INFRASTRUCTURE NEEDS BY COUNTY

Infrastructure needs vary widely across Tennessee's counties.

In general, the more people a county has and the more its population grows, the more infrastructure it will need and, fortunately, the more wealth it will likely have to pay for those needs. As has been the case throughout the history of this inventory, relationships among these factors are strong and well demonstrated by the variation reported for each Tennessee county, although they are not perfectly aligned in any county. Some counties are able to meet their infrastructure needs more easily than others, some continue to report the same needs year after year, and even fast growing counties can find it difficult to meet their needs. With state and regional projects factored out, the public infrastructure improvement needs reported for all counties across the state have a total cost estimated by local officials at nearly $13.8 billion. Map 1 shows how the cost varies by county across the state.

Map 1. Total Estimated Cost of Infrastructure Improvement Needs

Five-year Period July 2014 through June 2019

Five counties—Davidson and Shelby in the first tier for needed infrastructure improvements (dark blue in map 1), and Rutherford, Williamson, and Montgomery counties in the second tier (medium blue in map 1)—account for 42.7% ($5.9 billion) of the $13.8 billion needed for infrastructure improvements reported by local officials. Shelby and Davidson are also in the top tier (shaded dark blue) for total population in map 2, cost of completed improvements in map 4, property values in map 5, and taxable sales in map 6. They are the first and second most populous counties and are home to a quarter of the state's population. Between 2000 and 2014, Davidson and Shelby experienced the second and eighth greatest population growth in the state—Davidson grew by 98,027 and Shelby by 40,524. Not surprisingly, besides

needing the most infrastructure improvements,[9] these two counties also completed the most (see map 4), between them nearly a quarter (23.7%) of the state total. The surprising difference between these two counties is that Davidson completed the 15th most improvements per capita ($1,596) while Shelby completed the 68th most ($630). This is noteworthy because Davidson and Shelby have the two largest property and sales tax bases in the state, factors usually related to a county's ability to complete projects. It isn't clear why there is a large difference between the two. It may be that infrastructure needs and improvements in Shelby County were not being fully reported in the inventory.

Map 2. Total Population by County

2014

Source: Annual Estimates of Residential Population, US Census Bureau.

Rutherford, Williamson, and Montgomery counties round out the top five for infrastructure needs in map 1. Rutherford, the largest of the three (fifth for population) and the county that grew the most since 2000 (by 105,329 residents), reported needing the third most infrastructure improvements and completed the sixth most improvements. It has the sixth largest property and sales tax bases. Williamson, fourth for unmet needs, is the sixth most populous county. Between 2000 and 2014 its population grew by 77,129 residents, the third largest change behind Rutherford and Davidson. Population change is depicted in map 3. Williamson has completed more infrastructure improvements than most counties (third) and is fourth for property and fifth for sales tax bases. Montgomery, fifth for unmet needs, is the seventh most populous county; between 2000 and 2014 its population grew by 54,736 residents, the fifth largest increase. Montgomery is lagging in completed infrastructure improvements (eighth) and is tenth and eighth for property and sales tax bases.

[9] There are another $27.7 billion in regional needs across the state.

Map 3. Population Change by County

2000 to 2014

Source: Annual Estimates of Residential Population, US Census Bureau.

The next six counties are all in the fourth tier in map 1, shaded dark green—still above average and collectively accounting for $2.2 billion (16.1%) of the needed infrastructure improvements in the state. Knox County, like Davidson, is in the top tier for population, population change, property tax base, and sales tax base, but it ranks eighth for improvement needs and fourth for improvements completed (map 4, second tier). Knox would seem to be well situated to meet its infrastructure needs.

Map 4. Estimated Cost of Completed Infrastructure Improvements

Infrastructure Needs Reported July 1, 2009, and Completed by July 1, 2014

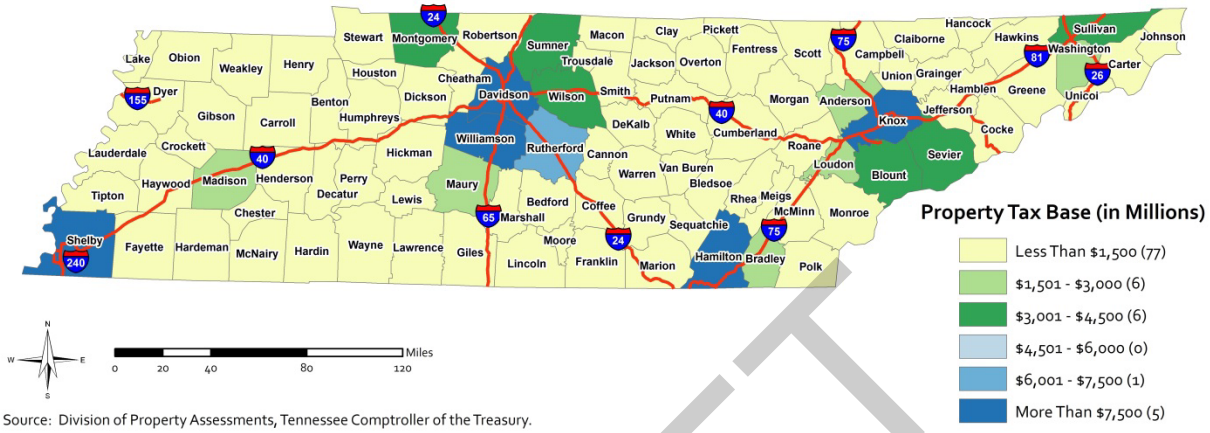
*See Appendix E for infrastructure improvements completed since 2009.

Improvement needs in three of the remaining five in the fourth tier in map 1 (Wilson, Washington, and Sevier) are reasonably aligned with their total populations, population growth, and property and sales tax bases (maps 2, 3, 5, and 6), as are their completed improvements (map 4). With one exception, all of these factors are within one tier of the fourth tier in each of those maps. Wilson County, the exception, is getting a lot done given its tax bases—it is fifth for completed infrastructure improvements (in the second tier in map 4) but only 12th for property tax base (in the fourth tier in map 5) and 13th for sales tax base (in the

fifth tier in map 6). Wilson may be responding to its population growth, which is ninth among the 95 counties (see map 3). Similarly, Washington County, although growing more slowly, is getting more done than its property and sales tax bases would seem to support.

Map 5. Equalized Assessed Property Values by County in Millions

2014



Source: Division of Property Assessments, Tennessee Comptroller of the Treasury.

Map 6. Taxable Sales by County in Millions

2014

Source: Tennessee Department of Revenue.

Sevier, seventh for unmet needs, is in the fourth tier for population change, completed improvements, property values, and taxable sales (maps 3 through 6) and in the fifth tier for population (map 2). Home to Gatlinburg, Tennessee's "Gateway to the Smokies," Sevier's ability to complete the tenth largest amount of infrastructure improvements in the state is directly related to its large property and sales tax bases, the seventh largest in the state and heavily supported by tourism.

The other two counties in the fourth tier for infrastructure needs, Sullivan and Sumner, report needing less new infrastructure improvements than might be expected based on their population factors. Sumner is in the third tier for population (map 2) and the second for population growth (map 3), but its property and sales tax bases fall in the fourth and fifth tiers

(maps 5 and 6). Sullivan is similarly situated although it is growing much more slowly (see map 3), which may explain its relatively low need for infrastructure improvements. Sumner, on the other hand, may be held back by its relatively small tax base.

Patterns become less obvious at this point and vary more among counties with smaller populations and fewer needs, partly because infrequent but large projects in smaller counties can affect their ranking for completion of infrastructure improvements.

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

Relative to population, infrastructure needs do not vary all that much. Most counties fall in the bottom three tiers, including the large ones discussed above. Only five small counties stand out: Van Buren, Humphreys, Clay, Pickett, and Perry. See map 7. These five counties are in the lowest tier for needs (map 1).

Map 7. Estimated Cost of Total Infrastructure Improvements Needed Per Capita
Five-year Period July 2014 through June 2019

The state's second smallest county, with a population of only 5,633, Van Buren has needed $25 million since 2006 to install and replace water lines. Clay, with a population of 7,765, has needed $20 million since 2002 to construct gas lines throughout the county and connect to the city of Celina. Much larger, with a population of 18,135, Humphreys County has needed $10 million to replace a bridge and $8 million to provide water and sewer at an industrial park since 2007. Planned improvements to State Route 13 in Perry County, with a population of 7,822, increased from $7.5 million to $10.7 million. Pickett County, with a population of 5,124, has needed a new high school for ten years now, estimated to cost a relatively modest $15 million. Needs of this size would not be significant in a county with a large population, but they are big enough to cause these small counties to have the largest infrastructure needs per capita. Outside of these five counties, infrastructure needs appear to be better aligned with

population. However, when you look at completed infrastructure improvements per capita in map 8, the counties are spread more evenly, with more in the top tier than in maps 1 through 7.

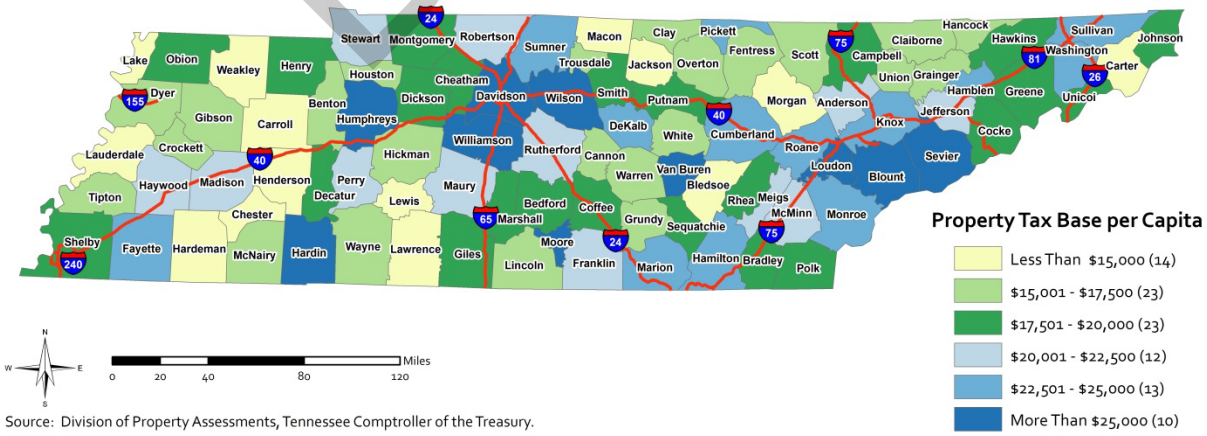
Map 8. Estimated Cost of Infrastructure Improvements Completed Per Capita

Infrastructure Needs Reported July 1, 2009, and Completed by July 1, 2014

The following maps suggest an explanation for the contrast between maps 7 and 8. There are exceptions of course, but counties in the top three or four tiers for infrastructure needs per capita (map 7) are more likely to be in one of those tiers for improvements completed per capita (map 8) if their per-capita tax bases are also in one of those tiers (maps 9 and map 10). For instance, Van Buren County is in the first tier for improvements needed per capita, improvements completed per capita, and property tax base per capita (maps 7, 8, and 9), despite having a per-capita sales tax base in the bottom tier, one of the nineteen smallest in the state (map 10).

Map 9. Equalized Assessed Property Values Per Capita by County

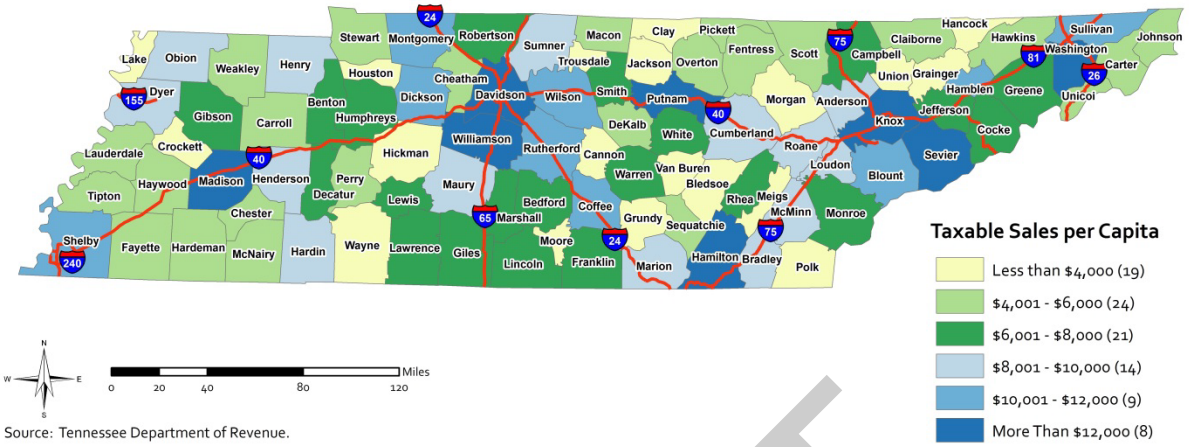
2014



Source: Division of Property Assessments, Tennessee Comptroller of the Treasury.

Map 10. Taxable Sales Per Capita by County

2014



Source: Tennessee Department of Revenue.

Van Buren is an example of the huge difference one project can make in a county with a small population. It has the highest reported per capita completed improvements ($3,599) largely because of the completion of a $13.3 million interchange at state routes 111 and 284. Arguably, considering its design and funding, the project could be considered regional and therefore would not be part of the $20.3 million in completed improvements included in the per capita calculation, but the reporting local government and development district feel that it serves mostly local residents.[10] Without this project Van Buren would be in the middle of the pack for completed improvements per capita at $1,238.

Wealth and population factors are strongly tied to infrastructure needs and completed improvements.

The maps in this chapter seem to indicate that population along with population growth and access to the resources needed to fund infrastructure are tied to both how much infrastructure is needed and how much is completed. Statistical analysis supports this observation. Correlation measures are the simplest and most common statistical approach to evaluating relationships like these. Correlation coefficients measure the strength of the relationship between two sets of numbers. The strength is reported as a range from zero for no correlation to one for perfect correlation. 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," with 763 square miles of land area, is almost seven times the size of Trousdale, which is only 114 square miles—dividing each of the factors by square miles ensures that land area does not distort the

[10] See http://www.tn.gov/assets/entities/tdot/attachments/studies-VanBurenSR-111atSR-284IJS.pdf for more details.

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

Factor Per Square Mile	Correlation With Improvement Needs Per Square Mile
Taxable Property	0.90
Taxable Sales	0.89
Income	0.88
Population	0.84
Population Gain or Loss	0.80
Population Change Rate	0.38

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

Factor Per Square Mile	Correlation With Infrastructure Completed Per Square Mile
Taxable Property	0.93
Taxable Sales	0.90
Income	0.90
Population	0.86
Population Gain or Loss	0.83
Population Change Rate	0.42

analysis. When this is done, five factors—taxable property, taxable sales, income, population, and population gain or loss—stand out in relation to both needs and the ability to meet those needs.

These five factors, as well as population change rate, rank the same for infrastructure needs as they do for completed improvements, with wealth factors (revenue sources for local governments) coming first. See tables 8 and 9. Population change rates, which get a lot of attention, are consistently only weakly correlated with unmet needs and completed improvements.

While correlation allows comparison of two factors at a time, regression analysis can compare a group of factors all together rather than in isolation to determine how they compare to each other. This kind of comparison can reveal subtler relationships than individual correlations can. And in fact, interactions among factors that look like strong predictors in isolation can produce surprising results. Regressions for the five highly correlated factors in tables 8 and 9 demonstrate that the set is a strong predictor of what counties need and are able to complete per square mile. This set of factors describes 86% of the variation in what is needed and 91% of the variation in what is completed. But although it is the second most strongly correlated factor for both needs and improvements made, sales tax base is not a significant factor when all five factors are considered together. This may be because the sales tax bases of

Table 10. Significance of Factors Affecting Infrastructure Needs and Completed Infrastructure

	Order of Significance	
Factors	**Infrastructure Needed**	**Completed Improvements**
Population	# 1**	# 2**
Income	# 2**	Not Significant
Population Gain or Loss	# 3**	Not Significant
Taxable Property	Not Significant	# 1**
Taxable Sales	Not Significant	Not Significant
Variance Described (R^2)	86%	90%

** Highly significant

* Significant

many counties are too small to play a large role in meeting infrastructure needs. Indeed, the property tax base is the most significant for improvements completed. Population, which ranks fourth in the individual correlations, is the most significant factor in relation to infrastructure needs and the second most significant for completed improvements. See table 10. These results are not counterintuitive but confirm expectations that the need for infrastructure is driven by population factors, while the ability to meet those needs relates to the ability to fund them.