farming we multiply each of the entries in the Farming column of Table 3 by its employment/output ratio and then sum the column.

Farming	$0.003 \times 1.2844 = .003853$
Manufacturing	$0.004 \times .5493 = .002197$
Trade	$0.002 \times .3712 = .000742$
Total	$.006792$

The figure .006792 is the direct and indirect employment per dollar of Farming output. Employment multipliers are typically expressed as employment per \$1 million of output or 6,792 for the Farming sector. The employment multipliers for Manufacturing and Trade are calculated in the same manner and are 8,058 and 5,321 respectively.

The June 1997 CHP study was accomplished through the use of a 68 sector, survey-based input-output model (Emerson, 1989) for the state of Kansas developed by the Economics

Department at Kansas State University. The Kansas input-output model was adapted to include six additional sectors corresponding to the six highway improvement types discussed previously. The input-output data for these six sectors was obtained by surveying highway contractors who obtained Kansas CHP (K-jurisdiction) highway construction contracts during the period July 1, 1991 to September 30, 1996. The value of these sample contracts as well as the value of total K-jurisdiction contracts by highway improvement type is displayed in Table 4. As noted above, K-jurisdiction highway construction projects are typically those projects on the state highway system outside of cities except for interstate highways, which are classified as K-jurisdiction projects regardless of location.

To simplify the contractors' task of completing the questionnaires, the number of sectors in the input-output model was reduced from 68 to 51 (see Appendix B).

1.4 Methodology

The research objectives were accomplished by utilizing output, income, and employment multiplier data from the June 1997 study referred to above. Therefore, the measured impacts are *approximations* since they are based on the assumption that the multipliers and other data measured in the 1997 study have not changed. As indicated by the data in Table 5 there is some limited support for this assumption.

Table 5 contains the output, income, and employment multipliers for the February 1996 study and the June 1997 study. As indicated above, the February 1996 study measured the impacts of contracts completed between July 1, 1991 and May 19, 1994. The June 1997 study expanded the scope of the research by extending the analysis to include contracts completed between July 1, 1991 and September 30, 1996. The February 1996 study included about 30% (\$827.8 million) of the highway construction contract value examined by the June 1997 study

Table 4

**Value of CHP (K-Jurisdiction) Highway Construction Contracts
by Highway Improvement Type*
(Millions of Dollars)**

Highway Improvement Type	Value of CHP K-Jurisdiction Sample Construction Contracts July 1, 1991-September 30, 1996	Value of CHP K-Jurisdiction Construction Contracts**
Resurfacing	\$375.3	\$647.0
Restoration and Rehabilitation; Reconstruction and Minor Widening	1,227.0	1,621.6
New Bridges and Bridge Replacement	106.6	156.0
Major and Minor Bridge Rehabilitation	43.9	80.6
New Construction; Relocation; Major Widening	221.1	309.8
Safety / Traffic Operations / Traffic Systems Management; Environmentally Related; Physical Maintenance; Traffic Services	30.7	49.6
Grand Total	\$2,004.6	\$2,864.6

* K-jurisdiction highway construction projects are typically those projects on the state highway system outside of cities except for interstate highways, which are classified as K-jurisdiction projects regardless of location.

** The total value of CHP (K-jurisdiction) construction contracts includes the value of all the contracts let over the entire duration (fiscal years 1990 through 1997) of the CHP.

Table 5**Output, Income, and Employment Multipliers of Two CHP Studies**Output Multipliers

(1) Highway Improvement Types	(2) February 1996 Study	(3) June 1997 Study	(4) Percent Differences of (3) From (2)
Category 1	2.719	2.672	-1.7%
Category 2	2.608	2.587	-0.8%
Category 3	2.328	2.374	2.0%
Category 4	2.431	2.518	3.6%
Category 5	2.554	2.468	-3.4%
Category 6	2.704	2.160	-20.1%

Income Multipliers

(1) Highway Improvement Types	(2) February 1996 Study	(3) June 1997 Study	(4) Percent Differences of (3) From (2)
Category 1	3.035	2.990	-1.5%
Category 2	2.234	2.347	5.1%
Category 3	1.928	2.088	8.3%
Category 4	1.712	1.726	0.8%
Category 5	1.964	2.241	14.1%
Category 6	2.350	2.124	-9.6%

Employment Multipliers

(1) Highway Improvement Types	(2) February 1996 Study	(3) June 1997 Study	(4) Percent Differences of (3) From (2)
Category 1	35.18	37.68	7.1%
Category 2	40.90	42.26	3.3%
Category 3	40.11	41.74	4.1%
Category 4	51.91	54.44	4.9%
Category 5	47.21	39.77	-15.8%
Category 6	50.62	34.12	-32.6%

(\$2.86 billion).

Examination of Table 5 reveals that with the exception of Category 6, the output multipliers are within 3.6% of each other. For the income multipliers, with the exception of Category 5, the multipliers are within 10% of each other. While the percent differences of the employment multipliers for Category 1 through Category 4 are relatively small, they are quite large for Categories 5 and 6.

Further perspective on the stability of the multipliers over time can be gained from the data in Table 6. The table compares the output, income, and employment impacts of the June 1997 study to the estimated impacts obtained by using the February 1996 study multipliers. As the data in Table 6 indicates, the output, income, and employment impacts generated by the two different sets of multipliers are quite close to each other. This outcome occurs for two reasons. One is that some of the June 1997 study output, income, and employment multipliers increased relative to the February 1996 study multipliers, while others decreased. Thus the *total* impacts generated by the two sets of multipliers are close to each other. The other reason is that most of the contract value examined by both studies is concentrated in Categories 1 and 2, and the output, income, and employment multipliers of the two studies for these two highway improvement categories are quite close to each other.

Taken together the data in Tables 5 and 6 provide some limited support for the assumption that the multipliers are relatively stable over time. To complete the project, KDOT provided the total as let contract value of K-jurisdiction projects for the first 5.33 years of the CTP for each of the six categories.

Table 6
Comparison of Output, Income, and Employment Impacts
Using Multipliers From Two Different CHP Studies

Type of Multipliers	Total Output Impact	Total Income Impact	Total Employment Impact
(1) June 1997 Study	\$7,369.1	\$1,422.6	117,820.2
(2) 1997 Impacts Using February 1996 Study Multipliers	\$7,472.0	\$1,362.7	116,662.5
(3) Difference of (2) From (1)	1.4%	-5.5%	-1.0%

Output and income impacts are measured in millions of dollars. Employment is full-time equivalent jobs.

CHAPTER 2

MULTIPLIERS AND ECONOMIC IMPACT APPROXIMATIONS

2.1 Multipliers

Output multipliers for the six highway improvement types were calculated by summing the appropriate columns of the direct, indirect, and induced requirement matrix obtained from the June 1997 CHP study. The output multipliers reveal the total increase in Kansas output resulting from a given increase in the output of the six highway improvement categories. Output multipliers are a good indicator of the degree of economic interaction between each of the highway construction categories and the rest of the Kansas economy. Those highway improvement types that buy most of their inputs from Kansas producers will have higher output multipliers than those categories that rely more heavily on out-of-state suppliers.

Income multipliers were calculated for each of the highway construction categories by dividing the values in the household row of the direct, indirect, and induced requirements matrix by their corresponding values in the household row of the direct requirements matrix. Income multipliers indicate the total income generated from the construction projects including direct wages and salaries as well as indirect income generated in supplier industries.

The employment multipliers by highway improvement type were computed by employing a three step procedure. The first step was to calculate employment/output ratios for each of the industry sectors in the Kansas input-output model, including the six highway improvement categories. The employment/output ratios for the six highway improvement types were computed from data supplied by the sample highway contractors. The corresponding ratios for the other Kansas industry sectors are computed from data in Minnesota Implan Group (1993). The second step was to multiply each of the entries in the columns of the six highway categories

of the direct, indirect, and induced requirements matrix by the appropriate employment/output ratio. The third step was to sum the columns of the six highway categories. The result is an employment multiplier for each of the six highway improvement types. These multipliers are expressed as employment per million dollars of output (i.e. highway contract value).

The output, income, and employment multipliers of the June 1997 CHP study for the six highway improvement types are as follows:

Highway Improvement Type	Output Multiplier	Income Multiplier	Employment Multiplier
Category 1	2.671768	2.990495	37.68
Category 2	2.587211	2.346804	42.26
Category 3	2.374471	2.087858	41.74
Category 4	2.518010	1.725710	54.44
Category 5	2.468194	2.240519	39.77
Category 6	2.159928	2.123587	34.12

The above multipliers actually under-estimate the economic impact of highway construction contracts. The sample highway contractors that provided purchase data for the June 1997 study received 1,136 prime contracts and 2,464 subcontracts. Since many of these contracts involved multiple subcontractors it was impractical to attempt to obtain the input data for highway work that was subcontracted. The effect of this is to omit the economic impact of the inputs that the contractors purchased from each other. Thus the output, income, and employment impacts calculated with the above listed multipliers are conservative estimates.

2.2 Direct Wages and Salaries and Employment

Direct wages and salaries are those paid by highway construction firms to their employees, and include employer paid benefits. If it is assumed that direct wages and salaries are the same percent of contract value as the June 1997 CHP study, the approximate wages and salaries paid by highway improvement type can be calculated by multiplying the percentages by the CTP

contract value. The results are in Table 7.

The data in Table 7 reveal that the percent of total contract value attributable to wages and salaries varies a great deal by highway improvement type; from a low of 14.1% for Resurfacing projects to a high of 38.7% for Major and Minor Bridge Rehabilitation.

Approximate direct labor hours and full-time equivalent employment attributable to CTP (K-jurisdiction) construction projects let during the July 1, 1999 to October 31, 2004 period are in Table 8. Direct employment is the employment of highway construction companies involved in CTP (K-jurisdiction) projects. Hours worked for these projects were approximated using the following three step procedure.

1. Compute hours worked per dollar of contract value by highway improvement type from data in the June 1997 CHP study.
2. Obtain the total contract value by highway construction category of CTP (K-jurisdiction) contracts let during the study period.
3. Multiply (1) by (2).

Approximated labor hours can be converted to full-time equivalent employment by assuming some value for annual hours worked per employee. Since highway construction is a very seasonal business we asked several contractors in the 1997 CHP study to provide an estimate of this figure. While there was some variation in the estimates, most of them clustered around 2,000 hours. Thus approximate direct annual full-time equivalent employment is obtained by dividing total hours worked by 2,000 hours. The approximated total hours worked for all six highway improvement types as a group is 35,406,760, resulting in estimated annual direct full-time equivalent employment of 17,704 in the highway construction industry.

Table 7

**Approximate Direct Wages and Salaries of CTP K-Jurisdiction Contracts
Let Between July 1, 1999 and October 31, 2004*
(Millions of Dollars)**

Highway Improvement Type	Wages and Salaries	Percent of Contract Value
Resurfacing	\$90.2	14.1
Restoration and Rehabilitation; Reconstruction and Minor Widening	\$279.1	22.1
New Bridges and Bridge Replacement	\$62.3	25.1
Major and Minor Bridge Rehabilitation	\$41.9	38.7
New Construction; Relocation; Major Widening	\$104.7	22.0
Safety/Traffic Operations/Traffic Systems Management; Environmentally Related; Physical Maintenance; Traffic Services	\$10.8	18.8

* Direct wages and salaries are those paid by highway construction companies and include employer paid benefits.

Table 8

**Approximate Direct Labor Hours and Full-Time Equivalent Direct Employment
of CTP K-Jurisdiction Contracts Let Between July 1, 1999 and October 31, 2004***

Highway Improvement Type	Total Hours Worked	Full Time Equivalent Employment
Resurfacing	6,267,341	3,134
Restoration and Rehabilitation; Reconstruction and Minor Widening	16,113,199	8,057
New Bridges and Bridge Replacement	3,690,645	1,845
Major and Minor Bridge Rehabilitation	2,653,887	1,327
New Construction; Relocation; Major Widening	5,967,133	2,984
Safety/Traffic Operations/Traffic Systems Management; Environmentally Related; Physical Maintenance; Traffic Services	714,555	357

* Direct hours and employment are the hours and employment generated within the construction industry itself.

When total estimated wages and salaries of \$589 million are divided by estimated total hours worked of 35.4 million, the result is an average wage per hour of \$16.64 for all Kansas CTP (K-jurisdiction) highway construction contracts let during the study period.

2.3 Output, Income, and Employment Impacts

The approximate output impacts by highway improvement category of CTP (K-jurisdiction) construction projects let during the study period are in Table 9. The output impacts are approximated by multiplying the contract value of each highway improvement category by the respective output multipliers obtained from the 1997 CHP study (see KDOT, 1997, p. 33). As

indicated by the data in Table 9, the Kansas CTP (K-jurisdiction) highway construction contracts generated an approximate output valued at \$7.1 billion (includes the direct impact of \$2.8 billion), or 2.6 times greater than the highway contract value (\$7138.4/\$2.792.9).

The approximate income impacts by highway improvement type of CTP (K-jurisdiction) construction projects let during the study period (July 1, 1999 to October 31, 2004) are in Table 10. The income impacts are approximated by multiplying the estimated direct wages and salaries (Table 7) by highway improvement type by the respective income multiplier obtained from the 1997 CHP study (see KDOT, 1997, p. 34). As indicated by the data in Table 10, the approximated income impact is \$1.4 billion (includes the direct impact of \$589 million), or 2.4 times greater than direct wages and salaries (\$1,384.6/\$589.0).

The employment multipliers of the 1997 CHP study can be combined with the total contract value of the six highway improvement types to calculate the approximate employment impacts of the Kansas CTP (K-jurisdiction) road construction contracts let during the study period. The employment impacts are approximated by multiplying the contract value of each highway improvement type by the respective employment multiplier obtained from the 1997 CHP study (see KDOT, 1997, p. 36). The data in Table 11 reveal that the Kansas CTP (K-jurisdiction) contracts let during the study period generated 114,635 full-time jobs with 46.6% occurring in Category 2. It should be noted that the approximated employment impact is a conservative estimate due to the inability to obtain purchase data for highway work that was subcontracted in the 1997 CHP study. The CTP during the analysis period generated an average of 41 jobs per million dollars of highway contract value ($114,635 / \$2,792.9 = 41$ jobs per \$1 million).

Table 9

**Approximate Output Impacts by Highway Improvement Type of CTP
K-Jurisdiction Contracts Let Between July 1, 1999 and October 31, 2004
(Millions of Dollars)**

(1) Highway Improvement Type	(2) Total Highway Contract Value	(3) Output Multiplier	(4) Output Impact
Category 1	\$639.8	2.671768	\$1,709.4
Category 2	\$1,263.1	2.587211	\$3,267.9
Category 3	\$248.2	2.374471	\$589.3
Category 4	\$108.3	2.518010	\$272.7
Category 5	\$476.0	2.468194	\$1,174.9
Category 6	\$57.5	2.159928	\$124.2
Total	\$2,792.9		\$7,138.4

Column (4) is the product of columns (2) and (3).

Table 10

**Approximate Income Impacts by Highway Improvement Type of CTP
K-Jurisdiction Contracts Let Between July 1, 1999 and October 31, 2004
(Millions of Dollars)**

(1) Highway Improvement Type	(2) Direct Wages and Salaries	(3) Income Multiplier	(4) Income Impact
Category 1	\$90.2	2.990495	\$269.7
Category 2	\$279.1	2.346804	\$655.0
Category 3	\$62.3	2.087858	\$130.1
Category 4	\$41.9	1.725710	\$72.3
Category 5	\$104.7	2.240519	\$234.6
Category 6	\$10.8	2.123587	\$22.9
Total	\$589.0		\$1,384.6

Column (4) is the product of columns (2) and (3).

Table 11

**Approximate Employment Impacts by Highway Improvement Type of CTP
K-Jurisdiction Contracts Let Between July 1, 1999 and October 31, 2004
(Full-Time Equivalent Employment)**

(1) Highway Improvement Type	(2) Total Highway Contract Value*	(3) Employment Multiplier	(4) Employment Impact
Category 1	\$639.8	37.68	24,107.7
Category 2	\$1,263.1	42.26	53,378.6
Category 3	\$248.2	41.74	10,359.9
Category 4	\$108.3	54.44	5,895.9
Category 5	\$476.0	39.77	18,930.5
Category 6	\$57.5	34.12	1,961.9
Total	\$2,792.9		114,634.5

* Highway contract value measured in millions of dollars.

Column (4) is the product of columns (2) and (3).

CHAPTER 3

CONCLUSION

This study approximated the output, income, and employment impacts of \$2.79 billion of CTP as let expenditures on K-jurisdiction projects during the July 1, 1999 to October 31, 2004 period.

The estimated impacts are as follows:

<u>Output Impact</u>	<u>Income Impact</u>	<u>Employment Impact</u>
\$7.1 billion	\$1.4 billion	114,635 jobs

The approximated impacts are conservative estimates due to the inability to obtain purchase data for highway work that was subcontracted in the 1997 CHP study.

The results of the 1997 CHP study and the CTP study are compared in Table 12. As the data in the table indicates the ratio of output impact to value of highway construction contracts is virtually identical for both studies (about 2.6). The ratio of income impact to direct wages and salaries is about 2.4 for both studies. The jobs per \$1 million of highway contract value is 41 for both studies.

This result occurs despite large differences in the composition of expenditures by highway improvement type during the two analysis periods as indicated in Table 13. As revealed by the data in Table 13, only 45.2% of the expenditures by highway improvement type in the CTP study were in Category 2 as opposed to 56.6% for the CHP study. The CTP study had slightly higher percentages in all the other highway improvement types including 17% in Category 5 compared to 10.8% for the CHP study.

Table 12**Comparison of the June 1997 CHP Study Results to CTP Study Results**

Impact Result	CHP Study	CTP Study
Ratio of Output Impact to Value of Highway Construction Contracts	2.57	2.56
Ratio of Income Impact to Direct Wages & Salaries	2.38	2.35
Jobs Per \$1 Million of Highway Contract Value	41.1	41.0

Table 13**Comparison of CTP and CHP Study, Percent of Expenditures by Highway Improvement Type**

(1) Highway Improvement Type	(2) Percent of CHP Study	(3) Percent of CTP Study	(4) Percent Difference*
Category 1	22.6	22.9	+0.3
Category 2	56.6	45.2	-11.4
Category 3	5.5	8.9	+3.4
Category 4	2.8	3.9	+1.1
Category 5	10.8	17.0	+6.2
Category 6	1.7	2.1	+0.4

* Column (3) minus column (2).

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APPENDIX A

**FEDERAL HIGHWAY ADMINISTRATION DEFINITIONS
OF HIGHWAY IMPROVEMENT TYPES**

NEW CONSTRUCTION – Construction of a new facility that will not replace or relocate an existing facility. A new facility will provide: (1) a facility where none existed, or (2) an additional and alternative facility to an existing facility that will remain open and continue to serve through traffic.

RELOCATION – Construction of a facility on a new location that replaces an existing route. The new facility carries all the through traffic with the previous facility closed or retained as a land-service road only.

RECONSTRUCTION – Construction on approximate alignment of an existing route where the old pavement structure is substantially removed and replaced. Such reconstruction may be to the existing number of lanes or may include widening to provide additional through lanes, or utilizing, or adding, or revising interchanges, replacing other highway elements such as a grade separation to replace an existing grade intersection or otherwise improving the existing facility without changing the basic character of the facility.

MAJOR WIDENING – The addition of lanes or dualization of an existing facility where the existing pavement is salvaged. Also included, where necessary, is the resurfacing of the existing pavement and other incidental improvements such as drainage and shoulder improvements.

MINOR WIDENING – Widening the lanes and/or shoulders of an existing facility without adding through lanes. In many cases, the improvement will include resurfacing the existing pavement and other incidental improvements such as shoulder and drainage improvements.

RESTORATION AND REHABILITATION – Work required to return an existing pavement (including shoulders) to a condition of adequate structural support or to a condition adequate for placement of an additional stage of construction. There may be some upgrading of unsafe features or other incidental work in conjunction with restoration and rehabilitation. Typical

improvements would include replacing spalled or malfunctioning joints; substantial pavement stabilization prior to resurfacing; grinding/grooving of rigid pavements; replacing deteriorated materials; reworking or strengthening bases or subbases, and adding underdrains.

RESURFACING – Placement of additional surface material over the existing roadway to improve serviceability or to provide additional strength. There may be some upgrading of unsafe features and other incidental work in conjunction with resurfacing. Where surfacing is constructed by separate project as a final state of construction, the type of improvement should be the same as that of the preceding stage—new route, relocation, reconstruction, minor widening, etc.

NEW BRIDGE – Construction of a new bridge which does not replace or relocate an existing bridge.

BRIDGE REPLACEMENT – The total replacement of a structurally inadequate or functionally obsolete bridge with a new structure constructed in the same general traffic corridor to current geometric construction standards. A bridge removed and not replaced or replaced with a lesser facility is considered a bridge replacement. Incidental roadway approach work is included.

MAJOR BRIDGE REHABILITATION – The major work required to restore the structural integrity of a bridge as well as work necessary to correct major safety defects. Bridge deck replacement (both partial and complete) and the widening of bridges to specified standards are included. Construction of a dual structure to alleviate a capacity deficiency is also included.

MINOR BRIDGE REHABILITATION – Work required to correct minor structure and safety defects or deficiencies, such as deck patching, deck resurfacing, deck protective systems, upgrading railings, curbs and gutters, and other minor bridge work.

SAFETY/TRAFFIC OPERATIONS/TSM (Traffic System Management) – A project or a

significant portion of a project that provides features or devices to enhance safety; or a traffic operation improvement which is designed to reduce traffic congestion and to facilitate the flow of traffic, both people and vehicles, on existing systems, or to conserve motor fuels; or which is designed to reduce vehicle use or to improve transit service.

ENVIRONMENTALLY RELATED – The category includes improvements that do not provide any increase in the level of service, in the condition of the facility, or in safety features. Typical improvements, which fall in this category, would be noise barriers, beautification and other environmentally related features not built as a part of the above identified improvement types.

PHYSICAL MAINTENANCE – Includes maintenance of condition for roads and structures.

TRAFFIC SERVICES – Includes snow removal and the maintenance of traffic control devices.

APPENDIX B

KANSAS INPUT-OUTPUT MODEL SECTOR DEFINITIONS

Agricultural

1. Agricultural Products – grain, soybeans, hay, dairying, poultry, cattle, hogs, other agricultural products
2. Agricultural Services – Includes establishments primarily engaged in performing soil preparation services, crop services, veterinary services, other animal services, farm labor and management services, and landscape and horticultural services for others on a fee or contract basis. SIC 07

Mining

3. Crude Petroleum and Natural Gas – Includes establishments engaged in operating oil and gas field properties. SIC 1311
4. Oil and Gas Field Services – Establishments primarily engaged in drilling wells for oil or gas field operations for others and establishments performing geophysical, geological, and other exploration services for oil and gas, on a contract, fee, or similar basis. SIC 138
5. Nonmetallic Mineral Mining, excluding Fuels – Establishments primarily engaged in mining or quarrying, developing mines, or exploring for nonmetallic minerals, except fuels. SIC 14
6. Other Mining – Includes mining of coal, metals, and other minerals not previously classified. SIC 10, 12, 132

Construction

7. Maintenance and Repair – Includes expenditures by firms for maintenance and repair services on capital assets.
8. Building Construction – Includes general contractors engaged in construction of residential, farm, industrial, public, and other buildings. SIC 15
9. Heavy Construction – Includes general contractors engaged in the construction of highways and streets, bridges, sewers, railroads, etc. SIC 16
10. Special Trade Contractors – Includes contractors specializing in activities such as plumbing, painting, plastering, carpentering, etc. SIC 17

Manufacturing

11. Apparel and Related Products – Includes establishments producing clothing and fabricating products by cutting and sewing purchased woven or knit textile fabrics and related materials. SIC 23

12. Paper and Allied Products – Includes establishments manufacturing pulp from wood and other cellulose fibers, and manufacturing paper and paper products such as bags, boxes, envelopes, etc. SIC 26
13. Printing and Publishing – Includes establishments engaged in printing by one or more of the common processes, such as letterpress, lithography, gravure, or screen; establishments that perform services for the printing trade such as bookbinding, typesetting, and photoengraving. SIC 27
14. Industrial Inorganic and Organic Chemicals – Includes establishments engaged in manufacturing basic industrial chemicals such as industrial gases, dyes, pigments, etc. SIC 281, 286
15. Agricultural Chemicals – Includes establishments engaged in manufacturing fertilizers, agricultural pesticides, and other agricultural chemicals. SIC 287
16. Other Chemicals and Chemical Products – Includes establishments manufacturing unfinished plastics, drugs, cleaning preparations, perfumes, paints, explosives, glue, ink, etc. SIC 282, 283, 284, 285, 289.
17. Petroleum and Coal Products – Includes establishments primarily engaged in petroleum refining, manufacturing paving, and roofing materials, and compounding lubricating oils and greases from purchased materials. SIC 29
18. Rubber and Plastic Products – Includes establishments manufacturing rubber products such as tires, rubber footwear, mechanical rubber goods, flooring, etc., and establishments manufacturing primary plastic products and miscellaneous plastics products. SIC 30
19. Cement, Concrete, and Plaster Products – Includes establishments producing hydraulic cement, concrete, and concrete products, plasterboard, etc. SIC 324, 327
20. Other Stone, Clay, and Glass Products – Includes establishments producing glass and glass products, brick, pottery, etc. SIC 321, 322, 323, 325, 326, 328, 329
21. Primary Metal Industries – Includes establishments engaged in the smelting and refining of ferrous and nonferrous metals. SIC 33
22. Fabricated Structural Metal Products – Includes establishments engaged in manufacturing fabricated iron and steel for structural purposes such as metal sash and doors, sheet metal work, boiler plate fabrication, etc. SIC 344
23. Other Fabricated Metal Products – Includes establishments producing nonstructural metal products such as tools, containers, fasteners, stampings, wire, pipe, etc. SIC 341, 342, 343, 345, 346, 347, 348, 349.

- 24. Farm Machinery and Equipment – Includes establishments engaged in manufacturing farm machinery and equipment. SIC 352
- 25. Construction and Industrial Machinery – Includes establishments engaged in manufacturing heavy machinery and equipment used by the construction, manufacturing, and mining industries. SIC 353
- 26. Food Products and Special Industry Machinery – Includes establishments manufacturing feed mill equipment, flour mill equipment, power saws, printing equipment, food packing machinery, etc. SIC 355
- 27. Electrical Machinery – Includes establishments engaged in manufacturing machinery, apparatus, and supplies for the generation, storage, transmission, transformation, and utilization of electrical energy. SIC 36
- 28. Other Machinery – Includes establishments manufacturing engines and turbines, machine tools, computing and accounting equipment, industrial machinery, etc. SIC 351, 354, 356, 357, 358, 359
- 29. Motor Vehicles and Equipment – Includes establishments manufacturing or assembling motor vehicles, passenger cars, truck and bus bodies, truck trailers, and parts for motor vehicles. SIC 371
- 30. Trailer Coaches – Establishments engaged in manufacturing trailer coaches, motor homes, and mobile homes. SIC 3792, 2451
- 31. Other Transportation Equipment – Includes establishments manufacturing transportation equipment not elsewhere classified. SIC 373, 375, 3799
- 32. Other Manufacturing – Includes establishments manufacturing goods not elsewhere classified such as textile mill products, lumber and wood products, furniture and fixtures, leather and leather products, scientific instruments, office supplies. SIC 21, 22, 24, 25, 31, 38

Transportation

- 33. Railroad Transportation – Includes establishments furnishing transportation by line-haul railroad, as well as switching and terminal establishments. SIC 40
- 34. Motor Freight Transportation – Includes establishments furnishing local or long-distance trucking or transfer services or those engaged in the storage of farm products, furniture, and other household goods or commercial goods of any nature. SIC 42
- 35. Other Transportation – Includes transportation services not elsewhere classified. SIC 41, 44, 45, 46, 47

Utilities

- 36. Communication – Includes establishments furnishing point-to-point communication services, whether by wire or radio and whether intended to be received aurally or visually, and radio and television broadcasting. SIC 48
- 37. Electric, Gas, and Sanitary Services – Includes establishments engaged in supplying electricity, natural gas, and other gas products, water, garbage collection, and other sanitary services. SIC 49

Wholesale Trade

- 38. Machinery, Equipment, and Supplies – Includes establishments engaged in wholesaling, machinery, equipment, and supplies. SIC 508
- 39. Other Wholesale Trade – Includes wholesalers not elsewhere classified. SIC 501, 502, 503, 504, 505, 506, 507, 509, 511, 512, 513, 516, 517, 518, 519

Retail Trade

- 40. Farm Equipment Dealers – Includes establishments engaged in marketing agricultural machinery and equipment. SIC 5083
- 41. Gasoline Service Stations – Include establishments engaged in selling gasoline and lubricating oils and possibly selling other merchandise or performing minor repair work. SIC 554
- 42. Eating and Drinking Places – Includes establishments selling prepared food and drinks for consumption on the premises. SIC 58
- 43. Other Retail Trade – Includes retail trade establishments not elsewhere classified . SIC 52, 53, 54, 55 (except 554), 56, 57, 59

Finance, Insurance, and Real Estate

- 44. Banking – Includes institutions that are engaged in deposit banking or closely related functions, including fiduciary activities. SIC 60
- 45. Other Financial Institutions – Includes credit and lending institutions other than banks, as well as security and commodity dealers, investment companies, etc. SIC 61, 62, 67
- 46. Insurance and Real Estate – Includes insurance carriers, agents, and insurance services, as well as real estate operators, agents, and real estate services. SIC 63, 64, 65, 66

Services

- 47. Lodging Services – Includes commercial and institutional establishments engaged in furnishing lodging, lodging and meals, and camping space and camping facilities on a fee basis. SIC 70
- 48. Personal Services – Includes establishments engaged in providing services, generally involving the care of the person or his/her apparel. SIC 72
- 49. Business Services – Includes establishments engaged in rendering services, not elsewhere classified, to business establishments on a fee or contract basis including advertising, maintenance services, employment services, equipment rental and leasing, and consulting services. SIC 73
- 50. Medical and Other Health Services – Includes establishments engaged in furnishing medical, surgical, and other health services to persons. SIC 80
- 51. Other Services – Includes establishments providing services not elsewhere classified including legal services, repair services, entertainment services, etc. SIC 75, 76, 78, 79, 82, (part), 83, 84, 86, 89