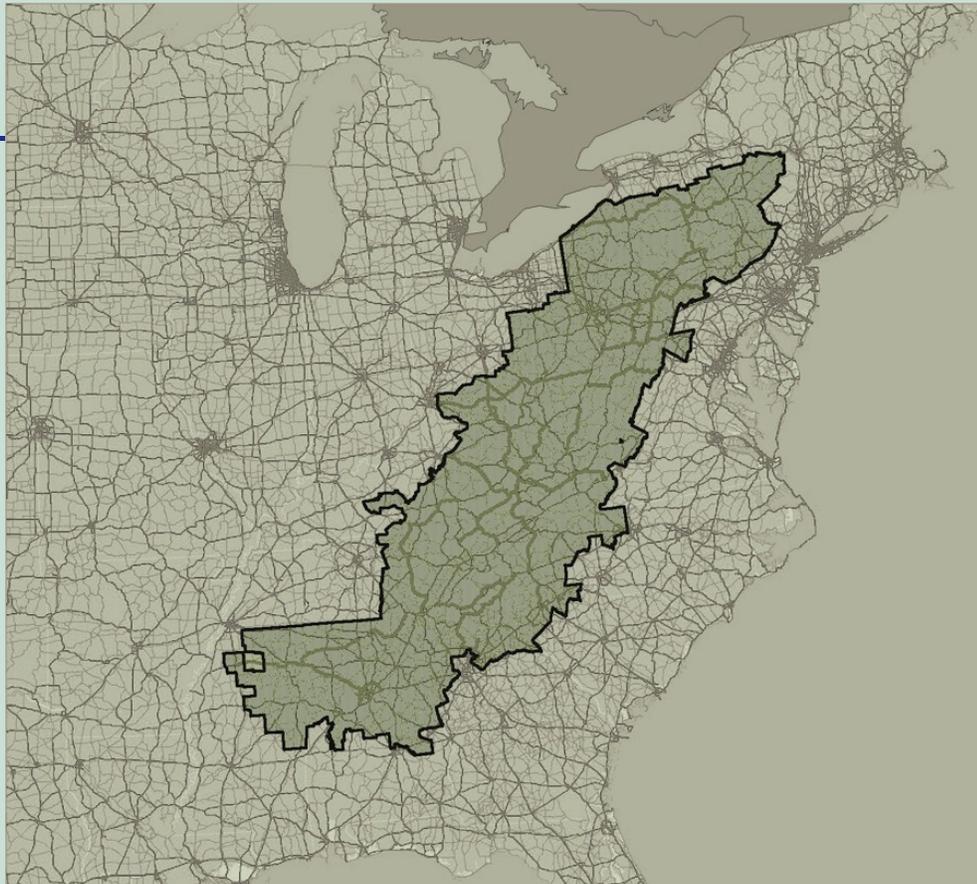


# Economic Impact Study of Completing the Appalachian Development Highway System

Final Report  
June, 2008



*prepared for*  
**Appalachian Regional Commission**

*prepared by*  
**Cambridge Systematics, Inc.,  
Economic Development Research Group, and  
HDR Decision Economics**



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*Final report*

# Economic Impact Study of Completing the Appalachian Development Highway System

You can view and download this report by visiting [www.arc.gov](http://www.arc.gov).

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The Appalachian Regional Commission's mission is to be an advocate for and partner with the people of Appalachia to create opportunities for self-sustaining economic development and improved quality of life.

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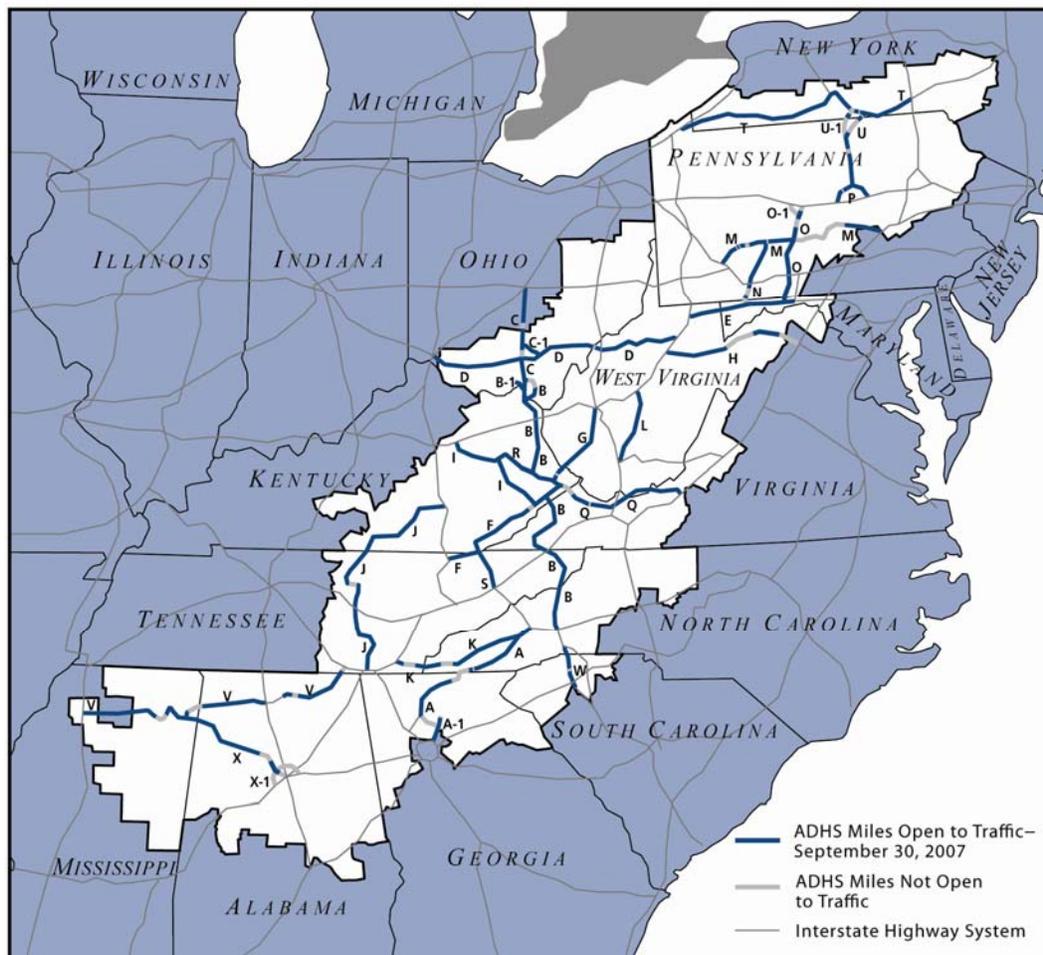


# Executive Summary

The Appalachian Regional Commission (ARC) has commissioned this economic impact study to estimate the economic impacts, benefits, and costs of completing the Appalachian Development Highway System (ADHS). The ADHS is the first highway system authorized by Congress for the purpose of stimulating economic development. The ADHS is a 3,571-mile near-interstate grade highway system composed of 31 corridors located in 13 Appalachian states with 3,090 eligible for improvement (see Figure ES.1). The system is approximately 85 percent finished and the completion will link the whole system into an integrated network connecting to national markets and trade flows.

Figure ES.1 ADHS Completed and Uncompleted Corridors

*Appalachian Development Highway System as of September 30, 2007*



Source: Appalachian Regional Commission

The purpose of this study is to assess the travel performance, trade, and economic development impacts directly related to completing the ADHS. In addition, the study assesses connectivity, accessibility, and network effects – in other words, how do the corridor improvements connect Appalachian people and businesses to other highway facilities, multimodal transportation, and economic markets (labor force, buyers/suppliers, tourists). The study has produced estimates of near- and long-term travel and economic benefits, including benefit/cost analysis to evaluate the expected economic return on investment of completing the ADHS to both the ARC region and the U.S. Furthermore, three regional case studies have been completed in the north, central and south sections of the ARC Region to provide detailed information for calibrating the modeling assumptions based on structured interviews with key transportation users and economic development experts.

Prior to this current study, the most recent extensive economic impact analysis of the ADHS was a July 1998 report that found positive economic and travel efficiency returns to ADHS investments.<sup>1</sup> There are a number of key differences between that study and this new effort such that it is difficult to compare findings. Those differences include: 1) the 1998 study examined benefits from 12 already completed highway segments rather than estimating benefits of the future completion of the ADHS; 2) that study was based on an analysis of individual highway segments, while this study emphasizes network benefits of a complete highway system; 3) this study makes use of national freight flow data not previously available, which allows for a more complete analysis of national freight system benefits; and 4) this new study estimates an additional benefit not examined in the earlier study, which is the potential for economic development benefits due to improved market access to labor force, buyers, suppliers and multimodal facilities.

Results of this study include a full range of transportation performance and economic development indicators organized by:

**Travel Efficiency Benefits** – Travel-time savings, route diversion, and transport cost savings;

**Direct Economic Impacts** – Reduced industry costs as well as economic development and tourism effects stemming from increased market accessibility;

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<sup>1</sup> Wilbur Smith Associates, *Appalachian Development Highways Economic Impact Study*, Appalachian Regional Commission, July 1998.

**Total Economic Impacts** – Full economic development impacts on the economy of the ARC region in terms of employment by industry, gross regional product, and personal income;<sup>2</sup> and

**Benefit/Cost Analysis** – Benefit/cost ratios and net present value (NPV) to measure expected return on investment.

As described in the full report, significant care was taken to avoid the double-counting of benefits. Study results are generally presented for two perspectives – the ARC region (410 counties in 13 states) and the entire United States. Since the ADHS has specific objectives in terms of increasing economic development opportunities for the Appalachian Region, the regional perspective on benefits of completing the ADHS is essential and emphasizes regional economic impacts. In addition, U.S.-level economic efficiency benefits of completing the ADHS are provided to demonstrate the national benefits of ADHS investment, and thus the national-level results are focused on transportation efficiency and productivity gains.

## KEY STUDY FINDINGS

The remainder of this executive summary presents key study findings and results organized by the four benefit and impact categories mentioned above.

### Travel Efficiency Benefits

ADHS corridor improvements will produce significant dollar values of travel benefits to individuals and businesses both within and outside the ARC region. Total user benefits (travel time, fuel and nonfuel operating costs, and safety) are estimated to be valued at \$1.6 billion annually by the year 2020, the hypothesized year of system completion, and grow to \$5.1 billion annually by 2035 under a medium-growth scenario (see Table ES.1).<sup>3</sup> These are national-level benefits reflecting travel efficiency gains for all trips affected by ADHS completion.

Completion of the ADHS will result in a significant reduction in travel time for personal, business, and long-distance freight trips. By 2020, the aggregate savings in travel time is estimated to be over 84 million hours annually (equivalent to 303,000 hours daily of travel time saved), which will grow to almost 212 million hours of reduced travel time by 2035.

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<sup>2</sup> Personal (nonbusiness) travel efficiency benefits are not included in total economic impacts.

<sup>3</sup> It is worth noting that relatively conservative assumptions were used regarding value of time and the potential for additional reliability and logistics benefits. In addition, this study used an innovative travel modeling approach that incorporated terrain factors to capture the impacts of mountainous, and often steep, Appalachian corridors.

**Table ES.1 Summary of User Benefits Due to ADHS Completion**  
*Medium-Growth Scenario*

Million of 2007 Dollars	2020	2035
Freight	\$444.0	\$2,993.9
Non-freight	\$604.0	\$1,140.9
Business Automobile	\$92.9	\$153.2
Non-business Automobile	\$463.3	\$764.1
<b>Total</b>	<b>\$1,604.2</b>	<b>\$5,052.0</b>

The improvements on the to-be-completed ADHS segments will result in a significant increase in traffic using largely rural interstates and expressways. Average daily traffic volumes are expected to increase by approximately 130 percent compared to what would occur if the remaining corridor segments are not completed. Despite the increase in traffic volumes, adding new capacity will result in lower total travel times with average speeds roughly doubling. This is especially true for freight truck trips which are projected to experience a 400 percent growth in miles traveled on ADHS corridors by 2035, doing so to gain shorter travel times and greater efficiency benefit.

Over 90 percent of automobile and non-freight truck benefits are estimated to accrue to the ARC region based on the origin-destination pattern of trips. Non-business auto user benefits include travel savings for reduced commute times (primarily within the ARC region). Meanwhile, over 65 percent of benefits to freight flows are *external* to the ARC region, reflecting the long-distance nature of the shipments affected and the national importance of completing the ADHS to facilitate goods movement into, out of, and through the ARC region.

### **Direct Economic Benefits**

Improvements in market accessibility for the ARC region will directly lead to increased economic development opportunities for the region. Accessibility gains were measured at the county level for labor, customer, tourist, buyer, and supplier markets, as well as reduced travel times to seaports, border crossings, airports, and intermodal rail facilities. The ARC region is estimated to gain \$2.1 billion annually by 2035 in economic activity (as measured by value added) due to market accessibility gains by 2035. These accessibility benefits are estimated to gradually phase-in over time based on historic time-series analysis of economic gains from completed ADHS segments.

Over half of the travel efficiency benefits are expected to accrue to business-related travel - commodity-based freight truck trips, local nonfreight truck trips, and business (on-the-clock) automobile trips as shown in Table ES.1. This is partly due to relatively higher values of time for business travel and partly due to fast-growing projections of long-distance freight truck travel. Reduced travel

time and distance for business-related trips directly impact the costs of doing business and the economic competitiveness of firms in the ARC region and nationwide.

Completion of the ADHS also will result in market accessibility improvements for large segments of the ARC region. Two hundred thirty-five out of 410 ARC counties are expected to see reductions in travel time to the nearest commercial airport, with 26 counties experiencing an 8 percent or greater reduction in travel time. Three hundred twenty-five out of 410 counties are estimated to increase their accessibility to buyer and supplier markets within a three-hour drive, with 59 counties experiencing an improvement greater than 10 percent.

### Total Economic Impacts

Total impacts on the economy of the ARC region result from the direct effects of reduced business-related travel time and costs, along with increased regional growth made possible by market accessibility gains and associated multiplier effects. These impacts gradually increase over time and by 2035 are estimated to generate approximately 80,500 jobs, \$5.0 billion in increased value added per year, including \$3.2 billion in increased wages per year for ARC region workers as shown in Table ES.2. To avoid potential double-counting these results: a) are only reported for the ARC region, leaving the analysis of U.S.-level benefits focused on travel efficiency and productivity effects; and b) represent net economic gains for the region, subtracting inter-regional relocation of economic activity from other parts of the region.

**Table ES.2 Total Economic Impacts of ADHS Completion in 2020 and 2035**

Impacts	2020	2035
Business Sales <sup>a</sup>	4,245	10,102
Value-Added <sup>a</sup>	2,099	4,995
Jobs	33,823	80,491
Wages <sup>a</sup>	1,343	3,197

<sup>a</sup> Annual impacts in millions of 2007 dollars.

The industries in the ARC region projected to benefit most directly from ADHS completion in terms of business retention, expansion, and relocation include: warehousing and distribution, manufacturing, mining and utilities, professional services, and other business services.

As demonstrated by the three detailed corridor analyses completed for this study, there are numerous real world examples of businesses that will directly benefit from the completion of highway corridors. For example, there is a strong wood products industry in West Virginia along Corridor H that exports many of their goods to overseas markets in Europe and Asia. When that corridor is

completed (significant sections remain in both West Virginia and Virginia), companies will be able to directly ship products to key port destinations such as Norfolk, Baltimore and the inland port in Virginia and thus significantly cut shipping costs and travel time, increase reliability, and improve safety.

### Benefit/Cost Analysis

Total undiscounted capital costs to complete the remaining segments of the ADHS are estimated to be \$11.2 billion (in 2007 dollars).<sup>4</sup> However, construction costs have been rising faster than the overall rate of inflation, so additional cost adjustments were added to the future time series of construction costs, raising the total undiscounted capital cost is \$16.6 billion. In present value terms, applying a 5 percent real discount rate and incorporating future operations and maintenance costs, total cost is estimated to be \$12.2 billion (in the high-cost scenario).

Table ES.3 presents cumulative impacts by category for the ARC region and the United States under a medium-growth scenario. These numbers represent the “present value” of a stream of annual travel efficiency or economic growth impacts over 30 years, using a 5 percent real discount rate.

**Table ES.3 Total Present Value of ADHS Completion Impacts**  
*30-Year Analysis*

Millions of 2007 Dollars Benefit Description	Medium Growth	
	ARC	United States
A Industry Cost Savings	17,310	29,114
B HH Out-of-Pocket Savings	165	173
C HH Value of Time Savings	5,482	5,718
D Market Access Growth <sup>a</sup>	10,684	2,069
E Indirect and Induced Growth <sup>a</sup>	9,551	N/A
<b>Total Impacts</b>	<b>43,192</b>	<b>37,074</b>

<sup>a</sup> Value Added.

<sup>4</sup> This cost estimate is slightly lower than the total presented in the *ARC 2007 Cost-to-Complete Report* which included 129 ADHS miles that were under construction. For the purpose of this study these miles were treated as completed and not included.

Impact categories include:

- A - Industry Cost Savings (travel benefits to business);
- B - Household (HH) Out-of-Pocket Savings (reductions in fuel and nonfuel automobile-related costs for passenger travel);
- C - HH Value of Time Savings (travel-time savings for passenger travel);
- D - Market Access Growth (economic development); and
- E - Indirect and Induced Growth (multiplier effects specific to the ARC region).

Traditionally, Categories A-C are considered to be measures of travel efficiency and Categories D-E are considered to be measures of regional economic impact. Since a key objective of the ADHS is to improve economic development in the ARC region, it is appropriate to compare total regional economic gains to cost to determine the likely economic return on investment.

Two types of benefit/cost (B/C) analysis are examined in this study to determine the economic return on investment for the ARC region and the entire United States - travel efficiency and total economic benefits (including economic impact categories D and E from above). While costs are the same from either perspective, benefits vary in two important ways. *Travel efficiency benefits* are significant for the ARC region but even higher from the U.S. perspective. National efficiency benefits are higher because a significant share of the affected trips are long-distance, high-value freight shipments with origins and destinations outside the ARC region. *Total economic benefits*, on the other hand, include benefits from increased market access and induced economic development, which accrue primarily to the ARC region,<sup>5</sup> in addition to all travel efficiency benefits (including personal, non-business travel benefits).

Table ES.4 (below) presents net present value and B/C ratio results for the ARC region and U.S. using a medium-growth forecast, conservative high-cost assumptions, and a 5 percent discount rate. For the travel efficiency benefits, the present value of benefits is estimated to be 2.9 times the cost at the U.S. level, with a B/C ratio of 1.9 for the ARC region. For the total economic benefits analysis, the present value of benefits for the ARC region is projected to be 3.6 times the estimated cost (with a range of 2.5 to 6.3 based on varying discount

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<sup>5</sup> For purposes of benefit/cost analysis, total economic benefits for the ARC region include the value-added created via greater economic development opportunities in the region. To account for potential shifts in the location of future economic growth, at the national level, this measure only includes net productivity and export gains associated with regional economic development.

rate, cost and forecast assumptions).<sup>6</sup> At the U.S. level, using a medium-growth forecast, conservative high-cost assumptions, and a 5 percent discount rate, the estimated total economic benefit is 3.1 times the estimated cost (with a range of 2.2 to 5.4 based on varying discount rate, cost and forecast assumptions). Under all scenarios, including conservative cost and discounting assumptions, completion of the ADHS is expected to result in significant benefits in excess of cost from both the national and ARC regional perspective.

**Table ES.4 Benefit/Cost Analysis of ADHS Completion**  
*Five Percent Discount Rate, Millions of 2007 Dollars*

		Net Present Value	Benefit/Cost Ratio
Travel Efficiencies	ARC Region	\$10,800	1.9
	United States	\$22,850	2.9
Total Economic Benefits	ARC Region	\$31,030	3.6
	United States	\$24,910	3.1

These benefit/cost ratios are within the range usually found for individual highway projects. They appear stronger than those found for many rural corridors, primarily because: 1) the remaining ADHS segments complete important linkages in a long-distance network that serves a growing domestic and global trade environment, rather than just serving connections between individual rural communities; and 2) these highway segments provide necessary access and connections to/from isolated, mountainous Appalachian communities thus providing significant new economic opportunities as detailed in the three corridor analyses. It also makes ADHS completion particularly important for supporting the future economic competitiveness of the national and ARC regional economies.

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<sup>6</sup> This range reflects various uncertainties inherent in any forecast such as discount rate, future cost escalation, the success of economic development initiatives, and baseline economic and demographic forecasts.