THE ENVIRONMENTAL AND ENERGY CONSERVATION BENEFITS OF THE MARYLAND HISTORIC TAX CREDIT PROGRAM

PART 2 OF AN ANALYSIS OF ECONOMIC AND ENVIRONMENTAL IMPACTS OF THE MARYLAND HISTORIC TAX CREDIT PROGRAM

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Preface

This report is part of a comprehensive economic and environmental impact analysis of the Maryland Heritage Rehabilitation Tax Credit program funded by the Abell Foundation and carried out by Lipman Frizzell & Mitchell, LLC (www.lfmvalue.com, Joe Cronyn, Principal) and Northeast-Midwest Institute (www.nemw.org, Evans Paull, Senior Policy Analyst). The main report, *"Heritage Tax Credits: Maryland's Own Stimulus to Renovate Buildings for Productive Use and Create Jobs, an $8.53 Return on Every State Dollar Invested,"* is available at http://www.abell.org/pubsitems/arn309.pdf.

Where the main report included a summary of the economic, environmental, and energy impacts, this report is a fully documented analysis directed only toward the environmental and energy benefits.

The authors gratefully acknowledge the assistance rendered by Patrice Frey, National Trust for Historic Preservation, and Peter Conrad, Maryland Department of Planning. Lastly, the authors acknowledge the Abell Foundation for funding the analysis – see www.abell.org for more information about the foundation.

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EXECUTIVE SUMMARY

This report examines the environmental and energy conservation impacts of the Maryland Heritage Structure Rehabilitation Tax Credit Program. The report is an adjunct to a related report on the economic and environmental impacts of tax credit. The main report, *"Heritage Tax Credits: Maryland's Own Stimulus to Renovate Buildings for Productive Use and Create Jobs, an $8.53 Return on Every State Dollar Invested,"* is available at http://www.abell.org/pubsitems/arn309.pdf. While the main report included a summary of the environmental and energy impacts, this report is a fully documented analysis of the environmental impacts.

Preservation programs have long been aligned with smart growth because of the obvious benefit of investing in existing communities and accommodating growth without sprawl. However, the literature in this area tends to make assertions without a great deal of quantification. This report attempts to fill that gap for the Maryland historic tax credit program.

The following is a brief summary of economic and fiscal impacts, excerpted from the report referenced above.

- Economic Development - Over 12 years, completed commercial projects have generated a total economic impact on the Maryland economy of more than $1.74 billion ($2009) in total economic activity, employing an estimated 15,120 persons earning $673.1 million ($2009). Construction labor on the job-sites totaled an estimated 9,248 workers earning $443.4 million ($2009)—over three-fifths of the total economic impact.
- Fiscal Impact -During their construction periods alone, the 407 projects generated an estimated $83.7 million ($2009) in State and local taxes—effectively paying down more than one-third of the State's total $213.9 million tax credit investment. The greatest return on the State's investment, however, comes from the long-term increase in employment and property taxes at the historic properties and their neighbors.

The following energy/climate and environmental impacts were summarized in the more general impact report, referenced above, and are fully documented and addressed in greater detail in this report

- Energy/VMTs/Climate **-** Historic preservation projects reduce vehicle miles traveled (VMT) 30%-40% as compared to suburban norms.
    - The households and employees accommodated in tax credit projects have reduced their travel by between 34.3 million and 45.8 million VMTs relative to regional norms,
    - Corresponding CO_2 emissions have been reduced by between 13,700 and 21,200 metric tons.
    - These VMT and CO_2 reductions represent between 1.7 million and 2.3 million gallons of gasoline, which is the equivalent to removing 2,500 and 3,800 cars from the road for a year.
- Embodied Energy - Preservation projects have retained (not wasted) 11.2 million MBTU of "embodied energy;"

- Avoided Demolition Energy -By avoiding demolition, preservation projects have also "saved" another 5,000 to 11,000 metric tons of CO_2, which is the equivalent of taking 900 to 1,900 cars off the road for a year;
- Saving Greenfields. Preservation projects, due to their urban locations and densities, have preserved and estimated 1,053 acres of greenfields that otherwise may have been developed for sprawl;
- Lowered Run-off. Run-off from preservation projects is estimated to be 30 to 40 percent less than alternative low density sprawl, with resulting benefits for water quality;
- Landfill Space Saved. Rehabilitation of tax credit properties has "saved" 387,000 tons of material from landfills. This amount of landfill material is the equivalent of filling a football stadium to a depth of 50-60 feet;
- Saving Infrastructure Investment. Preservation saves between 50 and 80 percent in infrastructure investments relative to suburban greenfields development. The historic tax credit program, in effect, counterbalances the public subsidies that continue to exacerbate sprawl by virtue of publicly funded infrastructure and flat rate charges for utilities.
- Natural Resources Conserved. Tax credit projects have conserved an estimated $100 million in natural resources (relative to new construction).

The above findings assessed past performance of the tax credit; researchers then converted the estimates into a forward-looking projection of impacts from each additional $1 million in tax credits. The following table represents this synthesis.

Table 1. Environmental Impact of Historic Preservation: Benefits of $1.0 Million Investment in Historic Tax Credits (Assumes 20% credit and Rehab Cost of $100 psf)

Benefit	Quantification
Renovated space	50,000 sq ft
Environmental Impacts:	
▪ Lower VMTs (30%-40% saving compared to sprawl)	198,000 – 264,000 VMTs
▪ Lower travel-related CO_2 compared to sprawl	92 – 123 metric tons CO_2
▪ If the rehab is also LEED equivalent for energy efficiency, the CO_2 "saved" relative to conventional construction in suburban location	164 – 195 metric tons CO_2
o This is equivalent in gallons of gasoline	18,700 – 22,000 gallons of gas
o This is equivalent taking vehicles off the road	30 to 35 vehicles
▪ Retained "embodied" energy	55,000 MBTUs
▪ Greenfield land preserved	5.2 acres
▪ Lowered run-off per sq ft or DU, relative to low density sprawl – percentage reduction	30 to 40%
▪ Less demolition debris in landfills, relative to demolition and new construction	2,500 tons
▪ Value of natural resources conserved, relative to new construction	$100,000
Infrastructure investments "saved"	$500,000 to $800,000

BACKGROUND

The benefits of historic preservation are usually measured in terms of their impact on revitalization of existing, often economically depressed communities. There are fairly extraordinary examples of cities where redevelopment of an old mill building near the center of town has sparked a larger renewal and generated growth in areas that were thought to be in perpetual decline. Job, investment, and fiscal impacts are impressive.

This report concentrates on the less well known benefits of preservation in environmental and energy conservation. Preservation programs have long been aligned with smart growth because of the obvious benefit of investing in existing communities and accommodating growth without sprawl. However, the literature in this area tends to make assertions without a great deal of quantification. This report attempts to fill that gap for the Maryland Heritage Structure Rehabilitation Tax Credit (hereafter referred to as "tax credit" or "historic tax credit").

This report is part of a comprehensive economic and environmental impact analysis of the Maryland Heritage Rehabilitation Tax Credit program funded by the Abell Foundation and carried out by Lippman Frizzell & Mitchell and Northeast-Midwest Institute. The main report, *"Heritage Tax Credits: Maryland's Own Stimulus to Renovate Buildings for Productive Use and Create Jobs, an $8.53 Return on Every State Dollar Invested,"* is available at http://www.abell.org/pubsitems/arn309.pdf.

Where the main report included a summary of the environmental and energy impacts, this report is a fully documented analysis of the environmental impacts.

A note on the scope of the data: this analysis only addresses the commercial credit piece of the tax credit program.

Maryland Historic Tax Credit Program

The tax credit program was established in 1996 to encourage the redevelopment of historic buildings and revitalization of our older communities by offering project sponsors tax credits equal to a percentage of eligible rehabilitation costs. The program evolved with several elements changing almost yearly: the amount of the credit varied between 10 percent and 25 percent; an overall program cap, first instituted in 2003, has varied between zero and $30 million; and a project cap of $3 million was instituted in 2003. For fiscal year 2009 the program is a 20 percent credit with a $10 million cap and a $3 million per project ceiling.

Part of the motivation for this report is that the program is scheduled to sunset in 2010, and program supporters are advocating for a five-year reauthorization that will establish greater predictability for the credit.

CLIMATE CHANGE, VEHICLE MILES TRAVELED, AND WALKABLE COMMUNITIES

VMTs and Smart Growth

Climate change experts are drawing attention the salient facts: Americans have been increasing their driving rates at a pace that will likely nullify gains in fuel efficiency, making greenhouse

gas reduction an elusive objective. Without a strategy to also lower vehicle miles traveled (VMT), mandated fuel efficiency standards will only succeed in lowering the projected INCREASE in greenhouse gases, not lower them.[1] The primary public policy mechanisms that can reduce VMTs are those that relate to smart growth – encouraging development patterns that make driving less necessary.

A comprehensive review of the literature by Urban Land Institute concluded that "compact development" saves in the range of 20-40 % vehicle miles traveled (VMTs) relative to sprawl.[2] Other studies that have come to similar conclusions include.

- A Center for Clean Air Policy study found that VMTs were an estimated 25 percent lower for an urban 20-unit per acre development than a suburban four-unit acre per acre development.
- An Atlanta regional study found that the travel patterns of residents of the area's "most walkable neighborhoods" accounted for 30 percent lower VMTs and 20 percent lower greenhouse gas emissions than the travel patterns of residents of the "least walkable neighborhoods.[3]
- A King County, Washington, study concluded that urban "interconnected neighborhoods," defined by density, frequency of intersections, and grid street patterns, reduced VMTs by 26 percent relative to a suburban spread development model.[4]

The factor that has proven to be most highly correlated with VMT reduction is density. Several studies found that doubling density corresponds to a 25 to 30 percent reduction in VMT.[5] One model for predicting VMT reduction and greenhouse gas impacts employs density as a sole input variable, because density is also highly correlated with all of the other VMT determinants, listed below.[6] The factors that are positively correlated with VMT reduction are, generally in rank order:[7]

- Density
- Mixing uses;
- Proximity to transit;
- Proximity to city center or job centers;

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[1] Urban Land Institute, Smart Growth America, the Center for Clean Air Policy, and the National Center for Smart Growth, "Growing Cooler: Evidence on Urban Development and Climate Change," Washington, D.C. January 2008 http://www.smartgrowthamerica.org/gcindex.html.

[2] Ibid. Other studies include: Pew Center on Global Climate Change, "Towards a Climate-Friendly Built Environment," Pew_Report; Kris Wernstedt, "Overview of Existing Studies on Community Impacts of Land Reuse," National Center for Environmental Economics, 2004; The Funders Network and the Environmental and Energy Study Institute, "Energy and Smart Growth – It's About How and Where We Build"

[3] Walkable neighborhoods were defined by three criteria: density, mixed land uses, and the interconnectedness of the street patterns. David Goldberg et al., "New Data for a New Era: Linking Land Use, Transportation, Air Quality, and Health in the Atlanta Region"

[4] Larry King, "Sprawl and Public Health," *Public Health Reports*, May-June 2002.- http://www.cdc.gov/healthyplaces/articles/Urban%20Sprawl%20and%20Public%20Health%20-%20PHR.pdf .

[5] John Holtzclaw,* Robert Clear, Hank Dittmar, David Goldstein and Peter Haas, "Location Efficiency: Neighborhood and Socio-Economic Characteristics Determine Auto Ownership and Use," *Transportation Planning and Technology*, Vol. 25(1), pp 1-27, March 2002. See also: Peter Newman and Jeffrey Kenworthy. *Cities and Automobile Dependence: An International Sourcebook*, Gower Publishing, 1989; and Gary Pivo, Paul Hess and Abhay Thatte. *Land Use Trends Affecting Auto Dependence in Washington's Metropolitan Areas, 1970 - 1990*, Washington state DOT, WA-RD 380.1, 1995.

[6] See: http://www.sflcv.org/density/

7 Holtzclaw, *ibid*; see also: Lawrence Frank and Gary Pivo. *Relationships Between Land Use and Travel Behavior in the Puget Sound Region,* Washington state DOT, WA-RD 351.1, 1994.

- Connectivity of the streets and the pedestrian friendliness of the public thoroughfare (grid streets)

Highly Urbanized Projects – greater VMT reduction
There are also some well documented cases, in dense mixed use close-to-downtown communities, where VMT reduction has been much greater than 40%.

In Atlanta the massive mixed use Atlantic Station project is significantly exceeding predicted VMT reduction. US EPA's pre-development modeling projected VMT savings of between 14 to 52 percent compared to alternative suburban locations.[8] Follow-up studies for residents and workers at Atlantic Station have shown greater VMT reductions. Atlantic Station residents average 73 percent lower VMTs per day relative to Atlanta region norms. Atlantic Station workers average 36 percent lower commuting VMTs per day relative to Atlanta region norms.[9]

Another analysis compared the highly urbanized, dense and historic North Beach area in San Francisco (100 households/ residential acre) to low density suburban San Ramon (three households/ residential acre) and found that North Beach reduced VMTs by 75 percent.[10]

Historic Preservation VMT Case Studies

There is one case study of an historic preservation project that was modeled for VMT reduction: the "Lamar on South Side" the redevelopment of the former Sears catalogue center, one mile south of downtown Dallas. The development includes 455 lofts that occupy 900,000 square feet, 120,000 square feet of office space, and 34,000 square feet for retail and other arts related uses in a ground-floor retail arcade running the length of the building along a former railroad tunnel. Historic preservation tax credits were the key financing source. US EPA examined the project in 2001 and compared it to a greenfields site in the outer suburbs. The findings projected a 23 to 38 percent reduction in VMTs due to the infill/historic preservation project. EPA projected parallel reductions in air pollutants such as NOx and VOCs.[11]

These findings place this project directly in line with the 20 to 40 percent reduction attributed to "compact development" in the ULI study. The fact that the project was in the central city, proximate to, but not located in, the city center makes it comparable to many Maryland historic preservation projects.

A Baltimore example that involves some limited data is the Catholic Relief relocation to the Stewart's Building in downtown Baltimore. When considering alternative locations, management surveyed their employees about how they got to work and found that:
- 37 percent used transit;
- 10 percent walked;
- Totaling 47 percent that accessed their work location via non-auto means.

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[8] U.S. Environmental Protection Agency, "Atlantic Steel Redevelopment," Washington, D.C., 2006, http://www.epa.gov/innovation/collaboration/atlanticsteel.pdf
[9] AIG Global Real Estate, 2008 Atlantic Station Project XL Report, provided to Northeast-Midwest Institute.
[10] John Holtzclaw. *Explaining Urban Density and Transit Impacts on Auto Use.* Natural Resources Defense Council, San Francisco, 15 January 1991, in California Energy Commission, Docket No. 89-CR-90.
[11] US Environmental Protection Agency, "Comparing Methodologies To Asses Transportation and Air Quality Impacts Of Brownfields And Infill Development," August, 2001.

These findings, if converted to VMTs, would indicate that the Stewart's building project reduced VMTs (relative to regional or suburban norms) by an amount that would easily exceed the 40 percent attributed to compact development.

Preservation Project Characteristics

Preservation projects tend to be located in smart growth and energy-efficient locations. This simply reflects the urban form of the pre-suburban era: densities, mixing uses, access to transit, grid streets, and proximity to the city center all reflected the historic/economic need for proximity to jobs and services at a time when car ownership was a luxury.

Of the five VMT reduction characteristics outlined above, researchers for the Maryland study were able to definitively quantify three: density, proximity to job centers, and mixing uses. Because access to transit is highly correlated with density and connectivity is strongly associated with the historic urban form, the lack of data is in these two areas is not a fatal flaw. Nevertheless the VMT reduction estimates should be characterized as "order of magnitude" estimates.

Population Density

Review of data from the Maryland Department of Planning (MDOP) assembled for this study indicates that tax credit projects are located in areas that are triple the density of mean densities of the developed parts of Baltimore County. The following methodology was used:

- Comparison area: The developed part of suburban Baltimore County was used as the comparison area because the densities are higher than other suburban jurisdictions, giving the findings a conservative bias. Acreage corresponds to the areas within the County classified as "developed" for residential and commercial uses by the Maryland Department of Planning – 36 percent of the land area is classified as developed. Population is county-wide census data, less population classified as rural. All jobs located in the county are assumed to be in "developed" areas. These assumptions give the findings a conservative bias.
- Historic Tax Credit Project areas. The Maryland Department of Planning provided 2000 census population and employment data for areas within ½ mile of each tax credit project. (Note each census block was counted as in or out depending on whether the centerpoint for the block was within ½ mile).

Three population density measures were calculated for the tax credit project areas – mean, median, and weighted average (weighted for eligible rehabilitation expenditures). Tax credit project area densities were approximately three times the Baltimore County developed area densities: 2.7 (median); 3.0 (weighted average) and 3.2 (mean).[12] See figure 2, below.

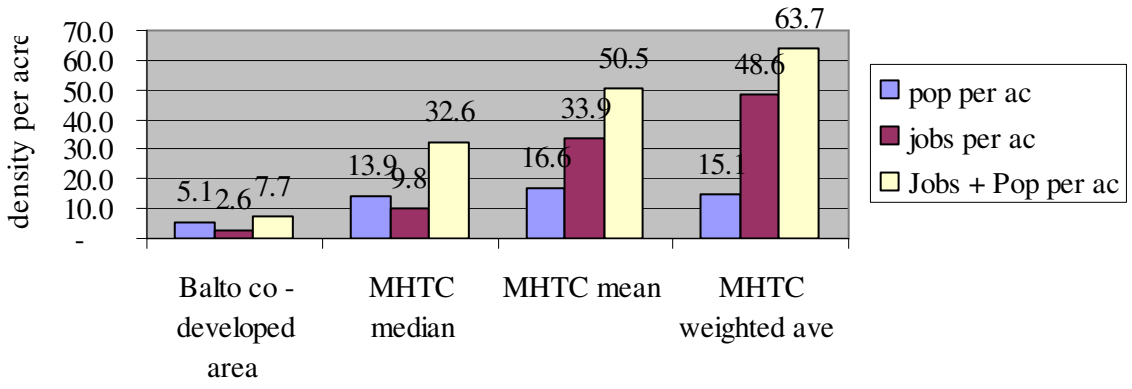
Job Density

Researchers used employment per acre data, the same as above, comparing the tax credit project areas to the developed area in Baltimore County. In this instance the differences between tax credit areas and the suburban Baltimore County area I more pronounced, with wider variations between mean median and weighted average. Tax credit area *median* job densities were 3.7 times the County job densities; tax credit area *mean* job densities were 13 times Baltimore County's job densities; and the *weighted average* (weighted for eligible rehabilitation

[12] A flaw in the data/methodology is that the Baltimore County data is only represented as a mean.

expenditures) tax credit project job densities were 19 times the Baltimore County developed area densities.[13] See figure 2, below.

Figure 1. MD Historic Tax Credit (MHTC) Project Area Densities Compared to Baltimore County Developed Areas



Mixing uses and Walkable Communities

The best measure for mixing uses is Walkscore. The website (www.walkscore.com) explains the measuring and scoring as follows: "Walk Score calculates the walkability of an address by locating nearby stores, restaurants, schools, parks, etc. Walk Score measures how easy it is to live a car-lite lifestyle—not how pretty the area is for walking." The walkscore for an address "is a number between 0 and 100:

- 90–100 = Walkers' Paradise**:** Most errands can be accomplished on foot and many people get by without owning a car.
- 70–89 = Very Walkable**:** It's possible to get by without owning a car.
- 50–69 = Somewhat Walkable**:** Some stores and amenities are within walking distance, but many everyday trips still require a bike, public transportation, or car.
- 25–49 = Car-Dependent**:** Only a few destinations are within easy walking range. For most errands, driving or public transportation is a must.
- 0–24 = Car-Dependent (Driving Only)**:** Virtually no neighborhood destinations within walking range. You can walk from your house to your car!

Project researchers ran walkscore on 397 of the 403 tax credit commercial projects (the other six did not have geo-codable addresses). The results were:

- Median walkscore – 91
- Mean walkscore – 82.2;
- Weighted average walkscore (weighted for eligible rehabilitation expenditures) – 86.9;
- 85 percent of tax credit projects ranked in the top "walker's paradise" category or the "very walkable" category.

Thus, almost all tax credit projects are in highly walkable communities, i.e. where there are alternatives to using automobiles to access services.

[13] A flaw in the data/methodology is that the Baltimore County data is only represented as a mean.

VMTs in Baltimore City

Note that 64 percent of all tax credit projects (and 86 percent of all tax credit expenditures) are located in Baltimore City. According to the Baltimore Metropolitan Council, residents of Baltimore City drive an average of 14.2 VMT/day, about one-half the rate of the suburban jurisdictions, which is 28.1 VMT/person/day.[14] Thus, the average resident of Baltimore City generates VMTs at a rate that is only about 50 percent of suburban norms, exceeding the above-cited 20 to 40 percent reduction attributed to compact development. Further, Baltimore City residents make 35 percent of their trips by non-auto means (14.4 percent/transit and 20.7 percent/non-motorized), compared to just 12 percent non-auto in the surrounding suburbs.[15]

Historic Tax Credit Projects and VMT Reduction

The above discussion found that: the population density of tax credit project areas exceeds suburban norms by a factor of approximately three to one, the job density of tax credit project areas is at least 3.7 times suburban norms; tax credit projects rank in the highest category for walkability; tax credit sites are concentrated in Baltimore City where residents tend to have much lower VMTs per person than outlying areas.

Researchers for this project used the above data to set up a VMT reduction model, designed to define, within a range, the likely VMT reduction attributed to each tax credit project. Because density is well established as the best correlate of VMT reduction, the model gives the greatest weight to density. Table 2 represents the weighting system.

Table 2. Weighting and Ranking to Predict VMT Reduction

	Tax credit project area as a multiple of Baltimore County			
	>6 X Balto Co	4 to 6 X Balto Co	2-4 X Balto Co	1.25 to 2 X Balto co
Population density	4	3	2	1
Concentration of jobs	4	3	2	1
Job + Pop combined density	4	3	2	1
Walkscore	90-100	80-89	70-79	60-69
walkscore ranking	4	3	2	1

The total score is the sum of each project's ranking on each of the four factors. Because the research indicates that doubling density corresponds to a 25 to 30 percent VMT reduction, projects that have densities that are a multiple of Baltimore County density by a factor of four or more are candidates for VMT reduction greater than the 20 to 40 percent attributed to compact development. Projects that are 2 to 4 times the Baltimore County densities are generally within

[14] Baltimore Metropolitan Council, Factors Affecting Travel Behavior, for the Transportation 2030 Project.
[15] Baltimore Metropolitan Council, 2001 Travel Survey, 2004.

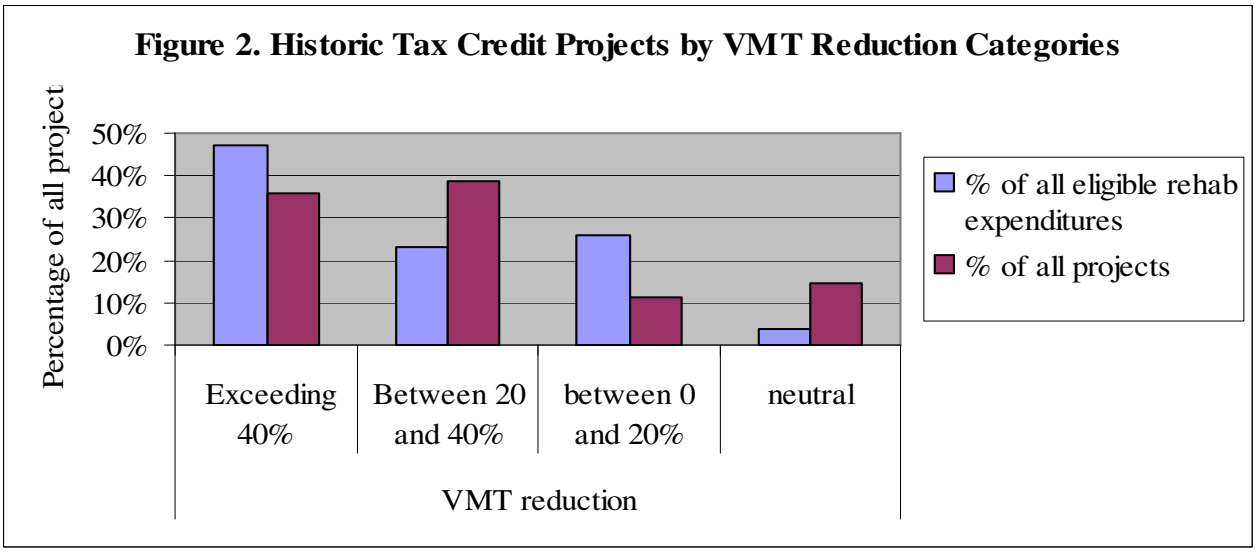
the 20 to 40 percent reduction range. Projects that are 1.25 to 2 times the Baltimore County densities are likely reducing VMTs by less than 20 percent, but greater than zero.

The ranking system, then, is as follows:

- Total score of 13 to 16 – reduce VMT by more than 40 percent;
- Total score of 8-12 – reduce VMT by between 20 and 40 percent;
- Total score of 4-7 – reduce VMT by between 0 and 20 percent
- Total score less than 4 – no effect on VMT

The result of this ranking system is shown in the table and graph, below.

Table 3. Historic Tax Credit Projects and VMT Reduction					
	Exceeding 40%	**Between 20 and 40%**	**between 0 and 20%**	**neutral**	**Total**
% of all eligible rehab expenditures	47%	23%	26%	4%	100%
% of all projects	36%	39%	11%	14%	100%
no. site meeting criteria	138	150	43	56	387
expenditures represented by these sites	$393,936,947	$ 92,446,142	$216,365,947	$30,886,529	$833,635,564



From this data the project researchers conclude that historic tax credit projects are in the high range of the VMT 20-40 percent VMT reduction generally attributed to compact development, that is in the 30 to 40 percent part of the range.

VMT reduction and CO_2

This 30 to 40 percent VMT reduction can be translated into carbon dioxide reduction as follows:

- $1.02 billion (2009 dollars) in eligible rehabilitation are assumed to be producing reuse that is 50 percent commercial and 50 percent residential. Using rules of thumb, this represents:
  - 2,548 dwelling units
  - 20,382 employees
- These households and employees have reduced their travel by between 34.3 million and 45.8 million VMTs relative to regional norms,
- CO_2 emissions have been reduced by between 13,700 and 21,200 metric tons.
- These VMT and CO_2 reductions represent:
  - 1.7 million and 2.3 million gallons of gasoline: or,
  - 2,500 and 3,800 cars from the road for a year.

From a future investment point of view, using the same assumptions, but calculating the savings for $1 million in new historic tax credits, results in:

- 198,000 to 264,000 VMTs "saved;"
- 92 to 123 metric tons of CO_2 "saved."

See Table 4 for a detailed accounting of these estimates.

Notes on VMT Reduction Methodology

The project researchers acknowledge that this model is a tool that produces only "order of magnitude" estimates. The limitations and disclaimers are many: staff did not have data on two of the five VMT factors: access to transit; and connectivity – these are assumed to be highly correlated with the known variables. Staff did not have access to data related to density of the projects, as opposed to the density of the areas – it was assumed that project densities reflect area densities, likely a good assumption for preservation projects. A number of assumptions had to be made relative to the Baltimore County comparison data in order to isolate developed area densities (these are outlined above). One data anomaly should be noted: a number of downtown Baltimore projects did not rank in the highest VMT reduction category because residential densities were relatively low for the 2000 census. If updated population estimates could be used (which would reflect the growth in downtown housing) many of these downtown projects would likely be re-classified as in the highest VMT reduction category Another data anomaly was that Tide Point landed in the 0 to 20% VMT reduction category – had a 1 mile radius been used to judge density instead of ½ mile, Tide Point would have moved up at least to the 20 to 40 percent category. This is noted because the $70 million total rehab costs skews the data. Lastly, a number of projects were taken out of the list because addresses did not geo-code or were not geo-coded correctly. The most significant of these is Montgomery Park.

Generally, the researchers would assert that more sophisticated data would likely to lead to higher, not lower VMT reductions.

Also note that staff reviewed the proposed methodology with a number of national experts on land use and VMT reduction. There was general concurrence; however, this was a conceptual review, not specific enough to make any claim that the methodology has been "peer-reviewed."

Table 4. Preservation, VMT Reduction and GHG Reduction

Baseline Findings and Assumptions		VMT/ annual	rate	metric tons, annually
Total Eligible Rehab expenditures	$ 1,019,097,557			
assumed % of commercial space	50%			
assumed % of residential space	50%			
Residential Calculations				
Regional averages				
one car - average VMT/annual		11,856	**	
CO2 for one car, metric tons				5.50 ***
CO2 per 1,000 miles, metric tons				0.46
cars per HH			1.57	*
CO2 per HH, metric tons				8.635
VMT per HH		18,614		
Tax Credit Residential Units				
> assumed residential space - $ per unit	$ 200,000			
> residential units renovated - DUs	2,548			
> Total VMT/annual if all MHTC HH held to regional norms		47,423,501		
VMT and CO2 - high estimate (40% savings)		11,168		
> VMT and CO2 savings per HH due to MHTC		7,446		5.18
> Total VMT and CO2 generated by all MHTC HH		28,454,101		3.45
> Total VMT and CO2 savings by all MHTC HH		18,969,400		8,800
VMT and CO2 - low estimate (30% savings)		13,030		
> VMT and CO2 savings per HH due to MHTC		3,723		6.91
> Total VMT and CO2 generated by all MHTC HH		33,196,451		1.73
> Total VMT and CO2 savings by all MHTC HH		14,227,050		4,400
Commercial Space				
Regional averages				
> average commuting distance per day per employee		13.7	*	
> average commuting VMT/employee/annual		3,288		
> CO2 per employee, annual				1.53
> Total VMT/annual if all MHTC employees held to regional norms		67,015,855		
> CO2 from MHTC employees if held to regional norms				31,088,664
Tax Credit Commercial Space				
> Commercial investment (50% of total)	$ 509,548,778			
> Space renovated - cost per sq ft	$ 100			
> Estimated commercial space renovated	5,095,488			
> Employees per 1000 sq ft	4			
> Employees in MHTC projects	20,382			
VMT and CO2 - high estimate (40% savings)		1,973		
> VMT and CO2 savings per employeee/year due to MHTC		1,315		0.61
> Total VMT and CO2 generated by all MHTC employees		40,209,513		20,383
> Total VMT and CO2 savings due to MHTC employees		26,806,342		12,435
VMT and CO2 - low estimate (30% savings)		2,302		
> VMT and CO2 savings per employeee/year due to MHTC		986		0.46
> Total VMT and CO2 generated by all MHTC employees		46,911,099		21,762
> Total VMT and CO2 savings due to MHTC employees		20,104,757		9,327
Total Impacts of MHTC projects - high estimate (40% savings)				
> Total VMT/annual - emplyees and residents of MHTC projects if held to regional norms		114,439,356		
> Total VMT generated by MHTC project employees and HH		68,663,614		
> VMT savings MHTC employees and HH vs. regional norms		45,775,743		
> CO2 (metric tons) savings - MHTC employees and residents				**21,235**
> converted to gasoline	2,420,833			
> converted to number of cars driving for 1 year	3,822			
Total Impacts of MHTC projects - low estimate (30% savings)				
> Total VMT/annual - emplyees and residents of MHTC projects if held to regional norms		114,439,356		
> Total VMT generated by MHTC project employees and HH		80,107,549		
> VMT savings MHTC employees and HH vs. regional norms		34,331,807		
> CO2 (metric tons) savings - MHTC employees and residents				**13,727**
> convert to gallons of gas @ 19.7 miles per gallon	1,742,731			
> converted to number of cars driving for 1 year	2,471			

* BMC - 2001 HOUSEHOLD TRAVEL SURVEY:

** - http://www.epa.gov/cleanenergy/energy-resources/refs.html#vehicles

*** http://www.epa.gov/cleanenergy/energy-resources/calculator.html

conversion factors: gas to btu 1 gal = 125,000 btu; convert 1 mbtu of natural gas to lbs CO2 = 117.08

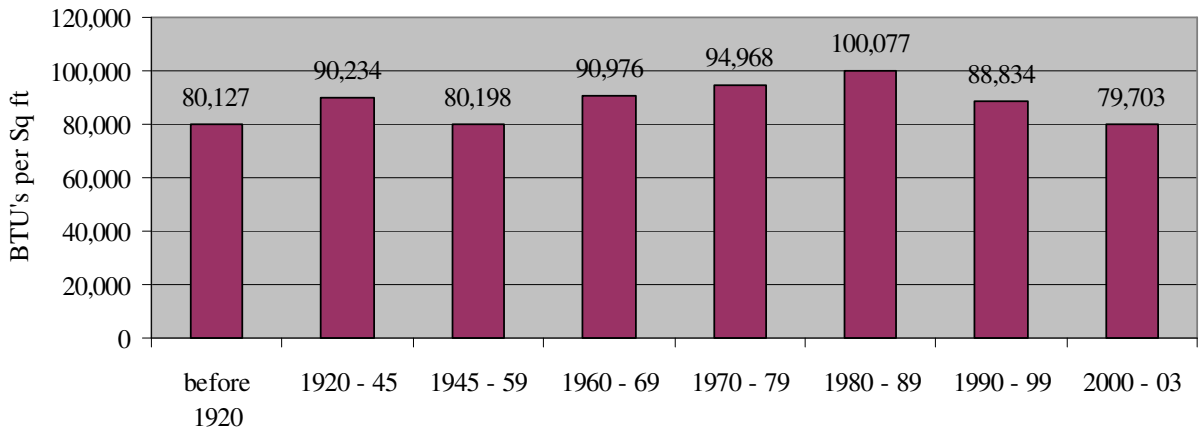
THE DUAL BENEFIT OF ENERGY-EFFICIENT BUILDINGS IN ENERGY-EFFICIENT LOCATIONS

The above discussion centered on transportation-related energy efficiencies of preservation projects. The discussion now turns to energy-efficiency within the building structure – operational energy conservation and opportunities to create the dual benefit of energy-efficient buildings in energy-efficient locations.

Are old Buildings Energy Hogs?

There is a common misperception that older buildings are less energy efficient than buildings built in more recent times. Data from the US Energy Information Administration indicates that buildings built before 1920 are approximately equivalent to buildings built from 2000 to 2003, and the worst energy offenders are actually those built in the 1970's and 1980's.

Figure 3. Commercial Bldgs - Average Energy Use per Square Foot by Time Period



The reasons that historic structures are relatively energy-efficient have to do with the use of materials that are superior insulators, use of natural ventilation, and siting/orientation for efficient heating and, especially, cooling in the pre-air conditioning era..

Preservation and Green Buildings

The green building movement and the historic preservation movement, once seen as almost working at cross-purposes with each other, are increasingly joining forces and calling attention to the win-win of historic rehabs that are also green and energy-efficient. US Green Buildings Council introduced LEED – EB (Existing Buildings) in 2004, in part, to address concerns that the LEED rating system was inadvertently reinforcing the myth that older buildings are inherently energy-inefficient. The rating system is now being revised to make it more user-friendly (for a discussion of the issues see: this article in Greener Buildings.com). There is now extensive literature and case studies relative to promotion of green and historic (see, for example, this article in Environmental Building News and this article in the AIA newsletter).

In the "VMT and Greenhouse Gas" section the researchers for this study have found that most tax credit projects are in locations that encourage non-auto means of access and egress, which has particular benefits for lowering greenhouse gases relative to suburban auto-dependent locations. Some tax credit projects have also taken steps to conserve energy within the building. These projects can be characterized as having the dual energy impact of energy-efficient buildings in energy-efficient locations.

HF Miller Tin Can and Box Company/2601 N. Howard Street[16]

HF Miller Tin Can and Box Company/2601 N. Howard Street, also known as the Census Building

With $4 million in state and federal historic tax credits providing the key financing, developers Donald and Thibault Manekin (Seawall Development) are undertaking a $19 million redevelopment of the former H. F. Miller & Sons Tin Box and Can Manufacturing Company building (also known as the Census Building) at 26th and Howard streets. The redevelopment is planned as a LEED Gold facility and is projected to save energy at a rate that is 34 percent below a code-compliant baseline, according to architect Tom Liebel of Marks-Thomas Architects.

The project will provide 30,000 square feet of office space for non-profits such as Teach for America, and the Baltimore Urban Debate League, as well as 40 apartments targeted for new teachers in the Baltimore City public school system. Employees and residents will be able to enjoy the benefits of locating in a highly walkable community – the project ranks as a "walkers paradise," a rating of 91 out of 100 points on www.walkscore.com. The project also has other VMT reduction characteristics - urban density, access to transit, and "inter-connected" grid streets – each linked to lowered use of the automobile, and, consequently lower impacts on greenhouse gases. The project can be predicted to be on the high end of the 20 to 40 percent reduction in vehicle miles traveled that is attributed in national research to "compact development." (See VMT and Greenhouse Gas section)

If this building achieves its internal energy objectives, AND reduces VMTs by 40 percent, it will lower CO_2 emissions by 296 metric tons, relative to norms.

[16] For more information on the H F Miller Building project, see:

- *Greg Lewis, Transforming a Brownfield in Baltimore*, on the NEMW website, or in *Community Investments, A Publication of the Community Development Department of the Federal Reserve Bank of San Francisco;*
- Greg Hanscom, "Baltimore Development Observed," The Urbanite, January, 2008, http://bellnational.org/news_events/Urbanite_Jan_2008.htm

Catholic Relief/Stewart's Building

Catholic Relief Services – Stewarts' Building

Catholic Relief's redevelopment of the former Stewart's Building in downtown Baltimore is another project that typifies "energy-efficient buildings in energy-efficient locations." The $18 million rehab (leveraged by $4.5 million in Maryland Historic Tax Credits) was gained LEED certification for energy efficiency and other sustainability elements.

The atrium, open floor plan, large windows (allowing daylight) and occupancy sensors all work to save energy. The building also makes use of district-chilled water, which provides efficiencies in air conditioning due to economies of scale.[17] District heating and cooling systems are also less carbon intensive than fossil fuel energy generators.[18]

The building now houses Catholic Relief's 400 employees in 170,000 square feet of renovated space. However, before deciding on the downtown location, management surveyed their employees about how they got to work and found that:

- 37 percent used transit;
- 10 percent walked;
- Totaling 47 percent that accessed their work location via non-auto means.19

The building also gets a walkscore (www.walkscore.com) of 98 out of 100 points, just shy of a perfect rating for walkability.

These findings would indicate that the Stewart's building project reduced VMTs (relative to regional or suburban norms) by an amount that would easily exceed the 40 percent reduction attributed in national research to "compact development."

Putting it all together – VMT savings at an estimated 50 percent of regional norms; energy efficiencies within the building envelope assumed to be 30 percent; and lower carbon emissions from the energy source (district heating and cooling) - this redevelopment project is a model for sustainability and low carbon accommodation of growth.

Other Projects Exhibiting Dual Energy Benefits

The other Maryland Historic Tax Credit projects that exhibit this win-win combination are:

- Brewer's Hill – first project to comply for the Maryland Green Buildings Tax Credit (http://www.brewershill.net/);

17 See: http://www.edcmag.com/Articles/Featured_Special_Sections/BNP_GUID_9-5-2006_A_10000000000000135797

18 New York Department of Environmental Conservation, "Waste-to-Energy: Reducing Emissions of Greenhouse Gases," http://www.dec.ny.gov/chemical/8979.html

19 Data provide by Ron Kreitner, Westside Renaissance.

- The Atrium/Hecht Co Building - 20 to 30 percent energy efficiency gains and multiple sustainability elements; uses the district heating and cooling system (see: http://www.atriumapts.net/southern_management/index.htm);
- 39 West :Lexington - 20 to 30 percent energy efficiency gains and multiple sustainability elements (see: http://www.39westlex.com/);
- Oella Mills - 20 to 30 percent energy efficiency gains and multiple sustainability elements (see: http://www.southernmanagement.com/communities/index.cfm?id=OM&b=s) ;
- Standard Oil Building - 20 to 30 percent energy efficiency gains and multiple sustainability elements;
- Clipper Mill – Applied for LEED for Existing Buildings (see: http://www.sber.com/baltimore/clipper_mill.php);
- Montgomery Park – 20 to 30 percent energy efficiency gains and multiple sustainability elements (see: www.montgomerypark.com)

EMBODIED ENERGY – PRESERVATION AND AVOIDED ENERGY LOSSES

Above sections addressed energy savings due to VMT reduction and due to energy efficiencies within the building. Preservation projects also save energy by avoiding wasteful misuse of energy resources, including:

- The "embodied energy" of the existing structure is retained and not wasted;
- The energy used to renovate existing buildings tends to be less building a new structure.
- The energy that it would have taken to demolish the existing building is "saved:"
- The energy that it would have taken to build suburban infrastructure is avoided.

These energy conservation benefits are more indirect than those calculated above, but should be considered from a societal point of view.

Embodied Energy

Embodied energy is defined as the amount of energy associated with extracting, processing, manufacturing, transporting and assembling the building materials – essentially the energy already expended to build and maintain a building. Preservationists argue that embodied energy, even though it is backward-looking, is legitimate to count when weighing the energy impacts of alternative plans, because it accurately brings in a longer-term, life cycle-oriented approach, which is entirely appropriate given that greenhouse gases dissipate over very long time periods.

Embodied energy can be calculated from the following website: http://www.thegreenestbuilding.org/ but is generally about 1.1 MBTU/sq.ft. for a generic commercial building.[20]

In order to calculate the embodied energy value of the historic tax credit program, researchers made the assumption that every tax credit project is one that, absent the tax credit, would have been a demolished building. Then, by converting the known total eligible rehabilitation

[20] The 1.1 MBTU per sq ft factor represents a clarification from Patrice Frey, National Trust for Historic Preservation. The embodied energy data is based on 1970's data that is being revised. According to Ms. Frey, the revisions will likely result in lower numbers.

expenditures ($1,019,097,557) into square feet (renovation assumed to average $100/sq ft), the embodied energy can be calculated:

- 10,190,976 sq ft of space X 1.1 MBTU/sq ft = 11.2 million MBTU embodied energy "saved."

This 11.2 billion MBTU is equivalent to 595,000 metric tons of CO_2 assuming use of natural gas[21] and is equivalent to 97,000 gallons of gasoline, which further represents taking 107,000 cars off the road. See Table 5.

Table 5. Embodied Energy

Buildings - embodied energy per sq ft – MBTU	1.10
tax credit projects total rehab expenditures, 2009 dollars	$1,019,097,557
tax credit project sq ft, assuming $100/sf	10,190,976
Embodied energy "saved" due to tax credit projects - MBTUs (from above)	**11,210,073**
converted to gallons of gas	97,391
conversion factor 1 MBTU = lbs of CO_2 for natural gas*	117.08
MBTU "saved" CO_2 in lbs	1,312,475,361
convert 1 metric ton to lbs	2,204
"saved" CO_2 in metric tons (from MBTU "saved")	**595,481**

Rehab vs. New Construction

The third source of energy savings due to preservation is that rehabilitation generally takes less energy than new construction. As stated elsewhere in this report, rehabilitation is more labor intensive than new construction (by a factor of 20 percent). A reasonable assumption is that materials are more energy-intensive than labor; therefore, even if rehabilitation costs are the same as new construction, there is an energy savings due to the less energy-intensive rehabilitation process. This differential cannot be quantified given current information.

Energy Impacts of Avoided Demolition

Historic preservation also saves energy by avoiding demolition. Again, making the simplifying assumption that every tax credit project is one that, absent the tax credit, would have been a demolished building, allows the calculation of energy "saved" by avoiding demolition.

There are two internet calculators for the energy conservation impacts of avoided demolition. One, http://www.thegreenestbuilding.org/, calculates the energy saved for 10.2 million sq ft of

[21] CO2 calculated from the EPA CO2 equivalency calculation tool: http://www.epa.gov/cleanenergy/energy-resources/calculator.html

space to be 107,005 MBTU. This can be roughly calculated to represent 5,000 metric tons of CO_2.

An alternative EPA calculator for energy lost in landfilling material (see http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_home.html) calculates the MBTUs at 205,000 MBTU or 10, 900 metric tons of CO_2.

Energy Conservation by Not Building Suburban Infrastructure

In the section Infrastructure section, below, the conclusion is that historic tax credit projects are saving between 50 and 80 percent in infrastructure investment relative to suburban greenfields development. It can be assumed that energy savings are approximately proportionate to construction costs, i.e. also in the 50 to 80 percent range. However, project researchers were unable to find credible sources for quantifying how much energy is expended in building infrastructure. A follow-up study could quantify energy used in building infrastructure, and then the 50-80 percent reduction could be applied to those numbers.

SAVING GREENFIELDS

The historic tax credit program involves, by definition, *re*development of land that has been previously used. Preservation, brownfields, and infill, generally, all represent alternative ways to accommodate growth and avoid the outward pressure to develop greenfields, farms, and virgin land. An EPA-funded study for brownfield sites estimated that one acre of brownfields redeveloped corresponds to conserving 4.5 acres of greenfields.[22] While comparable analysis for preservation is lacking, conceptually it makes sense that historic preservation projects would have an equal claim to land conservation because preservation projects are so strongly associated with older urbanized, relatively dense areas.

In order to estimate the greenfields "saved" by virtue of the tax credit program, project researchers:

- Converted eligible rehabilitation expenses into square feet by assuming that renovations were $100/sq ft;
- Assumed that tax credit projects have an average FAR of 1.0, which allowed conversion of square feet into acres;
- Applied the brownfields finding (1 ac/redeveloped equates to 4.5 acres land saved).

By these findings and assumptions, Maryland historic tax credit program has already saved 1,053 acres of greenfields land.

[22] George Washington University, "Public Policies and Private Decisions Affecting the Redevelopment of Brownfields: An Analysis of Critical Factors, Relative Weights and Areal Differentials," 2001, http://www.gwu.edu/~eem/Brownfields/

Table 6. Historic Tax Credit – Saving Greenfields Land

Historic tax credit projects total rehab expenditures, 2009 dollars	$1,019,097,557
Tax credit projects - total sq ft (assumes $100/sf)	10,190,976
Convert to acres assuming FAR	1.0
Acres redeveloped	234
Assume 1 ac redeveloped saves greenfields acres @	4.5
Acres greenfields conserved per past historic tex credit Investment	1,053
Acres greenfields conserved per $1 million historic tax credits	5.2

Historic tax credit investments conserve an estimated 5.2 acres of greenfields for every $1 million invested. Given that historic tax credits produces numerous other economic and environmental benefits, the historic tax credit program can be viewed as a cost-effective way to conserve greenfields, farms, and virgin land.

HISTORIC PRESERVATION AND INFRASTRUCTURE SAVINGS

Historic preservation projects, in contrast to new greenfields/sprawl development, are obviously re-using land that already has infrastructure in place. Still, because the aging urban infrastructure often requires repair, the difference is not "zero" to something.

Project researchers for the historic tax credit study examined the literature in the area of preservation, smart growth, compact vs. sprawl development, and infrastructure costs.

Capital Cost of Infrastructure and Compact Development

First, there were no studies that focused on the infrastructure costs of historic preservation projects.

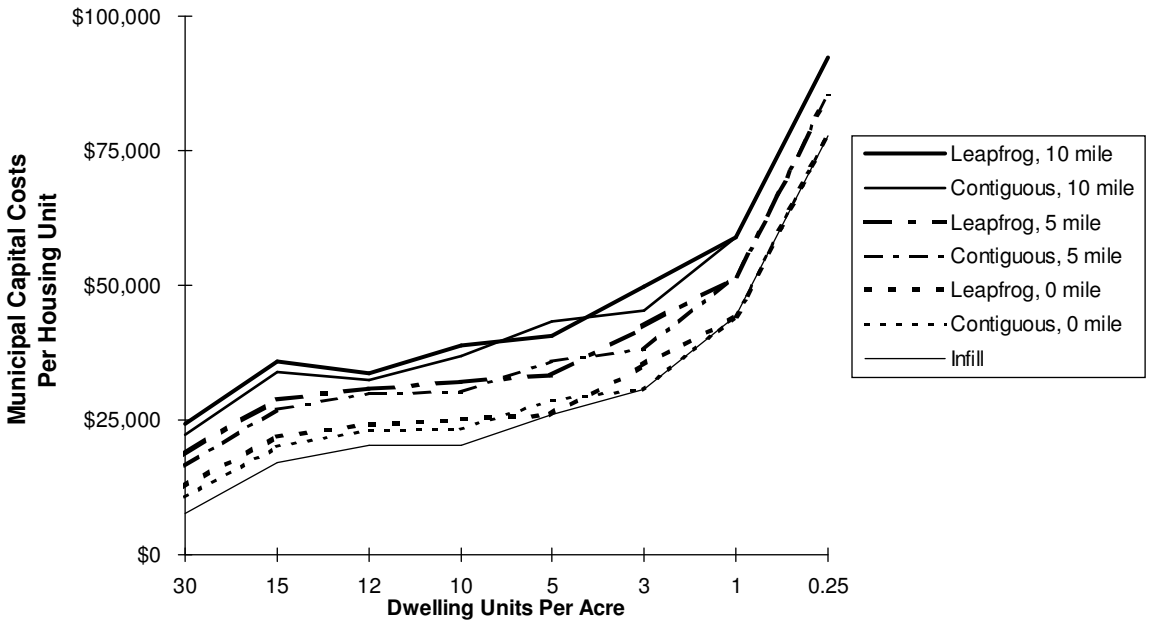
A Center for Neighborhood Technologies study suggests it takes at least five times more infrastructure investment for a greenfields site (at $50,000 per unit) relative to an infill/greyfields site (at less than $10,000 per unit).[23] Because this analysis isolates greyfields *re*development, as opposed *new* compact development, it is given some weight.

Another analysis examined the results from eight previous studies and created a graph of the per dwelling unit costs of providing infrastructure. This analysis differentiated projects by infill, contiguous, and leapfrog, as well as by a range of densities and distance from the center.[24]

[23] Scott Bernstein, "Using The Hidden Assets of America's Communities and Regions to Ensure Sustainable Communities." Center for Neighborhood Technology, 2003, http://www.cnt.org/hidden-assets/pt1f.html

[24] James Frank**, "**The Costs of Alternative Development Patterns: A Review of Literature." Washington, DC. Urban Land Institute. 1989.

Figure 4. Residential Service Costs of Infrastructure



Historic tax credit projects would all fall within the definition of infill and densities are assumed to be 12-15 DU per acre range, which corresponds to infrastructure costs on the order of $18,000 to $22,000 per unit. Spread development, assuming contiguous @ 3-5 units per acre and 5 miles from the center, costs $35,000 to $40,000 per unit, or almost double the infill amount. By these calculations the infrastructure savings attributable to compact/infill/preservation a little above or below 50 percent.

A series of other studies compare infrastructure costs for compact development vs. sprawl development. These studies have quantified the infrastructure savings due to compact development at between 10[25] and 65 percent[26] [27] These studies are less applicable (relative to the studies cited above) for the tax credit study because:

- They do not differentiate "infill" and *re*development from other compact development;
- The density differential (2-5 DU/ac for sprawl and 5-10 DU/ac for compact) understates the density of tax credit projects;
- They are generally looking at NEW compact development, which is presumed to involve higher infrastructure costs than tax credit projects, which involve repair not new construction.

Infrastructure Operations and Maintenance

Operations and maintenance (O&M) also tend to reflect the efficiencies of serving more dense compact development. A regression analysis by the Natural Resources Defense Council found

[25] Robert Burchell, David Listokin, Anthony Downs, et. Al, "Costs of Sprawl Revisited." National Academy of Sciences/ National Research Council. Transportation Research Board TCRP H-10. 1998.
[26].Center for Energy and Environment. (1999). *Two Roads Diverge: Analyzing Growth Scenarios for the Twin Cities Region.* www.me3.org/sprawl. Hammer, Siler, George Associates and Gould Evans Goodman Associates. (2001). *SMART* CHOICES: Understanding the Cost of Development. Mid-America Regional Council.
[27] Mix, Troy D. "Exploring the Benefits of Compact Development," for Delaware's Office of State Planning Coordination, 2003

that density indicators explained more than 50 percent of the operating cost variations among thirteen analyzed municipal water and sewer systems. Surprisingly, density explained more of the cost variations than the relative age of facilities. Their conclusion was that, when capital costs are annualized and compared to operating costs, operating costs are about three times greater than capital costs.[28] The significance of this is that, while capital costs may be partly borne by private entities, operations and maintenance costs (for water, sewer, and roads) are clearly paid for by the public sector, and clearly represent a subsidy of greenfields development.

Another source analyzed O&M costs for three development patterns and found that O&M was 42 percent more costly in the spread development option relative to the central option; however, this source estimates O&M at only about one-forth the magnitude of capital costs.[29]

Several studies also go the next step and draw from this and similar data the conclusion that flat unit pricing of utilities involves a significant cross-subsidy – more dense urbanized areas are effectively cross-subsidizing less dense sprawling areas.[30] With the Baltimore-Washington areas following a typical urban/poor-suburban/wealthy dichotomy, this raises an equity question of the poor subsidizing the well-off.

Calculating the Infrastructure Savings

In order to calculate infrastructure savings attributable to historic tax credit investments, a simplifying assumption is that, absent the tax credit program, all development that occurred in tax credit projects would have migrated to greenfields development.

Researchers reviewed several analyses which estimated the cost per unit of providing infrastructure to new sprawl development. While the Frank analysis, referenced above, when inflated to 2009 dollars, estimated the cost of servicing new sprawl development at approximately $60,000 per unit, a Twin Cities analysis placed the cost per unit at $23,500 (also inflated to 2009, also for sprawl). The Chicago study referenced above pegs the suburban cost at $50,000 to $60,000 per unit. For the current analysis, in order to be conservative, a low midpoint was used: $40,000.

With respect to the preservation projects vs, sprawl cost differential, this analysis uses a range of 50 to 80 percent savings, i.e. that the preservation projects are saving 50% to 80% of infrastructure costs relative to new suburban development. With literature review findings literally all over the map, staff relied to some degree on consultations with local developers and public works officials, who maintain that most preservation projects require no substantial infrastructure. The 50 percent part of the range reflects Frank's study and the differentiation of "infill." The 80 percent part of the range reflects the Center for Neighborhood Technology study and local feedback.

Following these data inputs, the infrastructure investment "saved" was calculated to be between $102 and $163 million – see Table 7.

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[28] Natural Resources Defense Council. (1998). *Another Cost of Sprawl: The Effects of Land*

[29] Pamela Blais, *The Economics of Urban Form*, in Appendix E of *Greater Toronto*, Greater Toronto Area Task Force (Toronto), December 1995.; cited in Todd Littman, "Understanding Smart Growth Savings," Victoria Transport Policy Institute, December, 2004

[30] Scott Bernstein, "Using the Hidden Assets of America's Communities for Sustainable Development," http://www.cnt.org/hidden-assets/pt1f.html

Infrastructure Conclusion

Infrastructure investment "saved" (attributable to historic tax credit investments) is estimated to be at least $102 million. Projecting forward, every $1 million in tax credit funding saves $500,000 in infrastructure investment that becomes unnecessary because growth is accommodated in the existing developed area.

From a policy perspective, the historic tax credit involves three gains relative to infrastructure:

- Some of the state's investment in the tax credit is recouped by virtue of infrastructure capital investments obviated;
- The investment (in the tax credit) continues to pay dividends in terms of lower on-going infrastructure maintenance costs – costs avoided by building in more dense, built-up areas;
- Less energy is used to build and maintain infrastructure for preservation projects, relative to suburban greenfields development.

The historic tax credit program, in effect, counterbalances the public subsidies that continue to exacerbate sprawl by virtue of publicly funded infrastructure and flat rate charges for utilities.

Table 7. Infrastructure "saved" due to historic tax credit investments

	Low Estimate	High Estimate
Sprawl cost per unit	$ 40,000	$ 40,000
Preservation "savings" rate relative to sprawl	50%	80%
Preservation "savings" dollar amt per unit (relative to sprawl)	$ 20,000	$ 32,000
Assumed Split of MHTC Projects - Residential and Commercial		
Total Eligible Rehab expenditures	$ 1,019,097,557	$ 1,019,097,557
assumed % of commercial space	50%	50%
assumed % of residential space	50%	50%
Residential Units and Infrastructure "Saved"		
> assumed residential space - $ per unit	$ 200,000	$ 200,000
> residential units renovated - DUs	2,548	2,548
> Infrastructure saved from space renovated	$ 50,954,878	$ 81,527,805
Commercial Space and Infrastructure "Saved"		
> Commercial investment (50% of total)	$ 509,548,778	$ 509,548,778
> Space renovated - cost per sq ft	$ 100	$ 100
> Estimated commercial space renovated	5,095,488	5,095,488
> Commercial space as % of residential space	100%	100%
> Infrastructure saved from space renovated	$ 50,954,878	$ 81,527,805
TOTAL infrastructure investment "saved"	**$ 101,909,756**	**$ 163,055,609**

LOWERING RUN-OFF AND IMPROVING WATER QUALITY

An EPA report compared the runoff attributable to various densities, but accommodating the same amount of development, and found that "the higher density scenarios generated less stormwater runoff per house at all scales and time periods." The report states,

"We found that:

- With more dense development of eight houses per acre, runoff rates per house decrease by about 74 percent from one house per acre.
- For the same number of houses, denser development produces less runoff and less impervious cover than low-density development.
- For a given amount of growth, lower density development covers more of the watershed."[31]

Above cited data indicates that historic tax credit projects are more dense than suburban development by a factor of at least three to one. Historic tax credit projects can therefore be presumed to lower run-off and improve water quality. The magnitude of the reduction could be estimated at 30 to 40 percent, or about one-half of that estimated by EPA (because EPA's density differential is greater).

LESS WASTE IN THE LANDFILLS

Demolition debris comprises about roughly 24% of the municipal solid waste stream. In 2003, construction and demolition (C & D) waste, nationally, was estimated to be 325 million tons, annually.[32] The EPA estimates that 115 lbs of waste is generated per square foot for residential demolition, and the demolition of non-residential buildings results is approximately 155 lbs of waste per square foot.[33]

Every tax credit preservation project is assumed to be an alternative to demolition. Historic tax credit projects have involved total rehabilitation expenditures of $1,019,097,557 (2009 dollars) over the 12-year life of the program. By converting the investment to square feet, applying the EPA waste number, subtracting out a percentage of the waste that is currently re-cycled, adding back in a factor for construction waste generated by the renovation, the tax credit projects can be estimated to have "saved" 387,000 tons of material from landfills over the life of the program. This amount of saved landfill material has been estimated to represent filling a football stadium to a depth of 50 to 60 feet.[34] Table 8 provides the detailed calculations.

Projecting forward, but using the same ratios, every $1 million invested in new tax credits will "save" 2,500 tons of demolition-related landfill material.

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[31] Richards, Lynn, "Water and the Density Debate," Planning Magazine, June 2006, APA http://www.epa.gov/smartgrowth/water_density.htm

[32] Construction Materials Re-Cycling Association: http://www.cdrecycling.org/

[33] Patrice Frey, "Making the Case: Historic Preservation as Sustainable Development," A draft white paper, October 2007

[34] See: http://www.ciwmb.ca.gov/ConDemo/CaseStudies/DGSDiversion.pdf

Table 8. Landfill Impacts – Tonnage Saved by Historic Tax Credit Rehab Activities

Demolition causes:	**Factors**
▪ Residential demolition - lbs of waste per sq ft of demolished space	115
▪ Commercial demolition - lbs of waste per sq ft of demolished space	155
▪ Lbs of waste per sq ft of demolished space -assume demolition is 1/2 res, 1/2 commercial -	135
▪ Percentage of waste that is currently recycled[35]	25%
▪ Net waste going to landfill - lbs of waste per sq ft of demolished space	101
Tax Credit projects total rehab expenditures, 2009 dollars	$1,019,097,557
Tax Credit projects – total sq ft if $100/sf	10,190,976
Pounds of demolition debris "saved" from landfill	1,031,836,276
Tons of demolition debris "saved" from landfill	515,918
Tax credit projects assumed to generate construction debris @ 25% of demolition[36]	128,980
Net tons of construction debris "saved" from landfills	**386,939**

Future Investment scenario	
New Tax credits	**$1,000,000**
Total rehab expenditures, assuming 20% credit	$5,000,000
Converted to renovated space @ $100/sq ft	50,000
Pounds of demolition debris "saved" from landfill	6,750,000
Tons of demolition debris "saved" from landfill	3,375
Tax credit projects assumed to generate construction debris @ 25% of demolition	844
Net tons of construction debris "saved" from landfills	**2,531**

[35] Franklin Associates, *Characterization of Building Related Construction and Demolition Waste in the United States*, US Environmental Protection Agency, 1998, ES-2, http://www.epa.gov/epaoswer/hazwaste/sqg/c&d-rpt.pdf.
[36] Assumption based on conversations with local developers and architects.

CONSERVING NATURAL RESOURCES

The construction industry is natural resource-intensive. One source indicates the following:

> Seventy percent of mineral materials used in the US economy are for construction. Since urban communities use fewer roads, sewers and power line on a per capita basis, materials use is more efficient than in sprawl development. For example, the Bureau of Mines found that per capita use of construction minerals in densely populated Cook County was 4½ tons per year. In sparsely populated nearby Lake County the annual rate was 11 tons… Two-thirds of the weight of new materials entering the economy is for construction and less than 10% of this total comes from scrap, even though the majority of materials ever mined reside in our existing buildings and infrastructure.[37]

Researchers for this report have not found further corroboration for the data represented above, but the general point, that construction is natural resource-intensive, is not subject to disagreement. As discussed in the main report, the IMPLAN economic model indicates that rehabilitation of commercial structures uses about 20 percent more labor per $1 million investment than new construction. Since labor and materials are roughly equal inputs into new construction activity, the converse would also be true – that rehabilitation is LESS resource intensive than new construction, also by a factor of approximately 20 percent.

To put a dollar value on this, an "order of magnitude" estimate can be made as follows:

- The historic tax credit facilitated $1.02 billion in eligible rehabilitation expenditures (2009 dollars);
- An "order of magnitude" estimate is that new construction is 50-50 labor/materials, whereas rehabilitation is 60-40 labor/materials;
- If those tax credit rehab expenditures had been used for new construction activity instead, the value of the raw materials attributed to the change (from rehab to new construction) would be approximately $100 million (20 percent of 50 percent). That is, the same amount of construction activity would have involved $100 million more in raw materials had the tax credit investment shifted to new construction.
- Looking to the future, every $1 million invested in historic tax credits can be represented as conserving $100,000 in natural resources.

WALKABLE COMMUNITIES AND HEALTH BENEFITS

The *appeal* of walkable communities is essentially a lifestyle choice, but the *benefits* of walkable communities include lowering greenhouse gases and lowering the incidence of numerous

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[37] John Young and Scott Bernstein. The Materials Efficiency of Communities. Forthcoming, Materials Efficiency Project and Center for Neighborhood Technology. 1999. Based on source materials and calculations by James Lemons and Earl Amey, United States Geological Service, 1995-1996. Cited in Scott Bernstein, "Using the Hidden Assets of America's Communities and Regions to Ensure Sustainable Communities," Center for Neighborhood Technology, http://www.cnt.org/hidden-assets/

diseases. The greenhouse gas impacts were assessed in the VMT section of the report. This section addresses the health benefits.

The chief measuring rod for walkable communities is a Brookings Institution-developed tool called walkscore. Walkscore (www.walkscore.com) is explained in the VMT section of the report under "Mixing Uses and Walkable Communities." By running walkscore for each historic tax credit project, project researchers found that Maryland Historic Tax Credit projects had a median walkscore of 91 ("walker's paradise"), indicating that the vast majority of assisted projects were in highly walkable communities.

Health Benefits of Walkable Communities

There is a large body of literature that correlates exercise with lowered risk of heart disease, high blood pressure, stroke, diabetes, hypertension, and obesity. And there is also significant research that links the urban form - walkable communities – with higher levels walking and physical activity. For example, one analysis found that residents of the most walkable neighborhoods were more than twice as likely to meet physical fitness guidelines relative to residents of the least walkable neighborhoods.[38] Another analysis concluded that residents of highly walkable neighborhoods take between one and two 15-to-30 minute more walks per week than their counterparts in less walkable neighborhoods. This physical activity in walkable neighborhoods is equated to a higher level of compliance with the DHHS physical activity guidelines.[39]

There is also a considerable body of research that links walkable neighborhoods with lower levels of obesity and other health ailments. An Atlanta area study found that living in a mixed use environment was the strongest urban form predictor of obesity. Each quartile increase in land use mix was associated with a 12.2 percent reduction in the odds of being obese (after controlling for socio-economic variables).[40] Two other analyses compared metropolitan counties based on a sprawl index and found that more dense and walkable areas were correlated with lower levels of several health problems, including obesity, high "body mass index," high blood pressure, arthritis, headaches, and breathing difficulties.[41]

These findings suggest that investments in the historic tax credit program are reaping benefits in terms of lowered health care costs, some of which accrue to the State of Maryland as a secondary

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[38] Frank, L.D., et al "Linking Objectively Measured Physical Activity with Objectively Measured Urban Form: Findings from SMARTRAQ", *American Journal of Preventative Medicine* 2005;28(2S2):117–125, 2005 Pages 117-125,cited in Reid Ewing, "Understanding the Relationship Between Public Health and the Environment," A Report to the LEED-ND Core Committee, US Green Buildings Council, May, 2006.

[39] Sollis, J. F. et al, "Active Transportation and Physical Activity, Opportunities for Collaboration on Community Health," Transportation and Research Part A 38, 2004, cited in Reid Ewing, "Understanding the Relationship Between Public Health and the Environment," A Report to the LEED-ND Core Committee, US Green Buildings Council, May, 2006.

[40] Frank, Lawrence, Andresen, Martin, Schmid Tom, 2004. Obesity Relationships With Community Design, Physical Activity, and Time Spent in Cars. *American Journal of Preventive Medicine* Vol 27. No 2, cited in Reid Ewing, "Understanding the Relationship Between Public Health and the Environment," A Report to the LEED-ND Core Committee, US Green Buildings Council, May, 2006.

[41] Ewing, R. Et al. "Relationship between Urban Sprawl and Physical Activity, Obesity and Morbidity" *American Journal of Health Promotion*, Vol 18. No. 1 2003; and Frank, Lawrence, Andresen, Martin, Schmid Tom, 2004. "Obesity Relationships With Community Design, Physical Activity, and Time Spent in Cars. *American Journal of Preventive Medicine* Vol 27. No 2; BOTH cited in Reid Ewing, "Understanding the Relationship Between Public Health and the Environment," A Report to the LEED-ND Core Committee, US Green Buildings Council, May, 2006.

fiscal benefit derived from the initial investment. The research is not at a level that allows us to quantify this benefit, but it is likely to be very substantial.

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