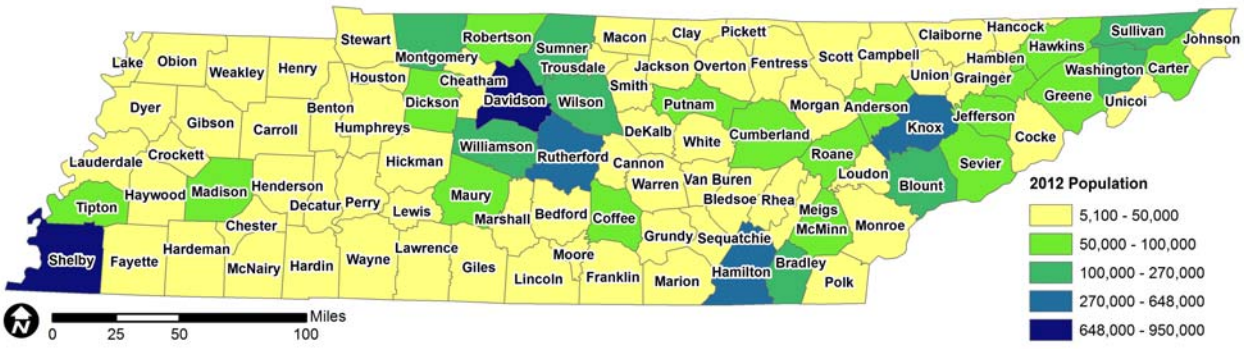
INFRASTRUCTURE NEEDS BY COUNTY

Infrastructure needs vary widely across Tennessee's counties.

Public infrastructure needs and the ability to meet them vary across Tennessee. Unsurprisingly, those counties with the largest populations, population growth, and tax bases need the most infrastructure and are consistently able to build the most. Local governments reported $15.5 billion in infrastructure needs.[14] Shelby, Davidson, and Rutherford, three of the most populous counties in the state (see map 1), are among the six with the greatest infrastructure needs (indicated by dark blue in map 2). Shelby and Davidson, the 1st and 2nd most populous counties, need the most, nearly one third ($4.6 billion) of the $15.5 billion. The 3rd and 4th most populous counties—Knox and Hamilton—are missing from the top six. They rank 8th and 9th for infrastructure needs and are shaded in light blue in map 2. The 5th through 7th most populous counties—Rutherford, Williamson, and Montgomery—plus Washington, the 10th most populous county, comprise the remainder of the top six for infrastructure needs.

Map 1. Tennessee – 2012 Population Estimates
Total Population by County

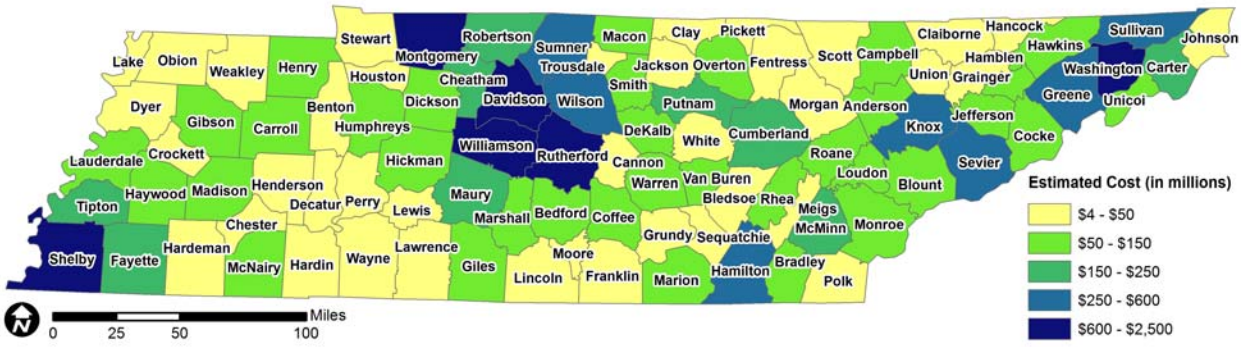


Source: Annual Estimates of Residential Population, US Census Bureau

[14] There are another $23.3 billion in regional needs across the state.

Map 2. Estimated Cost of Total Infrastructure Needs

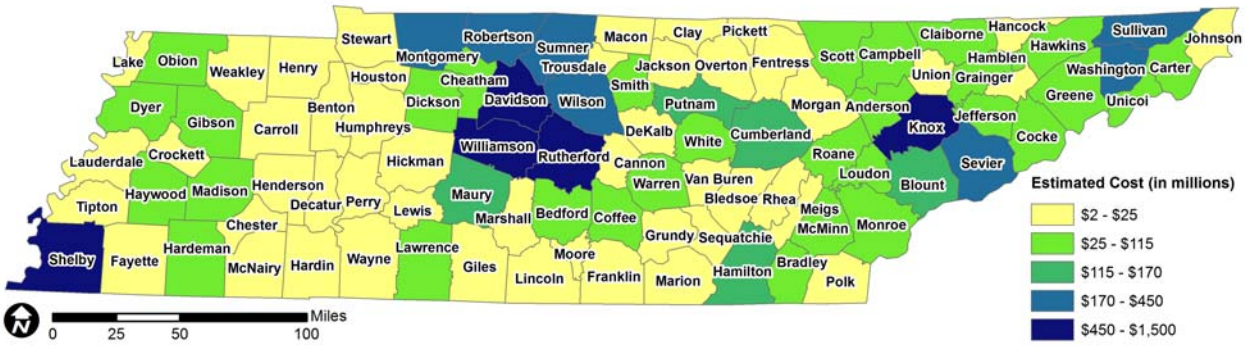
Five-year Period July 2012 through June 2017



Not only do the most populous counties need the most, they also complete the most. Nine of the ten most populous counties (shaded blue in map 3) are among the twelve that completed the most infrastructure improvements since the 2007 inventory. Nine are also among the ten with the largest property and sales tax bases, which may account for their ability to meet their infrastructure needs. Seven of the twelve that completed the most infrastructure are among the top ten counties for all three of these measures, population and both tax base measures: Shelby, Davidson, Knox, Rutherford, Williamson, Sullivan, and Montgomery. See appendix E for infrastructure improvements completed since 2007.

Map 3. Estimated Cost of Completed Infrastructure Needs

Infrastructure Needs Reported July 1, 2007, and Completed by July 1, 2012



Hamilton, 4th in population and tax bases, ranks 14th for infrastructure improvements since 2007 and is shaded green in map 3. Sumner, 8th in population and for infrastructure improvements since 2007, is among the top ten for property tax base but not for sales. Washington, 10th in population and for infrastructure improvements, is among the top ten for sales but not for property. Sevier, home to Gatlinburg and Pigeon Forge, is one of the twelve that completed the most infrastructure improvements and has the 7th largest sales tax base and the 9th largest property tax base in the state but only the 15th largest population. Wilson,

the 12th largest county, is the only county among the twelve completing the most infrastructure that is not among the ten with the largest property and sales tax bases. Robertson, the smallest county in the group of 12 that completed the most infrastructure (a $21 million jail expansion and a $35 million high school), is not among the ten largest nor is it among the ten with the largest tax bases. See appendix F for property and sales tax base information for the 95 counties.

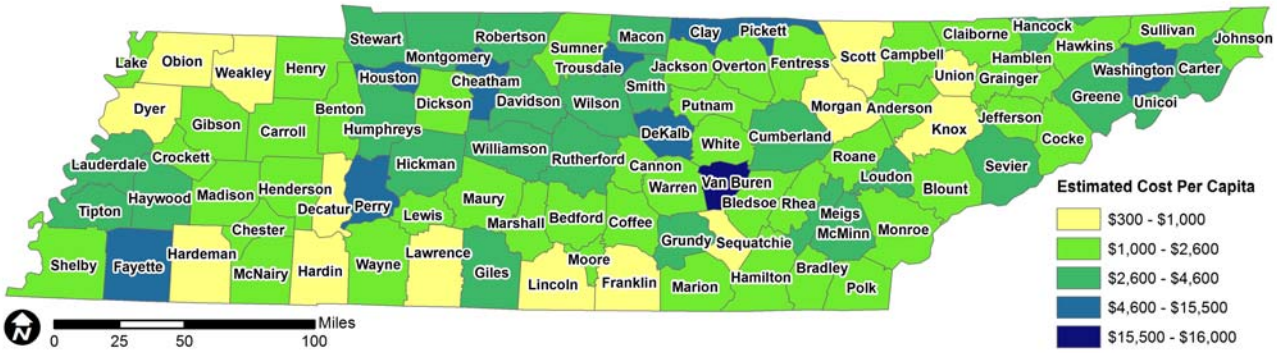
Four other counties fall into the same range on map 3 as Hamilton: Blount, Putnam, Cumberland, and Maury, in order of infrastructure improvements completed since 2007. None of them are in the top ten for population or tax bases, but Blount is 11th for population and property and 13th for sales. Putnam is the 18th largest county and ranks 15th for sales and 22nd for property. Cumberland is the smallest of these, ranking 24th for population, 22nd for sales, and 20th for property. Maury is the 16th largest county and has the 17th largest sales and property tax bases.

For example, Greene is light blue in map 2 but light green in map 3 and needs an average amount of infrastructure but completed much less than average. Greene has needed $35 million for a natural gas line extension since 2007. Fayette and Tipton are dark green in map 2 but yellow in map 3. These two counties have needs from 2007 that have not yet been met. Tipton needs $17 million for a new high school and Fayette needs $12 million to replace Jefferson and Somerville elementary schools.

Although the largest counties generally need the most infrastructure and get the most done and smaller counties need less overall and get less done, smaller counties may need just as much or more relative to their population. It turns out that when you examine needs per capita, most of the counties with the highest needs per capita, shaded blue in map 4, have small populations. Washington is the lone exception with a population of 125,000. Cheatham and Fayette have populations close to 40,000, DeKalb is close to 20,000, while the other six—Houston, Perry, Clay, Trousdale, Van Buren, and Pickett—have populations less than 10,000. The state's smallest county, Pickett, with a population of only 5,100, has needed a new high school for eight years now, estimated to cost a relatively modest $15 million. The state's second smallest county, Van Buren, with a population of only 5,628, needs $25 million to install and replace waterlines. Needs of this size would not be significant in a county with a large population like Shelby or Davidson, but they are big enough to cause these small counties to have the largest infrastructure needs per capita. Van Buren is first in per capita needs, and Pickett is second.

Map 4. Estimated Cost of Total Infrastructure Needs Per Capita

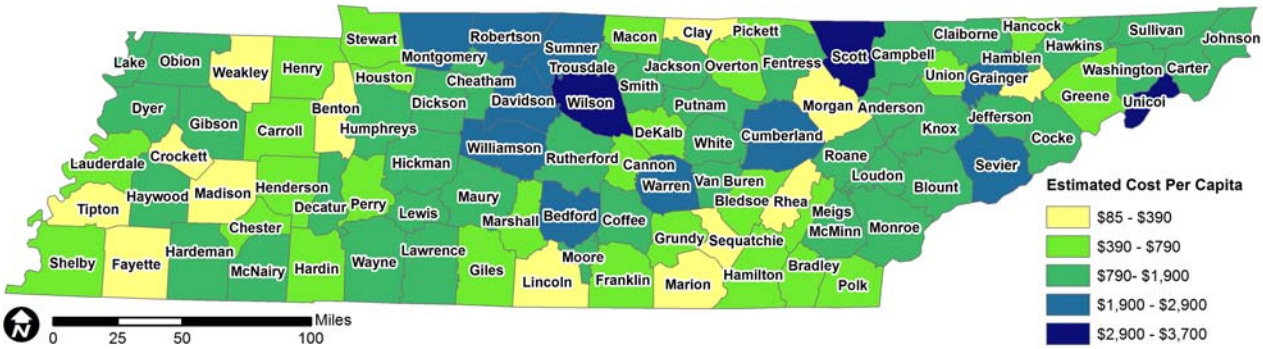
Five-year Period July 2012 through June 2017



The counties completing the most infrastructure improvements per capita fall mainly into two groups: small counties where one large project There is no obvious pattern looking at completed needs per capita. The thirteen counties across the state with greatest completed needs per capita, shaded in blue on map 5, include counties with both large and small populations. Wilson, Scott, and Unicoi, shaded in dark blue, are 12th, 63rd, and 70th for population. Davidson, Williamson, Montgomery, and Sumner, shaded in light blue, are 2nd and 6th through 8th for population, but the other light blue counties—Sevier, Greene, Cumberland, Bedford, Warren, and Grainger—have populations that rank from 15th to 60th.

Map 5. Estimated Cost of Completed Infrastructure Needs Per Capita

Infrastructure Needs Reported July 1, 2007, and Completed by July 1, 2012



So what factors might explain the variation in needed and completed infrastructure among counties that size does not? Likely candidates include population growth and wealth. Wealth in this instance means revenue sources for local governments and residents' ability to pay taxes based on their income. Analyzing these factors using a common statistical technique called regression produced the following conclusions:

- Income and taxable property matter more than taxable sales.
- When it comes to driving need, population factors matter most of all.
- And when it comes to meeting those needs, while population matters most, population gain comes second.

Both population and wealth factors are strongly tied to infrastructure needs and the ability to meet them.

So what factors might explain the variation that size does not? Likely candidates include population growth and wealth. Wealth in this instance means revenue sources for local governments and residents' ability to pay taxes based on their income. Statistical analysis can suggest explanations for things that general observation cannot. We looked at each of the factors using the simple statistical method of measuring correlations. Correlation coefficients measure the strength of the relationship between two sets of numbers. The strength is reported as a range from zero to one. The coefficient will be positive if one set of numbers increases as the other increases, or decreases as the other decreases; it will be negative if one increases as the other decreases. Because Tennessee's 95 counties vary so much in size—for instance, "Big Shelby" at 755 square miles, is almost seven times the size of Trousdale, which is only 114 square miles—we divided the factors by square miles to make sure that land area did not distort the analysis.

Table 8. Correlation Between Needed Infrastructure and Related Factors Divided by Land Area

Factor per square mile	Correlation with reported needs per square mile
Income	0.92
Taxable Property	0.91
Taxable Sales	0.89
Population	0.88
Population Gain or Loss	0.86
Pop Growth Rate	0.46

Table 9. Correlation Between Completed Infrastructure Needs and Related Factors Divided by Land Area

Factor per square mile	Correlation with completed needs per square mile
Taxable Property	0.91
Taxable Sales	0.90
Income	0.88
Population	0.84
Population Gain or Loss	0.74
Pop Growth Rate	0.27

When looked at in isolation, five factors stand out, both in relation to need and to the ability to meet needs. Wealth factors come first, then population. Population gain or loss comes next, but growth rates are only weakly correlated. Population growth rates get a lot of attention, but the population gain or loss is a much better indicator of a county's infrastructure need.

Population growth rate has been the factor with the lowest coefficient for the last three reports. See tables 8 and 9.

Population plays the strongest role in explaining infrastructure needs and completions.

While correlation allows comparison of two factors at a time, regression analysis allows you to compare a group of factors. Two regressions were performed–one examining factors as they relate to infrastructure needs and a second examining factors as they relate to completions.We found that population was the most significant factor in explaining infrastructure needs, followed by income and taxable property. Population gain was also significant but taxable sales were not. See Table 10.

Table 10. Significance of Factors Affecting Infrastructure Needs

	Factors in Order of Significance				
Statistical Significance	**Population**	**Income**	**Taxable Property**	**Population Gain or Loss**	**Taxable Sales**
Highly Significant	X	X	X	X	
Significant					
Not Significant					X

Note: All variables were divided by land area.

Population was also the most significant factor explaining a county's ability to meet its needs. Population gain, taxable property, and taxable sales followed in order of decreasing significance. In contrast to needs, income is not at all significant to completing infrastructure needs. See table 11. People and businesses shopping in a county other than the one in which they live or are located may explain why sales is significant for completions but not for needs. By shopping out of county, they contribute to the destination county's ability to meet its needs rather than their home county. Income is highly significant for needs but not for completions, possibly because property and sales are taxed by local governments but income is not.

Table 11. Significance of Factors Affecting Infrastructure Completed Needs

	Factors in Order of Significance				
Statistical Significance	**Population**	**Population Gain or Loss**	**Taxable Property**	**Taxable Sales**	**Income**
Highly Significant	X	X	X	X	
Significant					X
Not Significant					

Note: All variables were divided by land area.