Meeting the Transportation Challenges of the 21st Century: Intermodal Opportunities in the Appalachian Region

Economic Benefits of Intermodal Efficiencies

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INTRODUCTION

As has been demonstrated in the ARC Region, investment in transportation infrastructure can produce significant economic benefits. In the instance of freight-related intermodal investments, these economic impacts arise as a result of reducing the cost of doing business in a given region. Benefits may also arise as a result of the strategic significance of alternative mode choice as a business location determinant.

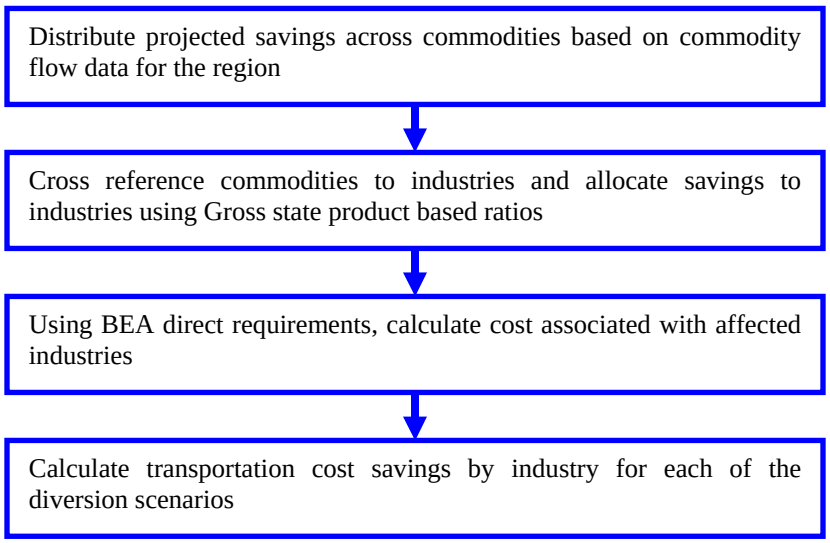
The first two parts of the current intermodal research effort consisted of an in-depth commodity flow analysis and the identification and profiling of specific intermodal case studies in the ARC Region. The purpose of this section of the study is to estimate the potential economic impacts of increased transportation efficiencies that can result from intermodal improvements.

Three of the intermodal case studies identified in the earlier phases of the research were selected for economic impact analysis, including the Trans-Tennessee Railroad, the Prichard Intermodal Yard (part of the Central Corridor Doublestack Initiative), and the Port of Pittsburgh Container-on-Barge projects. The selection was based on the availability of data, the diversity of the projects, and the commitment of sponsoring agencies regarding the projects. The economic modeling was conducted using the ARC's REMI model, which reports results on a north, central, and south regional basis. It is important to note that only the projected efficiency or savings in transportation costs were included as input into the REMI model. No construction impacts, safety benefits, or long-term strategic development impacts are included in this analysis. Therefore, the purpose of the current analysis is to provide some insight into the potential benefits of intermodal investment in the ARC Region, rather than serve as a major investment study. The following sections summarize the methodologies and results of an economic modeling exercise for each of the selected case studies.

TRANS-TENNESSEE RAILROAD

The analysis of the economic impact of transportation efficiencies arising from the proposed Trans-Tennessee Railroad is based on the findings of a report commissioned by the Tennessee Department of Transportation (TDOT).[1] An evaluation of the findings of that report was not conducted as a part of the current effort; rather the findings are assumed to be reasonable and serve as the initial input into the modeling process.

The TDOT report consisted of a benefit-cost analysis based on different truck-to-rail diversion scenarios. These estimated benefits included fuel savings, annual shipping costs savings, travel time efficiencies, accident savings, etc. The projected shipping cost savings and travel time efficiencies form the starting point of the current analysis. The estimated savings were combined with detailed information on commodity flow, statewide industrial employment, gross state product, and BEA direct requirement coefficients (which describe the importance of transportation costs relative to total costs across industries) to develop the input for the REMI model in terms of lower transportation cost by industry. The process is summarized in the following flow chart.



[1] "Task 8: Evaluation of Rail Infrastructure Proposals, Basic Freight Connection, Project 1, An East-West Rail Connection." Arcadis and Don Breazeale & Associates, Revised May 2003.

Three scenarios were evaluated: 5% diversion, 10% diversion and 20% diversion, where diversion refers to the diverting of commodities currently being (and forecasted to be) shipped by truck to being shipped by rail. The projected annual savings in shipping costs for these diversion scenarios, obtained from the TDOT report, are $43.9 million, $87.9 million and $175.8 million, respectively. Exhibit 1 displays the results for the ARC Region.

Exhibit 1
Economic Impact of Intermodal Efficiencies of Trans-Tennessee Railroad
ARC Region-wide Results

	Region Wide		
	Job Years (in 1000s)	**GRP* (bil fixed 96$)**	**Real Dis Income (bil fixed 96$)**
5 % Diversion Scenario			
35 year total	156.92	14.76	11.72
Annual average	4.48	0.42	0.33
10% Diversion Scenario			
35 year total	253.70	23.85	18.98
Annual average	7.25	0.68	0.54
20% Diversion Scenario			
35 year total	510.64	48.01	38.23
Annual average	14.59	1.37	1.09

*** Gross Regional Product**

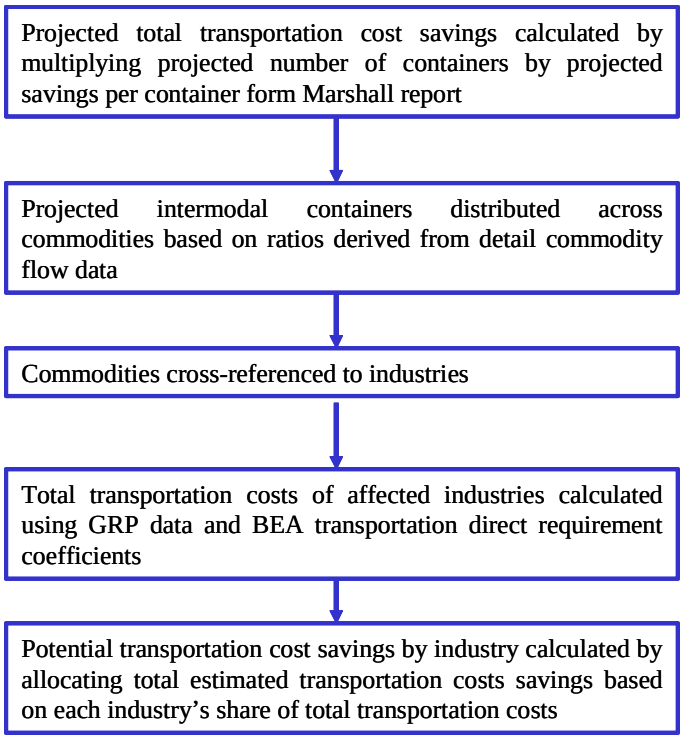
It appears that the Trans-Tennessee Railroad could provide substantial economic benefits as a result of increased intermodal efficiencies. Furthermore, the model results at the sub-region level suggest that the benefits would be distributed throughout Appalachia, including the north, central and south regions. The south region, in which the actual investment is physically located, would experience the most significant share of the benefits (51.0%), with 42.5% and 6.5% of the benefits projected to accrue to the north and central regions, respectively. In summary, preliminary benefits modeling suggest that all regions have the potential of experiencing a net gain in terms of employment, output, and income as result of the proposed Trans-Tennessee Railroad.

It should be noted that the 35-year total employment estimates represent the number of job years and is not cumulative jobs. For example, in the 20% diversion scenario for the south region, the 79.96 thousand total jobs does not mean that there will be 79.96 thousand new jobs in any given year. Rather, there will be an additional 79.96 thousand full-time equivalent jobs over the course of 35 years. If a job is created in year 1 and sustained for the entire 35 years, that 1 job represents 35 total full-time equivalent job years. Therefore, the better measure of employment is the average annual job estimate, which represents in any given year the number of full-time equivalent jobs the project is projected to support.

PRICHARD, WV INTERMODAL YARD

The analysis of the economic benefits of the transportation efficiencies arising from the proposed Prichard Intermodal Yard are based on an in-depth benefit-cost study of the Central Corridor Doublestack Initiative conducted by Marshall University in 2003. An evaluation of the findings of that report was not conducted as a part of the current effort; rather the findings are assumed to be reasonable and serve as the initial input into the modeling process.

The Marshall University study included estimates of container traffic and estimated transportation cost savings over a West Virginia facility at Prichard. Those estimates were compared to the commodity flow and drayage data, which were part of an earlier phase of this study to determine the likely types and volumes of commodities that would be flowing through the facility. The resulting commodity flow mix, combined with other data including employment, BEA transportation direct requirements, and GRP was used to translate the estimated transportation cost-savings from the Marshall University report into transportation savings by industry. From this, the input for the REMI modeling exercise was derived. The following flowchart summarizes the process.



Both an upper bound and lower bound scenario are modeled. The lower bound used the first year projections of traffic and the upper bound used maximum terminal capacity. Again, the economic impacts represent only the impacts arising from transportation costs savings and do not include any strategic economic development impacts. The impacts are modeled for the entire ARC Region as a whole, as well as the north, central and south regions. The results for the region are presented in Exhibit 2.

Exhibit 2
Economic Impact of Transportation Efficiencies arising from the Prichard Intermodal Yard

	Lower Bound			Upper Bound		
	Employment Job Years (in 1000s)	GRP* (bil fixed 96$)	Per Dis Income (bil fixed 96$)	Employment Job Years (in 1000s)	GRP* (bil fixed 96$)	Per Dis Income (bil fixed 96$)
Region Wide 30 year total	14.01	1.32	1.04	287.02	26.99	21.47
Annual average	0.40	0.04	0.03	8.20	0.77	0.61

* Gross Regional Product

Similar to the Trans-Tennessee railroad, the Prichard intermodal yard displays potential for significant economic benefits for all three sub-regions within the ARC Region. Over fifty percent of the estimated benefits are projected to accrue to the southern region, while the northern and central regions are projected to harness 43.0 percent and 6.5 percent of the estimated impacts, respectively.

It should be noted that the 35-year total employment estimates represent the number of job years and is not cumulative jobs.[2]

In addition to modeling the economic impacts of the transportation cost savings, a simplified analysis of strategic economic development impacts was conducted. The analysis represents a sketch level "what-if" analysis and should not be interpreted as an investment grade analysis. The major assumption used in the strategic economic development analysis was that the intermodal yard would increase the accessibility of ARC's north and central regions. Specifically, it was assumed that the intermodal facility would increase accessibility by .005 percent between the ARC counties in the north and central regions. This assumption is based on the fact the proposed intermodal yard would open more land for development, given access to a new mode of transportation, by increasing access to that land an average of .005 percent. The combined results from reduced transportation costs and increased accessibility are displayed in Exhibit 3.

As with the results from the transportation cost savings alone, the total impacts resulting from the Prichard Intermodal yard are spread across all three sub-regions in Appalachia. The northern region is projected to garner the largest share of the benefits (55.3 percent), while the southern and central regions capture 43.2 percent and 7.5 percent of the estimated benefits, respectively.

[2] For example, for the lower bound scenario, the 14.01 thousand total jobs does not mean that there will be 14.01 thousand new jobs in any given year. Rather, there will be an additional 14.01 thousand full-time equivalent jobs over the course of 35 years. If a job is created in year 1 and sustained for the entire 35 years, that 1 job represents 35 total full-time equivalent jobs.

Exhibit 3
Economic Impact of Intermodal Efficiencies and Increase Accessibility
Resulting from the Prichard Intermodal Yard

	Lower Bound			Upper Bound		
	Employment (in 1000s)	**GRP* (bil fixed 96$)**	**Per Dis Income (bil fixed 96$)**	**Employment (in 1000s)**	**GRP* (bil fixed 96$)**	**Per Dis Income (bil fixed 96$)**
Region Wide						
30 year total	165.44	15.38	11.60	517.04	46.80	30.95
Annual average	4.73	0.44	0.33	14.77	1.34	0.88

* Gross Regional Product

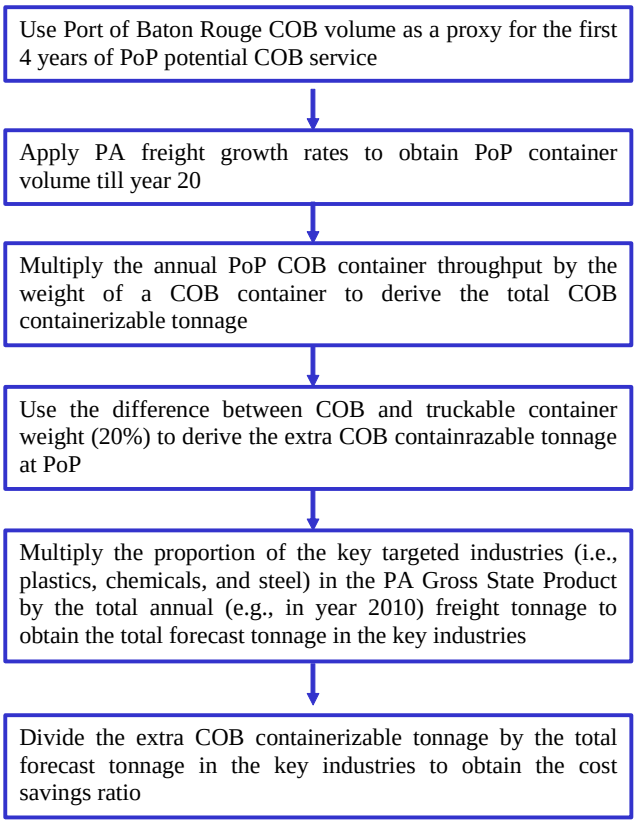
Although speculative in nature, the results of modeling an increase in accessibility arising from the Prichard Intermodal Yard illustrate the potential significance in terms of business attraction of the project. Despite the speculative nature of the modeling, the assumption of increase accessibility itself is plausible. Even though the site is currently in close proximity to Interstate 64, via US 52, there are very few proximal residential or commercial structures, indicating access to the site is not sufficient enough to support significant development. By providing access to intermodal rail, the access to the site itself is increased. The addition of a complementary mode of transportation will arguably make the site more attractive for industrial development. The addition of rail access will make the site more accessible for intermodal container traffic, leading to increased development opportunities. For example, the annual employment impact with strategic economic development considerations is ten-fold the estimated impact arising from the transportation costs alone. These results indicate that more in-depth analysis of the potential strategic benefits of this project is worth pursuing.

PORT OF PITTSBURGH CONTAINER-ON-BARGE SERVICE

The premise of the analysis for the Port of Pittsburgh (PoP) Container-on-Barge (COB) initiative is that transportation cost savings can be expected from taking advantage of moving freight in heavier containers on river barges. The starting premise of these estimates is the fact that containers moved by barge can be loaded to full weight capacity, whereas when moved by truck, containers are subject to road weight restrictions and can be loaded to only about 80 percent capacity. This gives the container-on-barge (COB) service about a 20 percent relative savings advantage. It should be noted that due to the time and limited data availability constraints, the savings estimates for Pittsburgh were developed applying a number of assumptions to allow for the development of a plausible, although speculative, scenario.

For the purposes of reader's ease, the following diagram summarizes the steps applied in the derivation of the COB service related cost savings ratio. A more detailed description is presented in the narrative that follows.

Summary of the Container on Barge (COB) Savings Ratio Derivation



In order to estimate the savings, one of the first steps was to project the number of containers and tonnage of freight that can result from a container-on-barge service at the Port of Pittsburgh. Since there were no specific forecasts developed for this type of a transport at the Port of Pittsburgh, the throughput of the Port of Baton Rouge was used as a proxy for what can be expected at Pittsburgh. The two ports handle similar volumes of freight[3], and have very good inland waterway system access. The Port of Baton Rouge commenced its weekly COB scheduled service, operated by Osprey Line to New Orleans and Houston, in the beginning of 2004. According to Port of Baton Rouge officials, about 2,200 containers were handled in the January to May period, and the Port is on course to ship 5,000 containers by the end of the year.

The Port recently signed agreements with the Ports of Memphis and Shreveport, and is expecting to reach additional agreements with Chicago and other Midwestern facilities within a year. The Port officials stated that the Port "experienced a sharp increase in demand after just a few months of service", and they "believe the container-on-barge service will steadily increase in popularity". The officials are expecting a doubling of container throughput volumes each year over the next few years, after which it is expected to level off.

[3] According to the US Army Corps of Engineers Waterborne Commerce Statistics Center, the 2002 tonnages for the Port of Greater Baton Rouge, and the Port of Pittsburgh were 60.6 million, and 52 million tons, respectively.

Based on these observations from the Port of Baton Rouge, similar volumes of containers were applied to the Port of Pittsburgh (please see Exhibit 4). Year 2005 (with its 5,000 containers) was assumed to be the first year of operations and, following the doubling of growth for two years and halving that pace in year four, the growth rate in Pennsylvania freight shipment tonnage was applied for the rest of the twenty-year time horizon[4].

Exhibit 4: Projected Container on Barge Throughput at the Port of Pittsburgh

Year	COB Volume (# of containers)
1	5,000
2	10,000
3	20,000
4	30,000
5	30,395
6	30,795
7	31,200
8	31,611
9	32,027
10	32,448
11	32,875
12	33,308
13	33,746
14	34,191
15	34,641
16	35,097
17	35,558
18	36,026
19	36,501
20	36,981

[4] Source: Freight Analysis Framework (FAF) State Profiles – PA.

The average weight of a truckable container is typically up to 25 tons. Since containers on barge can be loaded to about 20 percent more weight than truckable containers, an additional 20 percent was added to this weight. This COB containerizable weight was applied to the projected container throughput to obtain a forecasted total COB tonnage for the Port of Pittsburgh (please see Exhibit 5)

Exhibit 5: Projected Container on Barge Tonnage at the Port of Pittsburgh

Year	COB Volume (tons)
1	150,000
2	300,000
3	600,000
4	900,000
5	911,845
6	923,846
7	936,005
8	948,324
9	960,805
10	973,451
11	986,263
12	999,243
13	1,012,395
14	1,025,719
15	1,039,219
16	1,052,896
17	1,066,754
18	1,080,794
19	1,095,018
20	1,109,430

The projected annual difference between the COB and truckable tonnage is the extra containerizable tonnage that can be moved on barges through the Port relative to the trucking mode (see Exhibit 6).

Exhibit 6: Projected Extra Container Tonnage at the Port of Pittsburgh

Year	COB Volume (tons)
1	25,000
2	50,000
3	100,000
4	150,000
5	151,974
6	153,974
7	156,001
8	158,054
9	160,134
10	162,242
11	164,377
12	166,541
13	168,732
14	170,953
15	173,203
16	175,483
17	177,792
18	180,132
19	182,503
20	184,905

According to the Port's COB Pre-feasibility Study, plastics, chemicals, and steel were identified as the key commodities that the Port should be targeting for this type of service. It should be noted that plastics products, in addition to other commodities such as food (rice), are also the key commodities transported on barges through the Port of Baton Rouge; thus, there already appears to be a market for and established flows of these commodity groupings at both ports.

Next, the expected extra COB tonnage in year 6 (2010) – 154 thousand tons – was divided by the total forecasted Pennsylvania tonnage in the plastics, chemicals, and steel industries in 2010.

The latter (valued at over 63 million tons) was approximated by applying the proportion of these three industries in the Pennsylvania Gross Domestic Product[5] to the total state tonnage in 2010 (1,217 million tons) as forecasted in the FAF freight profile for the state. The resulting ratio of 0.24 percent is used to approximate the future transportation cost savings ensuing from the extra weight capacity that container-on-barge service at the Port of Pittsburgh may allow[6]. Even though this scenario focused on the three major regional industries, it is possible that some of the other tonnage could also benefit from the COB service.

Based on the input calculations described above, the economic impacts in the ARC Region of these estimated transportations costs were modeled using REMI for both an upper bound and lower bound number of containers. The results are displayed in Exhibit 7.

Exhibit 7
Economic Impacts of Intermodal Efficiencies Arising from Container-on-Barge Operations at Port of Pittsburgh

	Lower Bound			Upper Bound		
	Employment (in 1000s)	**GRP* (bil fixed 96$)**	**Per Dis Income (bil fixed 96$)**	**Employment (in 1000s)**	**GRP* (bil fixed 96$)**	**Per Dis Income (bil fixed 96$)**
Region Wide						
20 year total	79.51	5.87	2.64	159.14	11.76	5.29
Annual average	3.98	0.29	0.13	7.96	0.59	0.26

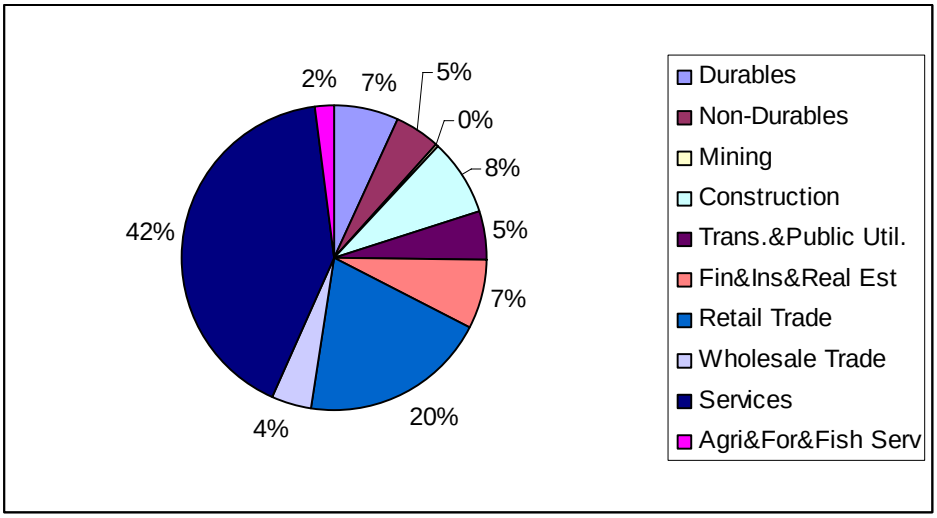
* Gross Regional Product

[5] Source: BEA Regional Economic Accounts, May 2003.
[6] It should be noted that container-on-barge service is typically results in a number of other benefits such as fuel, emissions, and safety relative to the truck mode, but these were not the subject of the current analyses.

As can be seen, there is indication that the COB operations at Port of Pittsburg could lead to a net gain in economic activity and the magnitude suggests that the project could result in significant benefits in terms of job and income for the region. It should be noted that the sub-regional modeling suggests the potential for a slight redistribution of economic activity from the central and southern regions to the northern region of Appalachia.

From a strategic economic development perspective, the Port of Pittsburgh COB service shows promise. Examining the estimated employment impacts by industry (see Exhibit 8) reveals that key industries within the ARC Region would be stimulated by the proposed investment.

Exhibit 8
Region-wide Employment Effects of Port of Pittsburgh Container-on-Barge Service by Sector



The Transportation and Public Utilities industry is projected to experience the largest stimulus, arguably driven by the fact that the new service would give rise to increased demand for logistic services that are not typically captured in the transportation and public utility industrial classification. Other key industries projected to capture significant portions of the employment increase include retail trade, construction, durable and nondurable manufacturing, and wholesale trade. This is not surprising given the experience with the impact of similar services at the Port of Baton Rouge. There, the area surrounding the port has experienced increased employment in those manufacturing and distribution firms that utilize the new service.

Conclusion

The preceding has provided the results of preliminary economic impact modeling for three potential freight intermodal projects in Appalachia. Although numerous assumptions were required in some cases, the results provide valuable information and insight into the economic development impact that freight transportation efficiencies can have as a result of increasing the competitive position of Appalachia by lowering the cost of doing business.

While the results produced are not meant to guide investment decision making, they do help to indicate the potential and provide support for more in-depth analysis and consideration of these and other transportation development opportunities in Appalachia.