Indiana Center for Coal Technology Research
Northwest Coal Corridor

Thomas F. Brady, Ph.D.
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Project History

• Premise of the Project - There is no direct North/South rail route
  – Analysis of coal movement **within** Indiana
    • 10 mines, 10 power plants
    • Indiana Coal Corridor
  – Integration of rail with water
    • Port of Indiana
    • Ohio River
Project Methodology

• Use a known route as a base scenario
• Construct experimental routes using intuition
• Supplement existing routes with abandoned routes if necessary
• Use computer simulation to generate cycle times for experimental routes
  – Account for variability
  – Account for congestion, breakdowns, right of ways, etc.
Project Assumptions

• Linton, IN was used as the origination point of Indiana coal

• Trains are 110 car, 286,000 pound capacity
Constructing Rail Routes

• Segments between Stations
  – Mileage
  – Active/Owner
  – Trackage Rights
  – Signaling Systems
  – # tracks on mainline
  – Density
  – Class
Class

- Federal Railroad Administration Classification System for Train Speed based on quality of track

<table>
<thead>
<tr>
<th>Class</th>
<th>Max Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>3</td>
<td>40</td>
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<tr>
<td>4</td>
<td>60</td>
</tr>
<tr>
<td>5</td>
<td>80</td>
</tr>
<tr>
<td>6</td>
<td>110</td>
</tr>
</tbody>
</table>
Density

- Classification based upon millions of gross ton miles per year
Ideal Route

• Minimize
  – Number of Owners
  – Mileage
  – Density

• Maximize
  – Class
Part I
Indiana Coal to Wheatfield

• Research Question: How do we get southern Indiana coal to northern Indiana?
Routes
## Indiana Results

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Miles</th>
<th>Segments</th>
<th>Operators</th>
<th># RW's</th>
<th>% RW</th>
<th>% Abandon</th>
<th>Signals</th>
<th>Main %</th>
<th>Density</th>
<th>Class</th>
<th>Cycle Time</th>
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</thead>
<tbody>
<tr>
<td>A - State Line</td>
<td>209</td>
<td>29</td>
<td>4</td>
<td>3</td>
<td>65%</td>
<td>0%</td>
<td>4</td>
<td>24%</td>
<td>3.86</td>
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<tr>
<td>B - Central Route</td>
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<td>3</td>
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<td>55.9</td>
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<tr>
<td>D - Gosport - Medaryville</td>
<td>185</td>
<td>16</td>
<td>4</td>
<td>2</td>
<td>31%</td>
<td>19%</td>
<td>3</td>
<td>0%</td>
<td>1.38</td>
<td>1.26</td>
<td>48.6</td>
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<tr>
<td>E - Handy Link</td>
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<td>1.9</td>
<td>1.06</td>
<td>44.0</td>
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Route Mileage

Miles

<table>
<thead>
<tr>
<th>Route</th>
<th>Miles</th>
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</thead>
<tbody>
<tr>
<td>A - State Line</td>
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</tr>
<tr>
<td>B - Central Route</td>
<td>220</td>
</tr>
<tr>
<td>C - Gosport Link</td>
<td>200</td>
</tr>
<tr>
<td>D - Gosport - Medaryville</td>
<td>180</td>
</tr>
<tr>
<td>E - Handy Link</td>
<td>200</td>
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</tbody>
</table>
Route Cycle Time

![Bar Chart: Cycle Time]

- A - State Line
- B - Central Route
- C - Gosport Link
- D - Gosport Medaryville
- E - Handy Link
Average Route Class

Class

<table>
<thead>
<tr>
<th>Route</th>
<th>Class</th>
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<td>B - Central Route</td>
<td>1.2</td>
</tr>
<tr>
<td>C - Gosport Link</td>
<td>1.4</td>
</tr>
<tr>
<td>D - Gosport - Medaryville</td>
<td>1.4</td>
</tr>
<tr>
<td>E - Handy Link</td>
<td>1.0</td>
</tr>
</tbody>
</table>
Average Route Density

![Average Route Density Chart]

- A - State Line
- B - Central Route
- C - Gosport Link
- D - Gosport - Medaryville
- E - Handy Link

Density

0 0.5 1 1.5 2 2.5 3 3.5 4 4.5

A - State Line  B - Central Route  C - Gosport Link  D - Gosport - Medaryville  E - Handy Link
Part II
Indiana Coal to Michigan

• Research Question: How do we get coal from southern Indiana to select Michigan destinations
Michigan and Coal

• Michigan has 88 coal-fired power plants at 33 locations, producing 12,891 megawatts
• 49 are larger than 50MW
  – Monroe = 3280MW
  – St. Clair = 1547MW
  – Campbell = 1540MW
  – Belle River = 1395MW
• These plants consume approximately 33,120,930 short tons of coal per year

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Where Does Michigan Get It’s Coal From?

![Chart showing coal distribution]

- **Great Lakes**
- **Truck**
- **Rail**
A Different Perspective

Montana (27%)
Colo (1%)
Wyoming (54%)
Illinois (5%)

Ohio (5%)
Penn (5%)
WV (8%)

K Y (9%)

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Michigan Coal Consumption Pattern

![Bar Chart Showing Michigan Coal Consumption Pattern]

- The chart illustrates the coal consumption pattern in Michigan over a period from 2011 to 2018.
- Each bar represents a year, with the height indicating the amount of coal consumed.
- A significant peak is observed in 2017, followed by a decline in subsequent years.

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Plants Chosen for this Study

• Close to the Western side of Michigan
• Close to water
• Near Indiana rail interface
  – Filer, Manistee
  – Cobb, Warren, Muskegon
  – Sims, Campbell, Grand Haven
  – Eckert, Simon, Erickson, Lansing
  – DeYoung, Holland
Supplying Michigan with Indiana Coal

- **3 Main Gateways**
  - West - New Buffalo (CSX)
  - Central – South Bend (CN)
  - East – Vistula (Norfolk Southern)

- **3 Indiana Routes**
  - West – State Line, Griffith, MC
  - Central – Gosport – Medaryville, MC
  - East – Indianapolis, Goshen, South Bend
Routes

- Filer
- Cobb, Warren
- Campbell, DeYoung
- Sims
- Eckert, Simon Erickson

A
B
C
D
E

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## Michigan Results

<table>
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<tr>
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<th>% Abandon</th>
<th>Signals</th>
<th>Main %</th>
<th>Density</th>
<th>Class</th>
<th>Cycle Time</th>
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<td>2</td>
<td>56%</td>
<td>0%</td>
<td>5</td>
<td>24%</td>
<td>3.82</td>
<td>1.16</td>
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<td>7%</td>
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<td>32%</td>
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<td>0%</td>
<td>4</td>
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<td>2.29</td>
<td>1.86</td>
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<td>12</td>
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<td>3.28</td>
<td>1.22</td>
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<tr>
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<td>11%</td>
<td>7</td>
<td>19%</td>
<td>2</td>
<td>1.65</td>
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`tbradyjr@pnc.edu 29`
Route Mileage

Miles

<table>
<thead>
<tr>
<th></th>
<th>A - DeYoung</th>
<th>A - Campbell</th>
<th>A - Cobb/Warren</th>
<th>B - DeYoung</th>
<th>B - Campbell</th>
<th>B - Cobb/Warren</th>
<th>C - DeYoung</th>
<th>C - Campbell</th>
<th>C - Cobb/Warren</th>
<th>D - Lansing</th>
<th>D - Filer</th>
<th>E - Lansing</th>
<th>E - Filer</th>
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<tbody>
<tr>
<td>Miles</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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</tbody>
</table>
Route Cycle Time

Cycle Time (Hours)

- A - DeYoung
- A - Cobb/DeYoung
- A - Sims
- B - Cobb/DeYoung
- B - Cobb/Campbell
- B - Sims
- B - Cobb/Warren
- C - DeYoung
- C - Cobb/DeYoung
- C - Cockburn
- D - Cobb/Warren
- E - Filer
- E - Lansing
- D - Lansing
- D - Filer
- E - Filer
- A - Campbell
- B - Campbell
- C - Campbell
- D - Lansing
- E - Filer
- E - Lansing
Average Route Class

Class

A. De Young
A. Campbell
A. Cobb/Warren
B. De Young
B. Campbell
B. Cobb/Warren
C. De Young
C. Campbell
C. Cobb/Warren
D. Lansing
D. Filer
E. Lansing
E. Filer

Class
Average Route Density

Density

A. DeYoung  A. Campbell  A. Cobb/Warren  B. DeYoung  B. Campbell  B. Sims  C. Cobb/Warren  C. DeYoung  C. Campbell  C. Sims  D. Lansing  D. Filer  E. Lansing  E. Filer

Density
Operational Aspects of Indiana to Michigan Coal Transport

• Assumptions
  – Fully supply Campbell
  – Unit train of 14,000 tons
  – Cycle times from simulation model

• # of Unit Trains Needed
  – Route A, 4
  – Route B, 4
  – Route C, 5
Summary

• The lack of a Class 4 or above true North/South rail route through Indiana contributes to costly or non-existent business opportunities
• Abandoned routes formerly provided North/South access
• Marginal improvement in routes can make a large financial impact due to the scale of coal transportation/consumption
• A combined water route using the Port of Indiana may enable export opportunities as well