Smart Growth America
Making Neighborhoods Great Together

THE FISCAL IMPLICATIONS OF DEVELOPMENT PATTERNS

Madison, WI

April 2015

Analysis of Madison, WI

Prepared by Smart Growth America for the City of Madison, WI
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Background and objectives

The connection between land use development patterns and the costs of providing public infrastructure and services has long been a topic of study, particularly since *The Cost of Sprawl: A detailed analysis* was published in 1974. Since that time, dozens, if not hundreds of studies, have been conducted relating to this topic. Most of these have concluded that "smart growth" (that is, more compact patterns of development) is associated with reduced local government spending on a per capita basis relative to sprawl (recognizing that the definition of each of those terms not entirely consistent). Smart Growth America's *Building Better Budgets* report, published in May 2013, summarizes the results of 17 of these studies.

Yet these findings are not often included in the typical fiscal impact analyses done in connection with new development proposals. There are many reasons for this, but the inconsistent methodologies used in the above-referenced studies, as well as the time-consuming data collection efforts they involve, have likely slowed the filtering of these academic findings into the "practice." Instead, most, (though not all) fiscal impact analyses rely on a simple average cost approach, which implicitly assumes that each new resident or job will add the same amount of public costs, regardless of whether they live and work in a sprawling, low-density development, or a high-density walkable urban one.

In connection with a grant from the U.S. Department of Housing and Urban Development, Smart Growth America ("SGA") aims to develop a fiscal impact methodology that not only accounts for the increased cost efficiencies associated with denser development patterns, but can also be easily adapted and used by local practitioners across the country. The City of Madison generously agreed to become a case study community in the development of this methodology.

Scenarios

The City of Madison asked SGA to review development plans at two different sites. The first, known as the Pioneer District, is the subject of this memo. The Pioneer District is approximately 1,400 acres in size and is largely vacant at present. The City of Madison provided two scenarios for evaluation. The "base" scenario reflects the current plan for the development of the Pioneer District. The second scenario, called "Plus 50" assumes 50 percent higher density on certain parcels within the District. Note that this scenario results in a different mix of development than the base scenario, meaning that any changes in revenues and costs are not due to changes in density alone but also to changes in the ratio of commercial space to residential space.

Therefore, SGA introduced two additional higher density scenarios, which assume the same development program as the base scenario and "Plus 50" scenario respectively, but on approximately 500 fewer acres. They are called the "Compact" and the "Compact Plus 50" scenarios, respectively. Finally, for purposes of comparison, SGA created a "Low Density" scenario, which assumes the same development as the base scenario but on approximately 1,000

acres more. The Low Density scenario, in particular, is purely hypothetical as it would consume more acreage than the Pioneer District contains. Nonetheless these scenarios help to evaluate the magnitude of public cost savings associated with more compact development patterns.
The quantity of development in each scenario is summarized below (see Table 1).

TABLE 1
Quantity of development in five scenarios

	Low Density scenario	**Base scenario**	**Compact scenario**	**Plus 50 scenario**	**Compact Plus 50 scenario**
Single-family detached homes	1,543	1,543	1,543	1,780	1,780
Multifamily units	3,236	3,236	3,236	4,466	4,466
Total units	**4,779**	**4,779**	**4,779**	**6,246**	**6,246**
Total gross acres	2,379	1,403	915	1,403	915
Net residential density	4.1	9.0	16.2	11.7	23.4
Commercial square footage	4,646,920	4,646,920	4,646,920	6,990,376	6,990,376

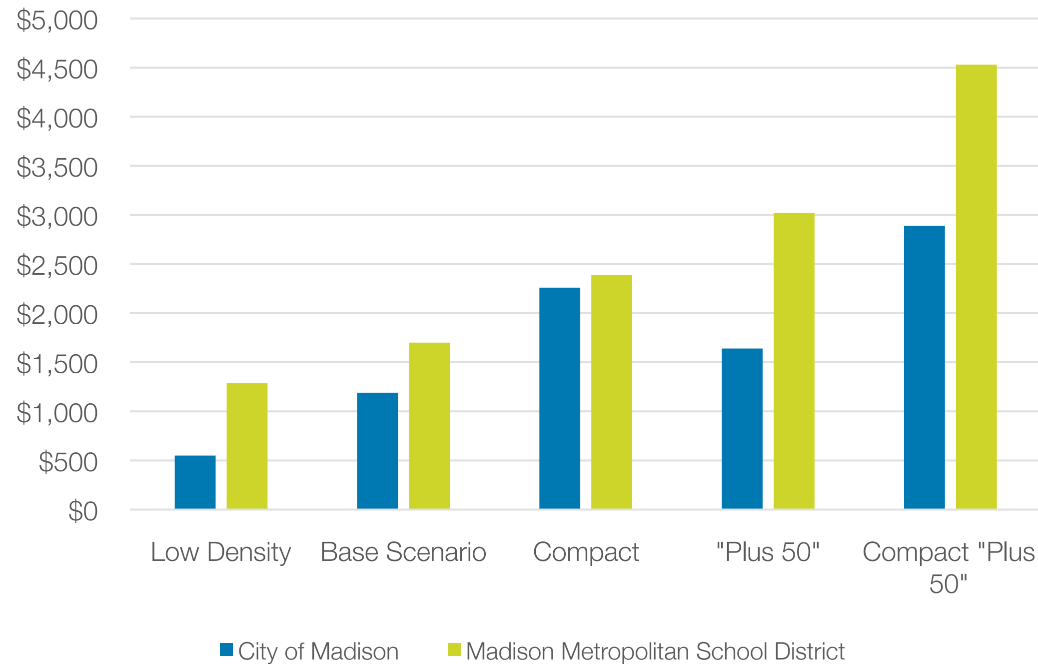
Key findings

Net fiscal impact

As the chart below clearly shows, as the density of development increases, the net fiscal impact per acre also increases (see Figure 1). Once again, the “Low Density”, “Base”, and “Compact” scenarios all have the same development program on a varying amount of land while the “Plus 50” and “Compact Plus 50” scenarios are based on a different development program, per Table 1.

FIGURE 1

Estimated annual net fiscal impact per acre



The relationship in the above chart is due mainly to two factors associated with higher density: cost savings and reduced land consumption.

For the City of Madison, the compact scenario would reduce estimated costs by approximately 12 percent over the low density scenario. Even after assuming a reduction in the average value of single-family homes due to smaller lot sizes[1], the cost savings under the compact scenario make a large difference to the bottom line net fiscal impact. Under the compact scenario, the net fiscal impact of $2.07 million for the City of Madison is 23 percent higher than the net fiscal impact under the base scenario of $1.66 million, and 53 percent higher than the net fiscal impact under the low density scenario. The net fiscal impact per acre is even more dramatic as the higher absolute net fiscal impacts are spread over fewer acres.

These results highlight the high opportunity cost of sprawl on public finances and the importance of the net fiscal impact per acre metric, as opposed to only the absolute total. Judged solely by the combined total of the net fiscal impact for both the City and the Madison Metropolitan School District, the compact scenario generates a total net fiscal impact that is 3 percent lower than the low density scenario. However, that net fiscal impact is achieved on 915 acres instead of 2,379. The remaining 1,464 acres and the property tax they generate is not included in the result. The remaining land, even if it remained vacant would generate property tax revenues, but more importantly, it could accommodate future growth and development, an opportunity that would be

1 Based on assessment records from the City of Madison. See page 5 for further details.

foreclosed under the low density scenario.[2] Because the value of the “saved” acreage is not reflected in the absolute totals, the net fiscal impact per acre is the more informative comparison between the programs.

This is important to note in interpreting the results for the Madison Metropolitan School District. For it, the compact scenario is estimated to result in a 2.3 percent cost savings over the low density scenario. On an absolute basis, this level of cost savings is not enough to compensate for the projected loss in tax revenue associated with smaller single-family lot sizes, so the analysis shows a decline in the absolute net fiscal impact for the Madison Metropolitan School District as density increases. However, the low density scenario consumes 1,464 fewer acres than the compact scenario. Therefore, on a per acre basis, the net fiscal impact to the Madison Metropolitan School District does increase as density increases. In fact, the net fiscal impact per acre under the compact scenario is nearly double that of the low density scenario, even under the assumption that single-family home values would decrease in the compact scenario.[3]

Table 2 presents a summary of the results by scenario. The results reflect the estimated annual net fiscal impact, at build-out, of each scenario. The net fiscal impact is defined as the projected revenues minus the projected operating costs and certain annualized capital costs.[4] All results are presented in 2015 dollars.

TABLE 2

Revenues, expenditures, and net fiscal impacts, by scenario

Revenues

	City of Madison				Madison School District		
Scenario	**Total**	**Per Capita (Res. & Emp.)**	**Per Acre**		**Total**	**Per Capita (Res. & Emp.)**	**Per Acre**
Low Density	$15,645,811	$662	$6,577		$19,625,708	$831	$8,251
Base Program	$15,083,051	$638	$10,751		$18,779,740	$795	$13,385
Compact	$14,752,060	$624	$16,120		$18,356,756	$777	$20,059
"Plus 50"	$20,306,016	$607	$14,473		$24,544,553	$734	$17,494
Compact "Plus 50"	$19,974,975	$597	$21,827		$24,121,504	$721	$26,358

2 The retained land could of course be put to a public purpose, such as new parks. In such a case, it might come off the tax rolls; nonetheless, it clearly has economic value, which might be approximated by considering the cost that would be incurred to purchase it for that purpose.

3 As noted and discussed further below, this analysis maintains the very conservative assumption that reduced lot sizes result in reduced single-family property values. If, on the other hand, we allow for the possibility that the value of residential property may rise on a square-foot basis when homes are located in walkable environments, and in close proximity to services offered in a mixed-use community, there arises the potential for the “location premium” to offset the value of the diminished land area.

4 The model does not currently account for all public capital costs. Only capital costs associated with fire protection, road resurfacing, pipe reconstruction, and school construction are included. Capital costs not accounted for are assumed not to vary directly with density. Future versions of this model will attempt to develop a more comprehensive accounting of all capital costs associated with new development, depending on data availability.

Expenditures

Scenario	City of Madison Total	City of Madison Per Capita (Res. & Emp.)	City of Madison Per Acre		Madison School District Total	Madison School District Per Capita (Res. & Emp.)	Madison School District Per Acre
Low Density	$14,334,441	$607	$6,026		$16,567,449	$701	$6,965
Base Program	$13,417,592	$568	$9,564		$16,395,796	$694	$11,686
Compact	$12,683,412	$537	$13,860		$16,172,703	$685	$17,672
"Plus 50"	$18,011,514	$539	$12,838		$20,306,696	$607	$14,474
Compact "Plus 50"	$17,326,913	$518	$18,934		$19,971,850	$597	$21,824

Net Fiscal Impact

Scenario	City of Madison Total	City of Madison Per Capita (Res. & Emp.)	City of Madison Per Acre		Madison School District Total	Madison School District Per Capita (Res. & Emp.)	Madison School District Per Acre
Low Density	$1,311,370	$56	$551		$3,058,259	$129	$1,286
Base Program	$1,665,459	$70	$1,187		$2,383,944	$101	$1,699
Compact	$2,068,648	$88	$2,260		$2,184,053	$92	$2,387
"Plus 50"	$2,294,502	$69	$1,635		$4,237,857	$127	$3,021
Compact "Plus 50"	$2,648,062	$79	$2,894		$4,149,654	$124	$4,534

Conservatism

SGA believes this model likely underestimates the improvement to net fiscal impact associated with higher densities. Most importantly, the model makes very conservative assumptions with regard to revenues. A wide body of research has confirmed that dense, walkable environments enjoy significant value premiums of 20 percent and higher over typical suburban product.[5] This means that the assessed value per square foot of development could well be higher in the compact scenario than the base or low density scenarios. At this point, however, we have not included any value premium associated with density in this analysis. In fact, to be conservative, SGA has assumed that the average single-family home land value would decrease with higher density due to smaller lot sizes.

In addition to the conservative revenue assumptions, SGA was not able to model certain other cost drivers that may be density-related due in part to a lack of sufficient data. Solid waste and recycling

5 CEOs for Cities. (2009). *Walking the Walk.* Available at http://www.ceosforcities.org/research/walking-the-walk/. Pivo, G. and Fisher, J. (2010, February). "The Walkability Premium in Commercial Real Estate Development." Responsible Property Investing Center, University Of Arizona and Benecki Center For Real Estate Studies, Indiana University. Available at http://www.u.arizona.edu/~gpivo/Walkability%20Paper%208_4%20draft.pdf. Leinberger, C. and Alfonzo, M. (2012, May). "Walk this Way: The Economic Promise of Walkable Places in Metropolitan Washington, DC." Brookings Institution Metropolitan Policy Program. Available at: http://www.brookings.edu/~/media/Research/Files/Papers/2012/5/25%20walkable%20places%20leinberger/25%20walkable%20places%20leinberger.pdf.

pickup, for example, is almost certainly less efficient in low density environments because of the greater distance, and therefore time and fuel between pickups. Police protection may also become less expensive in dense, walkable environments because of a need for fewer patrol cars and vehicle fuel and maintenance costs. The effective modeling of this relationship remains a task for future research.

Methodology

Revenues

Property tax
The City of Madison provided assumptions with respect to property values for each product type involved in the study.

However, SGA made its own estimates of single-family home values based on an analysis of land and improvement values in the vicinity of the Pioneer District. Using these homes, SGA conducted a linear regression analysis of the relationship between lot size and assessed land value. Using this analysis, SGA was able to estimate the likely impact on assessed value of the changes in lot sizes that follow the changing densities in each scenario. No adjustments for lot sizes were applied to townhouses, multifamily units, or commercial properties because land for these functions is typically valued on a per unit or per allowable square foot basis.

In each scenario, the assumed assessed values were multiplied by the appropriate tax rates for the City of Madison and the Madison Metropolitan school district.

Miscellaneous revenues
Residents and employees of the development were assumed to generate revenues related to licenses, permits, fees, and certain other miscellaneous sources at the same rate as current residents and employees. These revenues were assumed to not vary by density.

Expenditures

Density-related expenditures
SGA divided the expenditures associated with new development into two basic categories. The first includes those that are likely to be affected by the density of the development while the second includes all other expenditures. For purposes of this analysis, SGA has treated expenditures on the maintenance of roads and pipes, including water, sewer, and storm sewer, as well as fire protection and school transportation as density-related. This represents approximately 20 percent of the total operating expenditures by the City of Madison and 3 percent of the Madison Metropolitan School District. Other expenditure categories, in particular solid waste pickup, and police protection are likely also affected by the density of development but the available information was not sufficient for SGA to credibly analyze the relationship for all categories.

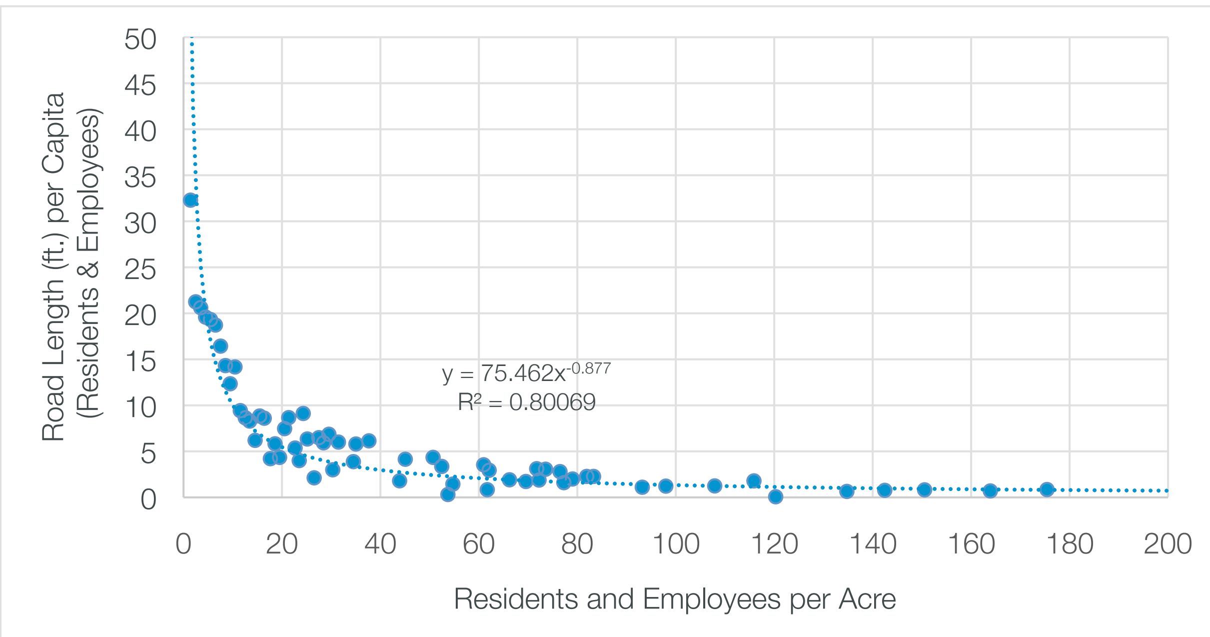
Roads
SGA analysis shows that there is a strong inverse relationship between road length and area per capita, and the density of development in the City of Madison. Using GIS, a grid of equal-sized cells was drawn across the City of Madison and the number of residents and employees determined, as well as the road length and area in each cell. From these data points, SGA a

formula was derived estimating both the road length and area needed per capita, at any reasonable density, assuming that the new development conforms to historical experience in the area.

A scatterplot, with road length per capita on the y axis and the density (measured in terms of residents and employees per acre) on the x axis, along with a regression formula describing the relationship between the two factors, is shown below.[6] As the chart clearly illustrates, there are significant improvements in efficiency when moving from typical suburban densities of 4-5 people and employees per acre to approximately 40 persons and employees per acre. Thereafter, the quantity of roads per capita decreases only slightly as density increases (see Figure 2). While the chart below depicts road length only, SGA found a similarly strong relationship between road area and population/employment density.

FIGURE 2

Quantity of roads per capita



In Madison, Capital costs for roads are paid by the developer; however, the City must maintain all roads. The City of Madison estimated that roads generally cost $3.00 per square foot to resurface and must be resurfaced every 20–40 years depending on usage. This model assumes that all roads will be resurfaced every 25 years. The cost of resurfacing is annualized by dividing the estimated resurfacing cost by the expected lifetime of 25 years. In addition, the model assumes that the new roads would generate the same average costs per square foot in terms of pothole repair and snow removal as all other roads in the City of Madison. Note that this model does not currently estimate the additional demand placed on off-site roads, which may also incur maintenance costs.

6 Note that each point may not represent one cell. Instead, values for all cells within certain density categories were averaged and presented as one point.

Water and sewer mains

The maintenance of water and sewer mains is performed by the City utility, which collects fees based on the quantity of water provided and wastewater processed. In a typical fiscal impact analysis, costs and revenues associated with public utilities are ignored because it is assumed that the utility adjusts its rates to cover all costs, such that any expenses associated with a new development would be covered by the revenue it would generate.

Nonetheless, the density of development does affect the costs to the utility. All else being equal, a development that requires an average of 100 feet of pipe between residences will cost more to maintain than a development with only 20 feet of pipe between residences. To account for this fact, SGA has developed a methodology that compares the ratio of pipe maintenance costs to the projected water and wastewater revenue generated by the development, to the same ratio for the City as a whole. If the ratio of maintenance costs to revenue generated is lower in the development than in the City as a whole, then the project is assumed to generate a positive cash flow to the City and vice versa.

Sewer and water mains typically follow the length of the street and SGA found that to be largely the case in the City of Madison. Therefore, SGA employed the same methodology used for road length to estimate the length of pipe needed in the development under each scenario. Water and wastewater use projections were made on a per resident and per employee basis using third party estimates.[7]

Pipe maintenance costs were based on the annualized cost of reconstruction, assuming a cost of $200 per linear foot and a lifetime of 100 years.[8] (The current analysis does not assume the reuse of any existing pipe.)

Fire/EMS protection

To be effective, fire and EMS services must respond to emergency calls in a short amount of time. The specific response time varies by community, but fire service budgets and capital requirements are typically based on an established standard. This necessarily means that, for any given response-time standard, the efficiency of fire service will be dependent on the density within the "fire service shed" (the geographic area served by a station). If it is developed at a very low density, then the cost of service, including the cost of the station, the ambulances, fire engine/ladders, and their staff will be spread over a few people and employees, and likely a low property tax base.

However, only the station costs are fixed. If density increases enough, the additional population will eventually require new fire engines and staff to serve them. SGA was unable to find any widely accepted standards, either in the City of Madison, or nationally, on the quantity of fire engines and staff per population and employee. Therefore, SGA assumed that the City of Madison would maintain its existing level of service, which is approximately one fully-staffed fire engine per 27,000 residents and employees and one fully staffed ambulance per 55,000 residents and employees.

The current City of Madison response standard is 5 minutes. Assuming 1 minute for dispatch, this equates to a 4 minute travel time for the fire engine. SGA estimated the distance that the fire engine could travel using a formula developed by the RAND institute and in use by ISO, a firm that

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7 https://www.home-water-works.org/about/calculator

8 SGA has not assumed any variation in pipe width associated with density. No correlations were apparent between the average pipe width and the density of existing development in the City of Madison.

analyzes the risk associated with public protection services for insurance companies.[9] SGA translated the distance the engine could travel in 4 minutes into the acreage of the response shed from a hypothetical station at the center of the proposed development.[10] Based on these assumptions, we found that the maximum service capacity for one fire engine and ambulance can be reached even at relatively low densities of approximately 6-7 residents and employees per acre. Therefore, the incremental operating efficiencies associated with rising density are already more or less maximized, even at low densities.

The capital cost of the station, however, is more fixed. Though additional bays may need to be added as the population of the response shed increases, much of the station would remain the same. These costs can then be "spread out" over more people and a larger property tax base as density increases.

Based on information provided by the City of Madison and additional sources, SGA estimated the cost of constructing a fire station, purchasing the necessary vehicles and equipment, and operating the vehicles on a per capita basis, assuming that the entire response shed is built-out.[11] This per capita cost is then multiplied by the number of residents and employees in the development in each scenario.

School transportation

All else being equal, school transportation costs should decline in areas of higher density, for two reasons: a) more students will live within the "walk zone" (close enough that they are expected to walk to school), and; b) for those who are bused, school buses should have smaller distances to travel, saving on fuel costs and other operating costs. Data collected by the state of Wisconsin and other states on district transportation costs bears this out – transportation costs per student clearly decline as density increases. The chart below, based on data from the Wisconsin Department of Public Instruction, illustrates the relationship (see Figure 3).

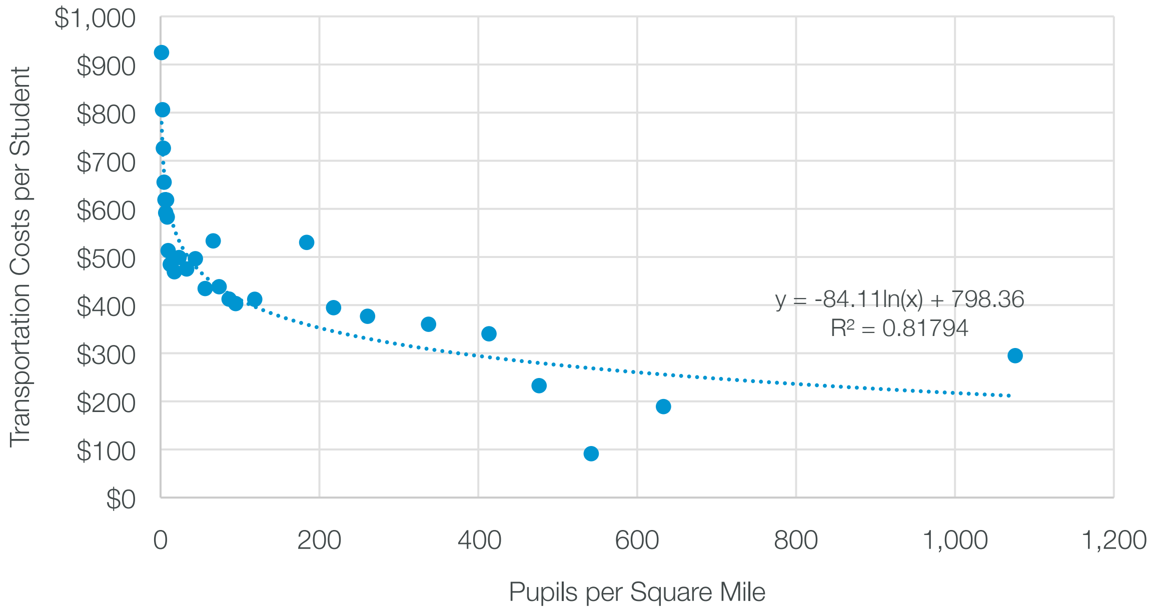
9 https://firechief.iso.com/FCWWeb/mitigation/ppc/3000/ppc3015.jsp

10 The estimate is based on the assumption that the fire engine response shed is roughly equivalent to the area of a circle with its center at the station, and radius equal to the distance the fire engine can travel in 4 minutes, after discounting the distance for connectivity issues. SGA estimated the appropriate discount by comparing the actual areas of various response sheds, using the street network, to the area in a whole circle.

11 Until the response shed is completely built-out, per capita costs would be higher but the intent of this model is to capture the long-term differences in costs associated with different densities, therefore the per capita costs at build-out were used.

FIGURE 3

Transportation costs per student



SGA's model calculates school transportation costs by estimating the number of students that are likely to be within the "walk zone" of any given school, assuming that the area around it is populated at the same gross density as the planned development in each scenario. Based on American Community Survey Public Use Microdata (PUMS) data for the City of Madison area, we estimated the number of students that would live in each development scenario and calculated the density of students per acre. The average student density was multiplied by the acreage of the walk zone for each school type (Elementary, Middle, and High). The number of likely students in the walk zone was then compared to the average school size by type for the City of Madison. If the number of students likely to be in the walk zone met or exceeded the typical school capacity, then transportation costs were assumed to be zero. If the number of students within the walk zone was less than the capacity of the school, the remainder were assumed to be eligible for school bus. No data was available on the percentage of eligible bus students that actually use bus. Pending the availability of better data or a better basis for an assumption SGA has assumed that 75 percent of eligible bus students were assumed to actually use bus, to account for the fact that some bus eligible students will find other means of transportation. Every bused student was assumed to generate annual costs equivalent to the current average expenditure per bused student in the Madison Metropolitan School District.

This model does not account for bussing due to reasons other than the distance from the school, e.g. integration, magnet schools, etc.

Non-density related operating expenditures

For all expenditures deemed not related to density of development, SGA applied the conventional methodology of average costing, whereby expenditure categories are averaged across the number of residents and employees in the jurisdiction. Each new resident and employee is assumed to generate these same costs. The distribution of costs between residents and employees is imprecise, as municipalities typically do not and/or cannot track expenditures at this level of detail.

SGA used judgment in this regard, informed by the total proportion of residents to employees in the City of Madison, as shown on Exhibit 12. Note, however, that the allocation of these costs can have significant impact on the results, particularly when comparing development scenarios with different ratios of residents to employees. SGA recommends that the City of Madison review these assumptions carefully.

Notes on interpretation

This study is intended to provide an estimate of the different costs and revenues associated with development at different densities. To that end, it compares annual revenues for each scenario at full build-out. It does not account for the time until build-out, which may well vary depending on the scenario. It also is a better calculator of the difference between scenarios, rather than the actual net fiscal impact in any given year of one scenario. This is mainly because major capital costs are annualized to provide an estimate of the overall long-term average costs. In reality, the City may need to spend very little money in the early years on maintaining infrastructure, for example, before eventually making a large balloon payment when infrastructure reaches the end of its lifetime. This model essentially assumes that the City saves up enough each year to make the large payment. The City's actual practice may differ, of course. In addition, the model does not account for all capital costs that may be generated by new development. For example, the capital cost of new police stations, libraries, and recreation facilities are not currently included in the model. These cost items were assumed to be either independent of density or SGA did not have sufficient data to establish a relationship between density and their costs. Therefore, the inclusion of these costs might reduce the net fiscal impact of each scenario but the difference between scenarios, and the basic conclusions of this analysis, would remain unchanged.

The model also does not specifically account for the capacity of existing infrastructure. This is a deliberate choice for two reasons. First, the information on school, police, and fire capacity is difficult to obtain. Particularly, with respect to police, and fire, there are often no objective standards on when a new staffing or equipment is required. Second, and perhaps more importantly, it is questionable to attribute the cost of a new station or school entirely to the new development that happens to push facilities beyond their "tipping point." Growth in prior years is equally responsible. For that reason, it is more important to understand the long-term average costs and apply them equally. The key point is that, while such a quantification may be important for a full fiscal impact analysis of prospective development, it would not affect the results here, because any such variation is likely to be the same regardless of the density of the development alternatives. In this analysis, our effort is simply to discern fiscal impacts that vary based on development pattern.

Smart Growth America is the only national organization dedicated to researching, advocating for, and leading coalitions to bring better development to more communities nationwide. From providing more sidewalks to ensuring more homes are built near public transportation or that productive farms remain a part of our communities, smart growth helps make sure people across the nation can live in great neighborhoods. Learn more at smartgrowthamerica.org.