A Prescriptive Analysis of the Indiana Coal Transportation Infrastructure

Interim Report for the CCTR Advisory Panel Meeting
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A Cost-Sharing Project with the
Joint Transportation Research Program
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Summary

This interim report details progress made to date on the scoping study of Indiana's coal transportation infrastructure. Throughout the literature search and investigative phases of this project, it is clear that there is a growing awareness of the importance that transportation plays in the domestic coal industry. There is even evidence that suggests transportation costs are significantly higher than the cost of mining coal. Numerous studies suggest that coal transportation infrastructures can be developed and utilized to significant competitive economic advantage. The Powder River Basin area in Wyoming is a stellar example of how a large natural resource and careful transportation planning can result in tremendous economic advantage to an area. It is estimated that nearly forty percent of the coal burned in US power plants comes from this area, which has increased coal production nearly forty percent since 1997. Significant rail infrastructure improvements have been made between this region and the national rail infrastructure, making it cost advantageous to ship coal nationwide.

The objective of this project is to quantitatively examine the coal transportation infrastructure in the state of Indiana. The significance of the problem was stated simply in a project support letter from Northern Indiana Public Service Company, a large Indiana-based coal burning utility that stated "Over the years, NIPSCO has routinely reviewed the potential of burning Indiana coal, however it has not been economical to do so, primarily from a transportation perspective".

Funding for this project was not entirely secured until early summer 2006. Thus, this report details activities completed since then. Due to the short duration and limited scope of this study, a truly comprehensive analysis of the Indiana position and potential with respect to the national coal transportation could not be fully developed. However, after hearing about the importance of logistics and transportation infrastructure to Indiana's future economic success at the recent Indiana Logistics Summit and receiving numerous requests for scenario studies from interested parties such as the Ports of Indiana, Vectren Energy, the city of Vincennes, Duke Energy, and Nisource, we feel that this project is in the right place at the right time. Additionally, we stand ready to put together a follow-on proposal that will more fully develop this scoping study into a comprehensive tool that can provide policy direction to the state of Indiana to succeed in this emerging area.

Project Background

The United States is at the crossroads of a looming energy dilemma. Global economic development has intensified the demand and resultant cost for basic energy commodities such as oil and gas. This demand has provided the impetus for a reevaluation of alternative energy sources. The state of Indiana is strategically positioned in this environment due to its central location and abundant source of coal. To exploit this position from an economic standpoint requires that the appropriate infrastructure be in place.

As with any commodity, the market price is a combination of factors that can be separated into two major categories. The first category consists of the process that extracts or creates the commodity. The second category consists of the process that moves the commodity to the customer. Historically, these two activities have been decoupled. With the advent of economic globalization in the 1990's the ***supply chain concept***, a total systems approach became the norm when analyzing economic activity. A simple definition of the supply chain concept is:

> Supply chain management is a set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouses, and stores, so that merchandise is produced and distributed at the right quantities, to the right locations, and at the right time, in order to minimize system-wide costs while satisfying service level requirements.

The basis of this proposal is to use the supply chain concept to analyze and suggest improvements to the Indiana coal transportation network. While the actual price of coal mining/extraction may be constant across major producers, the cost of transporting it to the customer may be highly variable, thus suggesting a major competitive dimension that may be exploited. The objective of this proposal is to examine the transportation component of coal movement using the Indiana transportation infrastructure and develop knowledge as to why the current inflow and outflow environment exists. Once the coal transportation infrastructure is defined, we will seek to optimize it to competitive levels through suggested capital improvements.

The movement of goods through a transportation infrastructure is subject to numerous external factors that can be characterized by two attributes: process variation and dependency. Process variation is present in any activity and presents numerous challenges to efficiency. In particular, the current United States rail infrastructure includes many bottlenecks that can add significant incremental time to accepted 'average' transport times. Dependency refers to the concept that any supply chain is composed of a number of links and the interdependencies of the links determine overall efficiency of the supply chain.

The primary benefit of this proposal will be the *characterization of the capacity of the Indiana transportation infrastructure along time and cost dimensions* as a link in the

national coal transportation infrastructure. Once accurate projections of the capacity are known, improvements will be developed and analyzed that optimize the efficiency of Indiana's coal transportation infrastructure. The primary output of this proposal will be a simulated environment that can be used to accurately project and build Indiana's coal transportation infrastructure into one that can add competitive value to Indiana's coal industry, allowing the state to compete nationally. It is anticipated that the methodology will be extended to examine issues particular to the State of Indiana's highway system.

Project Progress Summary

Task 1
Characterize the Demand and Supply States of Indiana Coal

This objective of this task is to define the major demand and supply points of coal in the state of Indiana. Due to the scoping nature of this project, only the ten largest producers and consumers will be analyzed. Additionally, the movement of coal from outside the state will not be considered due to scope issues. The following tables present up to date information concerning the ten largest coal producers and consumers of coal in the state of Indiana. Transportation methods and the percent of Indiana coal consumed are also included.

COAL CONSUMPTION AT INDIANA'S TOP 10 POWER STATIONS

Rank	Plant Name	Operator	Consumption, 000 (tons) ('04 data)**	Rail/Barge *	Scrubbed	% IN Coal
1	Gibson Station	Duke Energy Indiana	9,583	Rail (NS)	Yes	79
2	Rockport	IMPCo, AEP	9,207	Barge (NS)	No	16
3	RM Schahfer	NIPSCo	5,026	Rail (NS)	Yes	21
4	Petersburg	IPL	5,213	Rail (ISRR)	Yes	100
5	Clifty Creek	IKECorp	4,470	Barge	No	22
6	Cayuga	Duke Energy Indiana	3,185	Rail (CSX/INDR)	No	64
7	Merom	HEREC	2,899	Rail (INDR)	Yes	100
8	Tanners Creek	IMPCo, AEP	2,581	Barge (CSX)	No	92
9	Harding Street	Duke Energy Indiana	1,877	Rail (ISRR)	No	100
10	Wabash River	Duke Energy Indiana	2,247	Rail (INDR)	No	100

* Rail provider, even if not currently utilized, indicated in parenthesis

SOURCE: ** 2006 US Coal Industry Map; Global Energy Decisions, LLC. 2006; Indiana Coal Council, Inc.

COAL SUPPLY AT INDIANA'S TOP 10 COAL MINES

Rank	Mine Name	Mine Operator	Production, 000 (tons) '05	Rail Provider *
1	Somerville	Black Beauty Coal Company	8,144	ISRR (CSX, NS)
2	Farmersburg	Black Beauty Coal Company	3,846	CSX (INDR)
3	Gibson County	Gibson County Coal, LLC	3,506	CSX (NS, ISRR)
4	Prosperity	Five Star Mining Inc.	3,155	(CSX, ISRR)
5	Francisco	Black Beauty Coal Company	2,913	NS (CSX, ISRR)
6	Air Quality	Black Beauty Coal Company	2,131	CSX (ISRR)
7	Cannelburg	Solar Sources Inc.	1,989	ISRR (CSX)

8	Viking	Black Beauty Coal Company	1,548	ISRR (CSX)
9	Cypress Creek	Vigo Coal Co Inc.	1,288	NS/ISRR/SCS (CSX)
10	Miller Creek	Black Beauty Coal Company	1,016	(CSX, INRR, ISRR)

* Rail providers; parenthesis indicate other potential providers within a 15 mile radius
SOURCE: 2006; Indiana Coal Council, Inc.

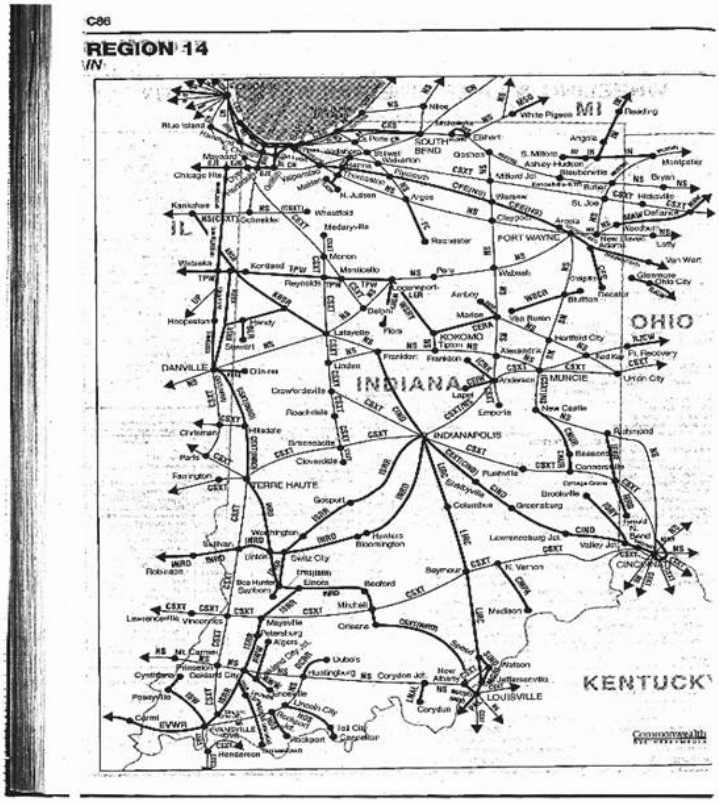
NOTE: Rail Abbreviations:

CSX: CSX Transportation
NS: Norfolk Southern Corporation
INDR: The Indiana Rail Road
ISRR: Indiana Southern Railroad
SCS: Squaw Creek Southern

Task 2
Characterize the Transport Methods of Indiana Coal Supply and Demand

The objective of this task is to define current and projected transportation routes and methods used to move coal from the ten largest coal consumers and producers defined in Task 1. The movement of commodities over a rail system is complex, due to the structure of the rail system in the United States. There are a small number of national mega-carriers who have consolidated over the years and operate large multi-state networks and a large number of smaller railroads, some of which operate less than ten miles of total track. Thus, the development of point-to-point rail connections is a complex process. The figure below shows the current rail infrastructure in the state of Indiana. Noticeably absent are north-south routes spanning the state.

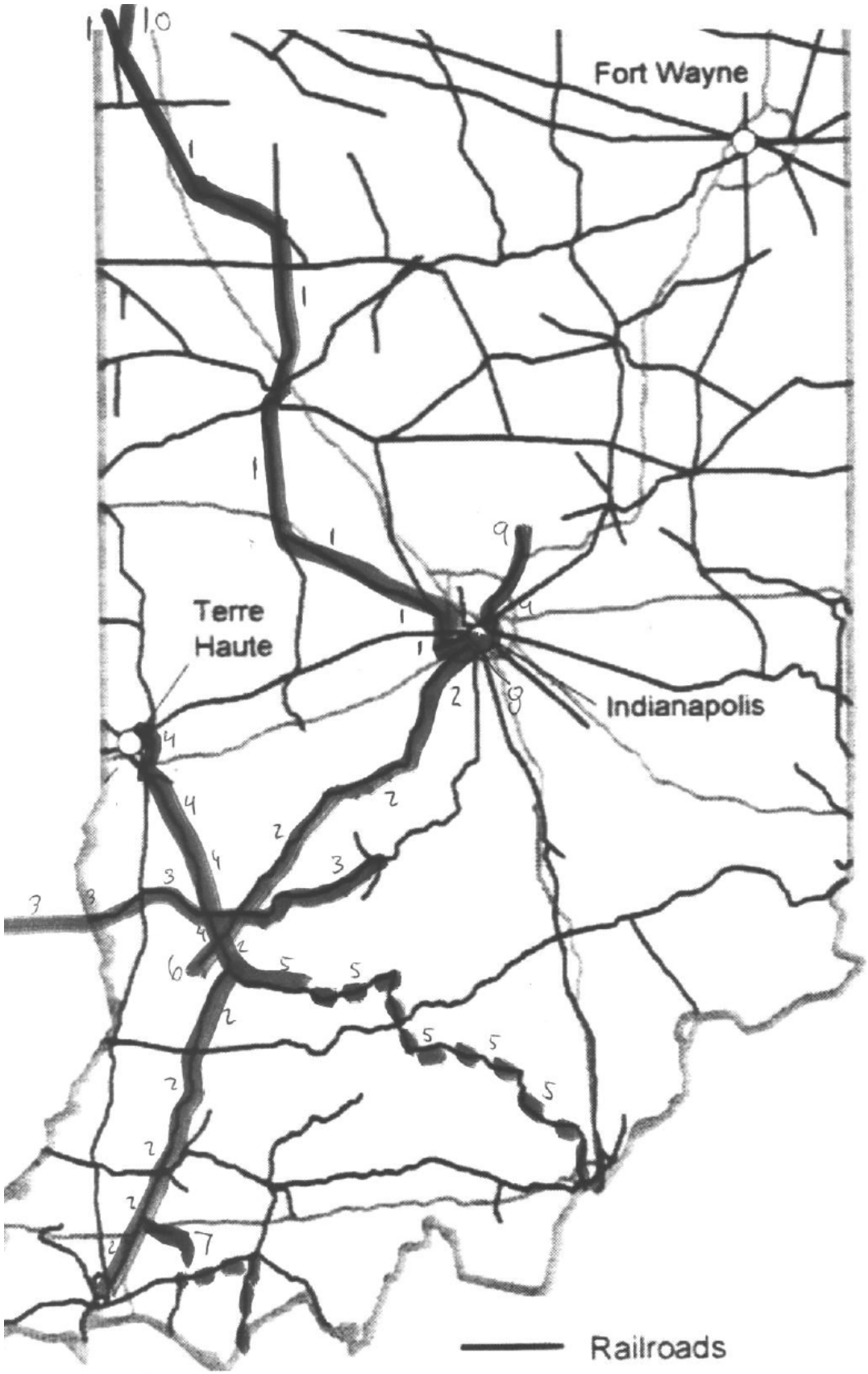
The operation of a railroad is dependent on many factors, including but not limited to route capacity, track condition, operating rules, equipment, and terminal operations. To characterize the Indiana coal transportation infrastructure, we have developed a series of timetables that detail significant rail routes within the state. Within the timetable are several variables that ultimately determine the coal transportation potential within Indiana. The Number column denotes how many tracks are available on the mainline. The Class column is a macro descriptor that includes such factors as welded versus jointed track, curvature, grade, maximum speed, signaling, etc. This variable ranges from a value of one, which denotes ideal conditions, to six, which denotes poor conditions. The routes we have detailed are shown in the figure below. A sample timetable for one of the routes is also shown.



INDIANA COAL RAILROAD TIMETABLE: ROUTE 2

STATION NAME	MILE POST	TRACK				NOTATION	INTERLOCKS
		OWNER	NUMBER	CLASS	SPEED		
READ DOWNWARD FOR SOUTHBOUND							
CP HOLT	172.5	IN, INCR	1	1	10	T	1, *CIND*, *CSXT*
MOORESVILLE	185.0	INCR	1	2	25		
MARTINSVILLE	199.0	INCR	1	2	25		
WHITAKER	209.0	INCR	1	2	25	P	
SPENCER	221.5	INCR	1	2	25		
WORTHINGTON	240.5	INCR	1	2	25	P,Y	
SWITZ CITY	247.5	INCR	1	2	25	A	3
BEEHUNTER	254.5	INCR	1	1	40	A	4, 6
ELNORA	260.5	INCR	1	1	40	A	5
CHAPPEL	279.5	INCR	1	2	25	M	CSXT
PETERSBURG	296.5	INCR	1	2	25		
ASHBY YARD	298.0	INCR	1	2	25	B,E,Y	
OAKLAND CITY	308.5	INCR	1	2	25	A	NS
GRAY JCT	309.5	INCR	1	2	25		
BUCKSKIN	317.5	INCR	1	2	25	T	7
STRAIGHT LINE JCT	337.5	CSXT, INCR	1	2	25		
BETWEEN STRAIGHT LINE JCT AND WANSFORD YARD CSXT TIMETABLE GOVERNS.							
WANSFORD YARD	338.0	CSXT	1	1	10	Y	CSXT
READ UPWARD FOR NORTHBOUND							

SOURCE: Comprehensive Railroad Atlas of North America; compiled by Chad Pfitzer


Fort Wayne
Terre Haute
Indianapolis
Railroads

Task 3
Develop a simulated environment of Indiana coal supply and demand

The objective of this task is to develop a computer simulation model of the Indiana coal transportation infrastructure. This simulated environment will allow what-if capability to demonstrate various performance aspects of the Indiana coal transportation infrastructure. Due to the scoping study nature of the project and the short time frame, a select number of specific scenarios will be simulated to demonstrate proof of concept. Simulation models of the following scenarios will be constructed and analyzed:

1. Francisco Mine to Wabash River Power Plant
2. Vincennes Railroad Relocation Project
3. TBD Southern Indiana mine coal to Port of Indiana
4. TBD Southern Indiana mine coal to Ohio River barge
5. Proposed Indiana Coal Corridor North/South scenarios

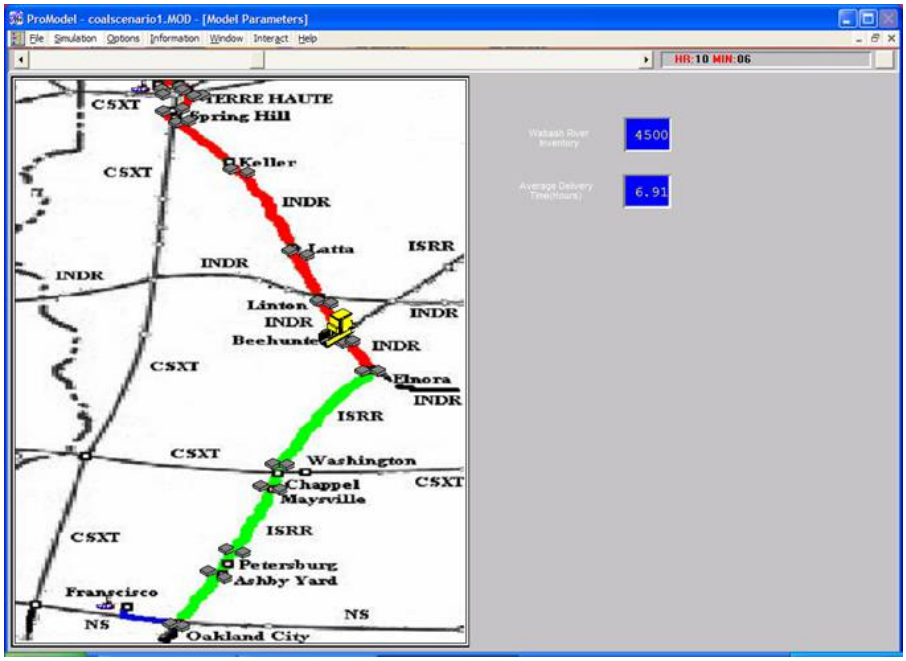
Work is nearly complete on the simulation model for scenario one. Performance measures are being validated and operational parameters are being added. Appropriate randomness factors are being added to assure realistic results. The Francisco mine produced nearly 2.1 million tons in 2004. The Wabash River Power Plant consumed nearly 2.2 million tons. Rail transportation between the mine and the power plant are detailed in the following table. The simulation model for the scenario is shown in the following figure. The model contains specific logic for each station in the route. Coal is delivered to the plant according to a classic inventory replenishment scheme. The target days of coal supply at the plant is a user specified input to the model.

SCHEDULE:
FRANCISCO MINE-WABASH RIVER POWER PLANT

STATION	MILEAGE	TRACK				NOTATIONS	OWNERS PRESENT AT INTERLOCKS
		OWNER	NUMBER	CLASS	SPEED		
READ DOWNWARD FOR NORTHBOUND							
FRANCISCO	0.00	NS	1	-	40		
OAKLAND CITY	5.75	NS, ISRR	1	-	25	A	NS, ISRR
ASHBY YARD	16.25	ISRR	1	_	25	B,E,Y	
PETERSBURG	17.75	ISRR	1	_	25		
MAYSVILLE	33.25	ISRR	1	_	25		
CHAPPEL	34.75	ISRR, INRD	1	_	25	M	ISRR, CSXT
ELNORA	53.75	INRD	1	_	40	A	ISRR, INRD
BEEHUNTER	59.75	INRD	1	_	40	A	INRD, ISRR
LINTON	65.75	INRD	1	_	20	A	INRD
LATTA	73.75	INRD	1	_	20	B,T,Y	
KELLER	78.75	INRD	1	_	40	P	
SPRING HILL	96.75	INRD	1	_	25	M	CSXT

BELT JCT	98.00	INRD	1	_	25	M,T	CSXT
VAN YARD	103.00	INRD	1	_	25	B,Y	
PRESTON	104.25	INRD	1	_	10	M	CSXT
DEWEY	104.75	INRD	1	_	10	M	CSXT (INRD)
WABASH RIVER POWER PLANT	109.25	INRD	1	_	10		
READ UPWARD FOR SOUTHBOUND							

SOURCE: Comprehensive Railroad Atlas of North America



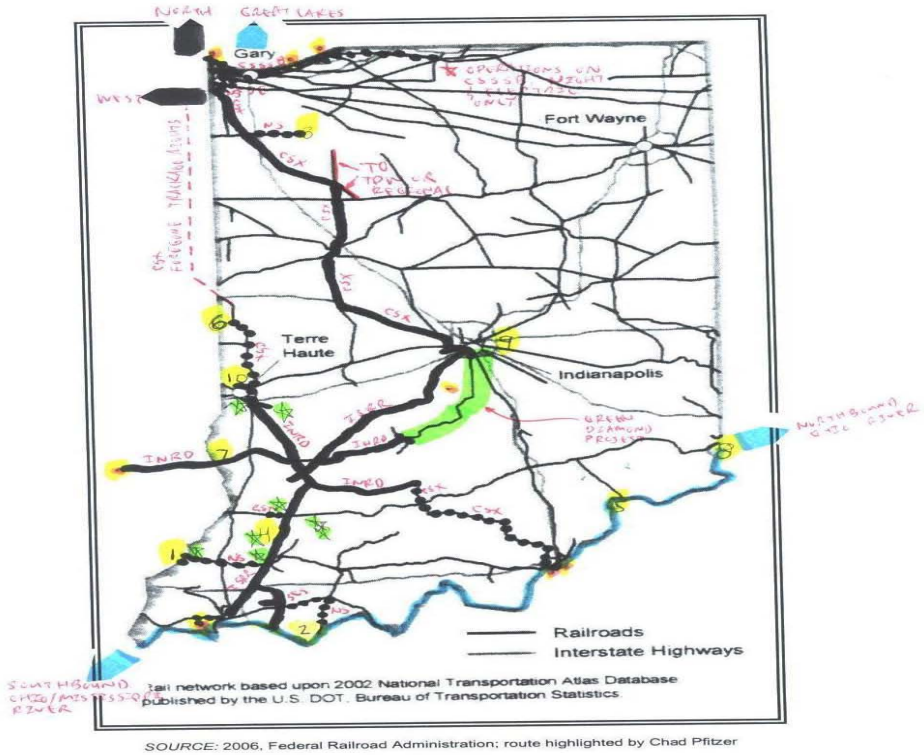
Task 4
Develop a Set of Transportation Infrastructure Improvements to Address Bottlenecks in Current Indiana Coal Network

The objective of this task is to develop a set of transportation infrastructure improvements to alleviate bottleneck situations in either cost or time as generated from Task 3. Using the simulated environment developed in Task 3, projected economic benefits for each potential improvement will be determined.

A preliminary concept, dubbed the Indiana Coal Railroad, or Indiana Coal Corridor has been suggested and is presented in the figure below. This concept addresses the movement of large quantities of coal from southern Indiana mines into northerly and southerly directions. Movement of coal to the northern portion of the state can facilitate potential use in northern power plants, barge shipment from the Port of Indiana to upper Great Lakes areas, or access to trans-continental BNSF, NS, or CSX markets through mainline connection in the Chicago area. Movement of coal to the southern portion of the state can facilitate potential use through the shipment on barges on the Ohio to rail access points in the CSX network to the southeastern United States.

Further development of this concept, including several alternatives in northern Indiana is

Figure 1: INDIANA COAL RAILROAD



SOURCE: 2006, Federal Railroad Administration; route highlighted by Chad Pfitzer

in process.

Task 5
Develop a Return on Investment Methodology and Simple Portfolio Optimization Model

The objective of this task is to develop a simple return on investment model that will be used to rank and prioritize the transportation infrastructure improvement alternatives posed in Task 4. There has been no progress made on this task to date.

Summary and Conclusions to Date

During the development of this project to date, we have been encouraged by the significant amount of interest in the methodology and preliminary results. We are also encouraged by the increasing number of suggested scenarios to analyze. Significant scenarios to analyze that have been suggested, but cannot be accommodated due to the scoping nature of this project include:

1. Significant increase in Southern Indiana coal shipments to Crane
2. Vectren issues in southern Indiana
3. Coal shipment on the Great Lakes
4. Movement of Indiana coal into the national coal transportation rail networks

We believe that this project can be leveraged into a significant full-scale study of the Indiana coal transportation infrastructure. A key component of this expanded scope will be to include the national coal rail infrastructure. Additionally, it would be beneficial to include the potential for backhauling of certain Indiana commodities such as limestone. Finally, the ability to accurately predict the impact of ethanol and bio-diesel markets on the rail infrastructure of Indiana will be central to any type of economic expansion for the state.