INFRASTRUCTURE NEEDS BY COUNTY

Infrastructure needs vary widely across Tennessee's counties.

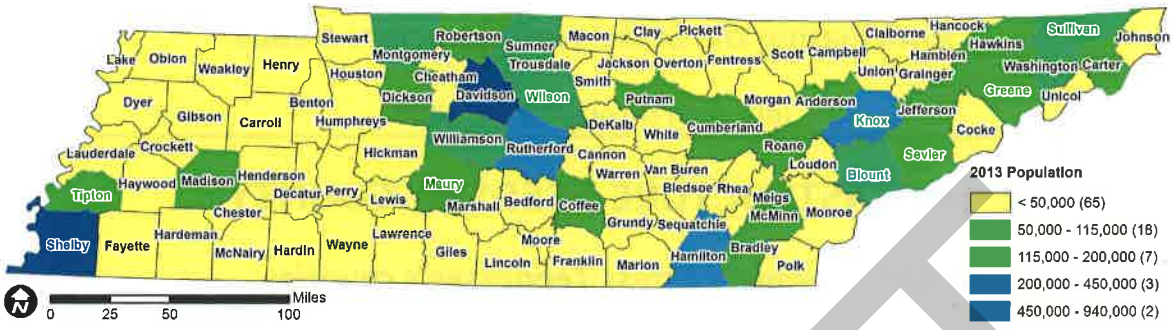
Population and population gain or loss drive infrastructure needs; population and wealth explain the ability to meet needs. In other words, the more people a county has or adds, the more infrastructure it will need, and the more wealth it will have to pay for these needs. A sparsely populated rural county doesn't need as much wastewater treatment capacity as densely populated Shelby County, nor does a county with population loss need as many new schools as rapidly growing Rutherford County. Wealth factors increase a county's ability to tackle needed improvements—if a county has a large population or the destinations to draw in customers and tourists, that county has more fiscal capacity.

Shelby and Davidson, the 1st and 2nd most populous counties making up a quarter of the state's population (see map 1), report needing the most infrastructure improvements, between them nearly one-third ($3.9 billion) of the $14.1 billion reported by local governments.[14] The 3rd and 4th most populous counties—Knox and Hamilton—are missing from the top five for infrastructure needs, but still report quite a bit, ranking 9th and 12th (the only counties shaded in light blue in both map 1 and map 2). The 5th most populous county, Rutherford, reports needing the 4th most infrastructure improvements. The 6th and 7th most populous counties—Williamson, and Montgomery are 3rd and 5th when it comes to infrastructure needs. See map 2 for total infrastructure needs by county. When comparing map 1 and map 2, the pattern of total infrastructure needs across Tennessee in map 2 is similar to the pattern of population across the state seen in map 1.

The five counties with the greatest infrastructure needs were the only ones whose populations increased by more than 10,000 residents. Between 2009 and 2013, Montgomery (5th in needs and 9th in completed needs) increased by 24,223 residents, Shelby (2nd in both needs and completed needs) increased by 19,645, Rutherford (4th in needs and 5th in completed needs) increased by 17,056, Williamson (3rd in both needs and completed needs) increased by 16,159, and Davidson (1st in both needs and completed needs) increased by 13,091. Collectively these five counties accounted for 57% of the increase in population for Tennessee over that period. The populations of 28 counties decreased during that period, collectively by 13,621.

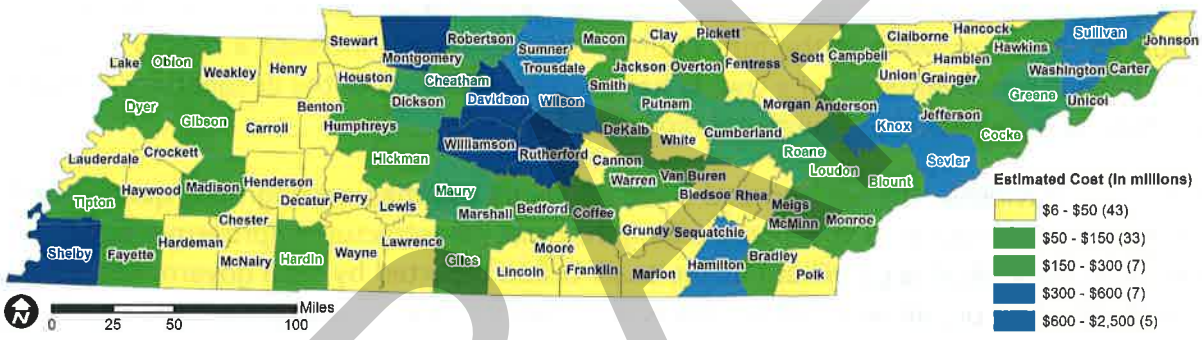
[14] There are another $28.3 billion in regional needs across the state.

Map 1. Tennessee - 2013 Population Estimates
Total Population by County



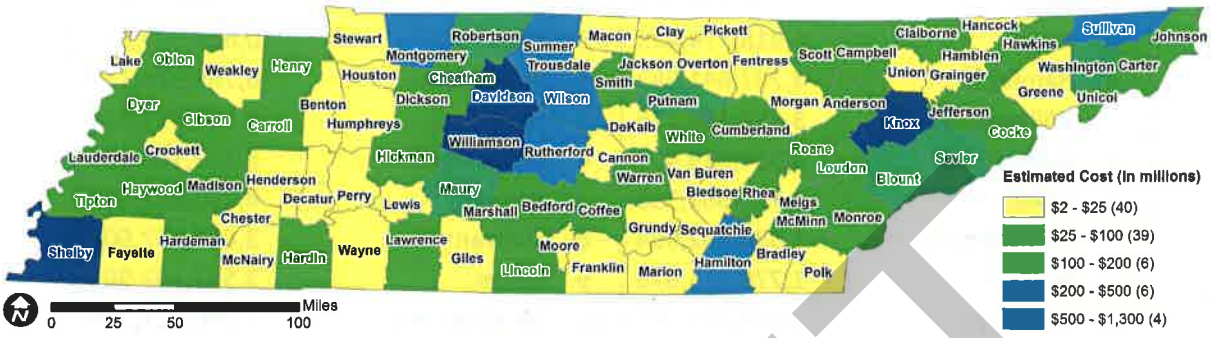
Source: Annual Estimates of Residential Population, US Census Bureau

Map 2. Estimated Cost of Total Infrastructure Needs
Five-year Period July 2013 through June 2018



Not only do the most populous counties need the most infrastructure improvements, they have also completed the most. Nine of the ten counties that completed the most infrastructure improvements since the 2008 inventory (shaded blue in map 3) were also in the top ten most populous counties. The other county, Wilson, is 12th for population. Six of the ten—Shelby, Davidson, Knox, Rutherford, Williamson, and Montgomery—are also among those counties in the top ten for population growth, infrastructure needs, and property and sales tax bases. The other four most populous counties are Hamilton (4th) , Sumner (8th), Sullivan (9th), and Washington (10th). Sullivan (18th for population growth, 11th for needs, 6th for completions, 9th for sales tax base, and 8th for property tax base) is one of only two counties in the top 10 for population that is not in the top 10 for needs; the other, Hamilton is not in the top 10 for either needs (12th) or completions (11th). Sumner is 7th in population growth, 8th for needs, 7th for completions, 12th for sales tax base, and 7th for property tax base. Washington, 10th in population, 11th for population growth, 6th for needs, and 11th for completed infrastructure needs, is 10th for sales but 13th for property and is shaded dark green in map 3.

Map 3. Estimated Cost of Completed Infrastructure Needs Infrastructure Needs Reported July 1, 2008, and Completed by July 1, 2013[15]



Five other counties fall into the same range on map 3 as Washington: Robertson, Sevier, Blount, Putnam, and Maury, in order of infrastructure improvements completed since 2008, but there are no obvious similarities among these counties. Robertson, despite having the 20th largest population, 21st largest sales tax base, and 22nd largest property tax base, made the 12th most infrastructure improvements, largely because of two projects, a $21 million county jail and a $35 million high school built to house students that neighboring Sumner County had been serving. Without these two projects, Robertson would have ranked 35th; this is a good example of how infrequent but large projects in smaller counties can affect their ranking on completions. Local governments, including Robertson County's, usually fund such improvements through the use of bonds, which is somethng repaid over time, so counties like Robertson can do this kind of thing now and then but not year after year. Sevier County, home to Gatlinburg and Pigeon Forge, completed the 13th most infrastructure improvements and has the 7th largest sales tax base and the 9th largest property tax base but only the 15th largest population. Having large tax bases for its size enables Sevier to spend more on infrastructure than its population alone might suggest is needed relative to other counties.

The other three counties in this group have made infrastructure improvements more in line with their populations and tax bases. Blount has the 11th largest population and property tax base, the 14th largest sales tax base and completed the 14th most infrastructure needs. Putnam has the 18th largest population, 15th largest property tax base, and the 20th largest sales tax base, and completed the 15th most infrastructure improvements. Maury is ranked 16th for population, property tax base, and infrastructure improvements completed and 17th for sales tax base. See table 8 for the 20 top ranked counties for property and sales tax base and appendix F for property and sales tax base information for all 95 counties.

[15] See appendix E for infrastructure improvements completed since 2008.

Table 8. Top 20 Counties for Taxable Property Base and Taxable Sales Base 2013

	Taxable Property			Taxable Sales	
1	Davidson	$ 12,426,545,933	1	Davidson	$ 20,157,034,927
2	Shelby	10,898,428,983	2	Shelby	17,836,710,021
3	Knox	6,918,774,423	3	Knox	10,893,393,846
4	Hamilton	4,707,641,982	4	Williamson	8,789,674,134
5	Williamson	3,458,180,276	5	Hamilton	8,583,457,944
6	Rutherford	3,354,839,497	6	Rutherford	6,147,105,395
7	Sevier	2,730,062,335	7	Sumner	4,201,832,547
8	Montgomery	1,930,902,994	8	Sullivan	3,669,257,607
9	Sullivan	1,778,715,075	9	Sevier	3,557,182,961
10	Washington	1,629,021,241	10	Montgomery	3,396,157,706
11	Madison	1,529,396,810	11	Blount	3,266,737,465
12	Sumner	1,513,159,268	12	Wilson	3,191,312,703
14	Wilson	1,451,927,308	14	Washington	2,987,458,037
13	Blount	1,327,019,949	13	Madison	2,037,177,800
15	Putnam	1,048,233,932	15	Bradley	1,975,526,855
16	Bradley	971,076,096	16	Maury	1,712,009,952
17	Maury	856,304,739	17	Loudon	1,678,260,093
18	Anderson	754,791,542	18	Anderson	1,647,794,297
19	Hamblen	711,890,595	19	Hamblen	1,449,379,631
20	Coffee	619,671,710	20	Putnam	1,440,533,071

Source: Tennessee Comptroller of the Treasury, Division of Property Assessment–equalized assessed property values, Tennessee Department of Revenue–total taxable sales.

Some counties that need relatively average amounts of infrastructure, such as Greene, Macon, and Humphreys, have smaller tax bases than average. Greene is dark green in map 2 but yellow in map 3 and needs an average amount of infrastructure but completed much less than average. Greene has needed $30 million for a sewer system since 2004. Humphreys and Macon are light green in map 2 but yellow in map 3. These two counties have needs from 2008 that have not yet been met. Humphreys needs $9.6 million to replace a bridge and $8 million for water and sewer at an industrial park. Macon needs a new school and a new water line from the Cumberland River to Lafayette, each costing $10 million. Unlike Robertson County, these counties have not yet leveraged bonds to meet these needs.

Relative to their populations, counties with small populations need and complete just as much or more infrastructure than counties with large populations.

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 populations. In fact, the counties with the largest needs per capita (Van Buren, Humphreys, and Clay), shaded blue in map 4, have small populations. The

state's second smallest county, Van Buren, with a population of only 5,626, needs $25 million to install and replace water lines. Clay, with a population of 7,813, needs $20 million to construct gas lines throughout the county and in the city of Celina. Needs of this size would not be significant in a county with a large population, like Shelby or Davidson or even Washington, but they are big enough to cause these small counties to have the largest infrastructure needs per capita.

Map 4. Estimated Cost of Total Infrastructure Needs Per Capita Five-year Period July 2013 through June 2018

The counties completing the most infrastructure improvements per capita fall mainly into two groups: small counties where one large project was completed and large counties where a lot of work is being done. The ten counties across the state with the greatest completed needs per capita, shaded in blue on map 5, include counties with both large and small populations. Van Buren, Scott, Wilson, Unicoi, Williamson, and Robertson, shaded in dark blue, rank 94th, 63rd, 12th, 70th, 6th, and 20th for population. Warren, Bedford, Hardin, and Davidson, shaded in light blue, rank 38th, 33rd, 58th, and 2nd. The two groups complete about the same amount per capita regardless of population, suggesting that other factors besides population are important for meeting needs.

Map 5. Estimated Cost of Completed Infrastructure Needs Per Capita Infrastructure Needs Reported July 1, 2008 and Completed by July 1, 2013

Taxable property, taxable sales, and income are strongly tied to explaining infrastructure needs and completed needs.

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

Factor per square mile	Correlation with reported needs per square mile
Taxable Property	0.89
Income	0.89
Taxable Sales	0.89
Population Gain or Loss	0.87
Population	0.82
Pop Growth Rate	0.47

So what factors might explain the variation among counties in the amount of infrastructure they need or complete where the size of the population does not? Likely candidates include population growth and access to the resources needed to fund infrastructure.

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 and the other decreases. Because Tennessee's 95 counties vary so much in size—for instance, "Big Shelby" at 755 square miles of land area, is almost seven times the size of Trousdale, which is only 114 square miles—we divided each of the

Table 10. Correlation Between Infrastructure Completed and Related Factors Divided by Land Area

Factor per square mile	Correlation with infrastructure completed per square mile
Taxable Property	0.89
Taxable Sales	0.88
Income	0.86
Population	0.80
Population Gain or Loss	0.57
Pop Growth Rate	0.10

factors by square miles to make sure that land area did not distort the analysis.

When analyzed in isolation, five factors per square mile stand out, both in relation to needs and the ability to meet needs. Wealth factors, revenue sources for local governments, and residents' ability to pay taxes based on their income, come first. Population gain or loss comes next for needs and then population; these two are reversed for completed needs. Growth rates, which get a lot of attention, are only weakly correlated for needs or completed needs. Population growth rate has been the factor with the lowest importance for the last four reports. See tables 9 and 10.

Looking at all the factors as a group, population gain or loss is the most significant indicator for needs, while population is the most for completions.

While correlation allows comparison of two factors at a time, regression analysis allows you to compare a group of factors all together rather than in isolation. Two regressions were performed—one examining factors as they relate to infrastructure needs and the second examining factors as they relate to completions. We found that population gain or loss per square mile was the most significant factor in explaining infrastructure needs but not significant for explaining completed infrastructure needs. Population per square mile was the second most significant in explaining needs and first in explaining completed needs, and is the only factor that is significant for both. As noted above, the five counties with the greatest infrastructure needs were the only ones whose populations increased by more than 10,000 residents. See table 11.

Table 11. Significance of Factors Affecting Infrastructure Needs and Completed Infrastructure

	Order of Significance	
Factors	**Infrastructure Needed**	**Completed Infrastructure**
Population Gain or Loss	#1 **	Not Significant
Population	#2 **	#1 **
Taxable Sales	Not Significant	#4 *
Income	Not Significant	#2 **
Taxable Property	Not Significant	#3 **

** Highly significant.
* Significant.

The wealth factors of taxable sales, income, and taxable property were not significant in explaining infrastructure needed but taxable sales was the third most significant for explaining completed needs. People and businesses shopping in a county other than the one in which

they live or are located may explain why taxable 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.