

# Building Tennessee's Tomorrow: Anticipating the State's Infrastructure Needs

July 2013 through June 2018

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## INFRASTRUCTURE NEEDS BY COUNTY

### *Infrastructure needs vary widely across Tennessee's counties.*

In general, the more people a county has or adds the more infrastructure it will need and the more wealth it will likely have to pay for those needs. The relationships among these factors are strong and well demonstrated by the variation reported for each Tennessee county, but they are not perfectly aligned in any county. Some counties are able to meet their infrastructure needs more easily than others, while others continue to report the same needs year after year. And even fast growing counties can find it difficult to meet their needs.

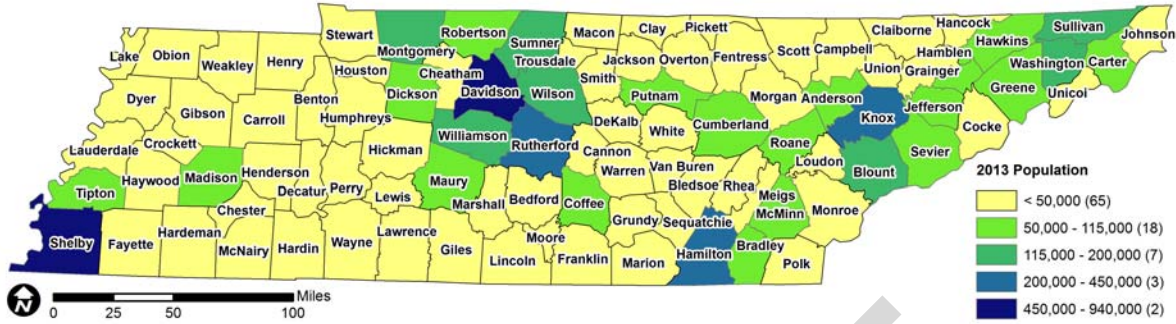
Shelby and Davidson, the 1<sup>st</sup> and 2<sup>rd</sup> most populous counties, making up a quarter of the state's population (see map 1), report needing the most infrastructure improvements, between them nearly one-third (\$3.9 billion) of the \$14.1 billion reported by local governments.<sup>14</sup> The 3<sup>rd</sup> and 4<sup>th</sup> most populous counties—Knox and Hamilton—are missing from the top five for infrastructure needs, but still report quite a bit, ranking 9<sup>th</sup> and 12<sup>th</sup> (the only counties shaded in light blue in both map 1 and map 2). The 5<sup>th</sup> most populous county, Rutherford, reports needing the 4<sup>th</sup> most infrastructure improvements. The 6<sup>th</sup> and 7<sup>th</sup> most populous counties—Williamson and Montgomery, are 3<sup>rd</sup> and 5<sup>th</sup> 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 (5<sup>th</sup> in needs and 9<sup>th</sup> in completed needs) increased by 24,223 residents, Shelby (2<sup>nd</sup> in both needs and completed needs) increased by 19,645, Rutherford (4<sup>th</sup> in needs and 5<sup>th</sup> in completed needs) increased by 17,056, Williamson (3<sup>rd</sup> in both needs and completed needs) increased by 16,159, and Davidson (1<sup>st</sup> 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.

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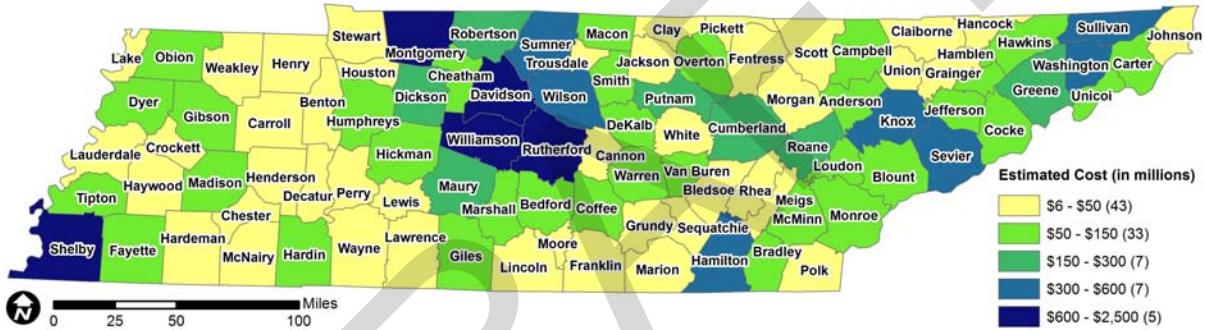
<sup>14</sup> There are another \$28.2 billion in regional needs across the state.

**Map 1. Tennessee – 2013 Population Estimates**  
*Total Population by County*



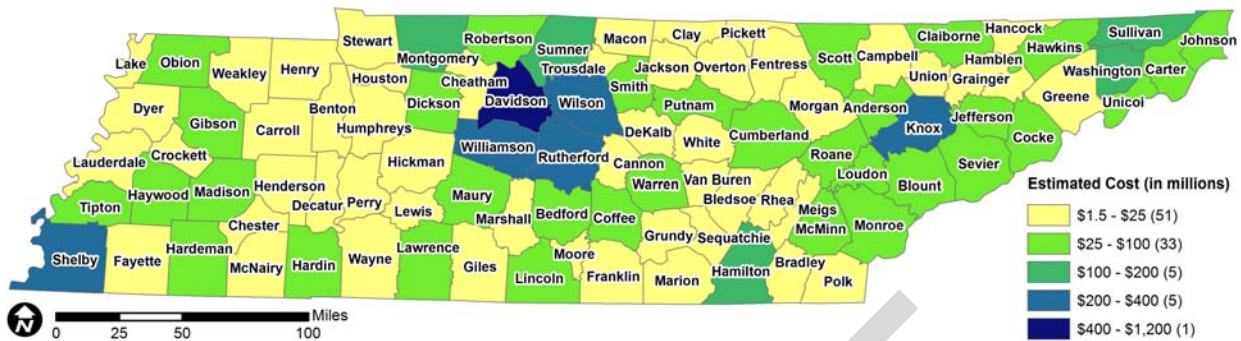
Source: Annual Estimates of Residential Population, US Census Bureau

**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. Five (Davidson, Shelby, Knox, Williamson, and Rutherford) of the six counties that completed the most infrastructure improvements since the 2008 inventory (shaded blue in map 3) were also in the top six most populous counties. The other county, Wilson, completed the 6<sup>th</sup> most improvements and is 12<sup>th</sup> for population. Davidson, Shelby, Williamson, and Rutherford are the only counties in the top six for population, population growth, infrastructure needs, completed infrastructure improvements, and property and sales tax bases. The other five counties completing the most infrastructure improvements are shaded dark green—Sumner (7<sup>th</sup>), Sullivan (8<sup>th</sup>), Hamilton (9<sup>th</sup>), Washington (10<sup>th</sup>), and Montgomery (11<sup>th</sup>). Sumner is in the top ten for every measure except sales tax base (12<sup>th</sup>), Sullivan is in the top ten for all but needs (11<sup>th</sup>) and population growth (18<sup>th</sup>), Hamilton is in the top ten except for needs (12<sup>th</sup>), and Washington is in the top ten except for property tax base (13<sup>th</sup>). Putnam, shaded light green on map 3, with the 18<sup>th</sup> largest population, 20<sup>th</sup> largest property tax base, and the 15<sup>th</sup> largest sales tax base, completed the 12<sup>th</sup> most infrastructure improvements.

**Map 3. Estimated Cost of Completed Infrastructure Needs**  
*Infrastructure Needs Reported July 1, 2008, and Completed by July 1, 2013<sup>15</sup>*



Infrequent but large projects in smaller counties can affect their ranking on completions. For example, Robertson (also shaded light green), despite having the 20<sup>th</sup> largest population, 21<sup>st</sup> largest sales tax base, and 22<sup>nd</sup> largest property tax base, made the 13<sup>th</sup> 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 40<sup>th</sup>; this is a good example of local governments, including Robertson County's, use of bonds to pay for many such improvements. Since bonds are repaid over time, local governments can make large investments, relative to available resources, in infrastructure periodically, but not year after year.

The next two counties shaded light green have made infrastructure improvements more in line with their tax bases. Maury is ranked 16<sup>th</sup> for population and property tax base, 14<sup>th</sup> for infrastructure improvements completed, and 17<sup>th</sup> for sales tax base. Blount has the 11<sup>th</sup> largest population and property tax base, the 14<sup>th</sup> largest sales tax base, and completed the 15<sup>th</sup> most infrastructure. Carter completed the 16<sup>th</sup> most infrastructure improvements despite being ranked 23<sup>rd</sup> for population, 34<sup>th</sup> for property tax base, and 30<sup>th</sup> for sales tax base. Sevier County, home to Gatlinburg and Pigeon Forge, completed the 17<sup>th</sup> most and has the 7<sup>th</sup> largest sales tax base and the 9<sup>th</sup> largest property tax base, but only the 15<sup>th</sup> largest population. Although Sevier has large tax bases for its size, its spending on infrastructure is more in line with its population. 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.

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

<sup>15</sup> See appendix E for infrastructure improvements completed since 2008.

from the Cumberland River to Lafayette, each costing \$10 million. Unlike Robertson County, these counties have not yet leveraged bonds to meet these needs.

**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

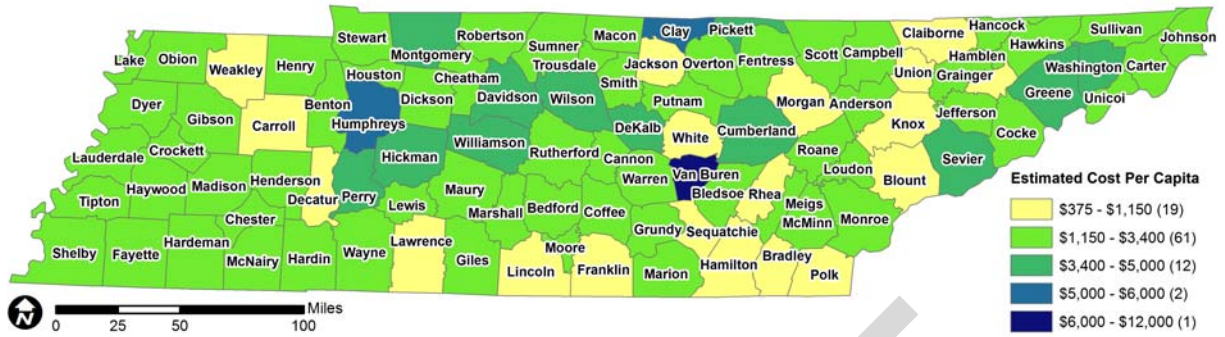
Source: Tennessee Comptroller of the Treasury, Division of Property Assessment—equalized assessed property values, Tennessee Department of Revenue—total taxable sales.

***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.

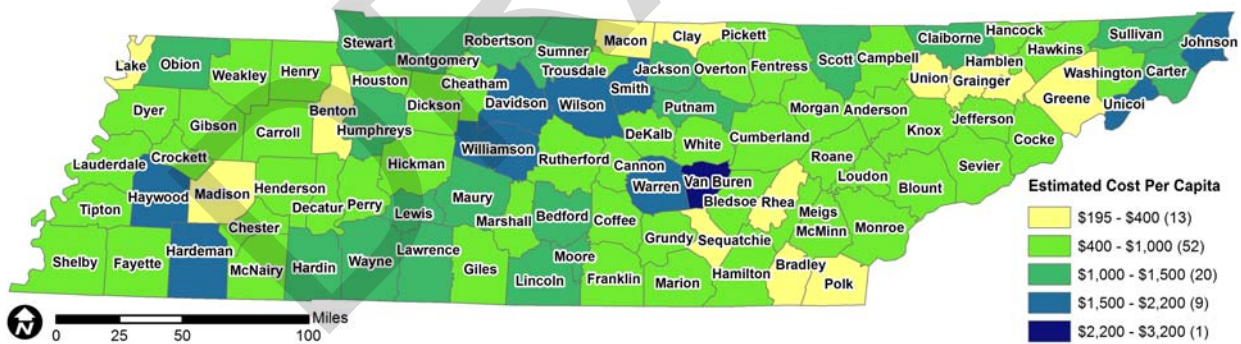


**Map 4. Estimated Cost of Total Infrastructure Needs Per Capita**  
*Five-year Period July 2013 through June 2018*



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, shaded in dark blue, ranks 94<sup>th</sup> for population. Unicoi, Smith, Johnson, Davidson, Haywood, Wilson, Williamson, Warren, and Hardeman, shaded in light blue, rank 2<sup>nd</sup> through 71<sup>st</sup>. These counties 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
Taxable Sales	0.89
Income	0.87
Population	0.82
Population Gain or Loss	0.78
Pop Growth Rate	0.24

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

**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	0.90
Taxable Sales	0.89
Income	0.87
Population	0.82
Population Gain or Loss	0.77
Pop Growth Rate	0.16

Five factors stand out when analyzed in isolation, both in relation to needs and the ability to meet needs. All six factors rank the same for needs as they do for completed needs with wealth factors, revenue sources for local governments, coming first. 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.

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 completed infrastructure improvements. The regressions show that the factors in combination are a strong predictor of what a county needs and is able to complete per square mile. The factors explain 86% of the variation in what is needed and 89% of the variation in what is completed. See table 11.

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

Factors	Order of Significance	
	Infrastructure Needed	Completed Needs
Population	# 1**	# 1**
Income	# 2**	# 2**
Population Gain or Loss	# 3*	# 4*
Taxable Sales	Not Significant	# 3**
Taxable Property	Not Significant	Not Significant
<b>Variance Explained (R<sup>2</sup>)</b>	86%	89%

\*\* Highly significant

\* Significant