Reported Infrastructure Needs By County[28]

The Largest Infrastructure Needs Are in Counties with the Largest Populations and the Largest Population Gains

With regional projects factored out (see note at right), eight of the ten counties reporting the largest infrastructure needs in dollar terms were also among the top for total population and for population gains from 1990 to 2001. Those two population factors play a somewhat smaller role in relation to the bottom ten counties. Six of the bottom ten for total report needs were among the bottom ten for population, and four were among the bottom ten for population gain. Growth rates played a much smaller role for both groups.

Statistical analysis supports the inference that population factors are closely related to total infrastructure needs. TACIR staff analyzed the relationship between reported needs and possible explanatory factors including demographic and geographic factors, as well as fiscal factors. The factors are listed at right. Fiscal capacity was measured in terms of tax base and income, the same data used in TACIR's computation of education fiscal capacity. Tax base measures included total sales and taxable property value. Income was included as a measure of the ability of county residents to afford higher or lower tax rates. Based on three separate but similar statistical analyses, population and population gain play the most significant role of all of these factors across all 95 counties (see Table 10).

Table 10. Significance of Factors Affecting Reported Infrastructure Needs

	Number of Models in Which Factor Was Significant*		
Explanatory Factor	**Highly Significant**	**Significant**	**Not Significant**
2001 Population	2	0	1
Population Gain	1	1	1
Population Density*	n/a	1	n/a
Income	0	2	1
Taxable Sales	0	0	3
Taxable Property Value	1	0	2
Land Area*	n/a	n/a	1

* Total number of models was three. Density and land area were used to make counties more comparable, rather than as separate factors, in two of the three models.

[28] For information on each county, see Appendix D.

Factors That May Explain Differences in Reported Infrastructure Needs

- ✓ Population
- ✓ Population Gain
- ✓ Population Density
- ✓ Land Area
- ✓ Fiscal Capacity or Wealth–i.e., can we afford it?

NOTE: Infrastructure needs that serve substantial numbers of people who lie outside the county in which the infrastructure is located are identified in the inventory as regional to facilitate fairer comparisons across counties. This distinction facilitates comparisons across counties by excluding from county totals infrastructure needs that serve substantial numbers of non-residents.

Examples of regional infrastructure include major transportation corridors designed to route traffic through the county to other destinations; colleges and universities; solid waste facilities that receive refuse from outside the county; and water treatment plants that serve multiple jurisdictions.

Because these types of projects are excluded from the county-level analysis, the totals here will not match the totals elsewhere in this report.

Top Ten, Bottom Ten Patterns Indicate That Population and Population Gain Play a Major Role in Total Reported Infrastructure Needs in Dollar Terms

Eight of the ten counties reporting the greatest need for infrastructure improvements were among the top ten for population. Eight were also among the top ten for population gain—seven counties appeared in the top ten for all three (greatest need, largest population and largest population gains). Five of those seven are located in the northern half of Middle Tennessee: Davidson, Montgomery, Rutherford, Sumner and Wilson. Of those five, only Montgomery is not contiguous with the others. (See Tables 9, 11 and 12.)

Table 11. Infrastructure Improvement Needs Reported for the Ten Most & Least Populous Counties

—Excluding Projects Identified as Regional—

Five - year Period July 2002 Through June 2007

Rank	County	2001 Population	Percent of Total	Total Estimated Cost	Percent of Total	Cost Per Capita
1	Shelby	896,013	15.60%	$ 3,636,291,463	20.60%	$4,058
2	Davidson	565,352	9.80%	2,989,633,250	17.00%	$5,288
3	Knox	385,572	6.70%	842,662,485	4.80%	$2,185
4	Hamilton	307,377	5.40%	561,708,355	3.20%	$1,827
5	Rutherford	190,143	3.30%	753,667,886	4.30%	$3,964
6	Sullivan	152,787	2.70%	264,723,897	1.50%	$1,733
7	Montgomery	135,023	2.40%	456,246,802	2.60%	$3,379
8	Sumner	134,336	2.30%	353,948,513	2.00%	$2,635
9	Williamson	133,825	2.30%	575,752,999	3.30%	$4,302
10	Washington	108,380	1.90%	252,587,385	1.40%	$2,331
Top Ten Subtotal		**3,008,808**	**52.40%**	**$10,687,223,035**	**60.70%**	**$3,552**
All Others[29]		**2,658,424**	**46.30%**	**$ 6,732,056,570**	**38.20%**	**$2,532**
86	Jackson	11,162	0.20%	14,711,400	0.10%	$1,318
87	Clay	7,918	0.10%	45,430,000	0.30%	$5,738
88	Houston	7,916	0.10%	12,447,000	0.10%	$1,572
89	Lake	7,764	0.10%	3,236,000	0.00%	$417
90	Perry	7,504	0.10%	18,882,000	0.10%	$2,516
91	Trousdale	7,345	0.10%	36,495,000	0.20%	$4,969
92	Hancock	6,768	0.10%	12,040,888	0.10%	$1,779
93	Moore	5,887	0.10%	6,866,000	0.00%	$1,166
94	Van Buren	5,477	0.10%	30,085,000	0.20%	$5,493
95	Pickett	5,048	0.10%	14,978,000	0.10%	$2,967
Bottom Ten Subtotal		**72,789**	**1.30%**	**$ 195,171,288**	**1.10%**	**$2,681**
Grand Total		**5,740,021**	**100.00%**	**$17,614,450,893**	**100.00%**	**$3,069**

[29] For information about the middle 75 counties, see Appendix D.

Table 12. Infrastructure Improvement Needs Reported for the Ten Counties with the Largest and Smallest Population Gains

—Excluding Projects Identified as Regional—

Five - year Period July 2002 Through June 2007

Rank	County	1990 Population	2001 Population	Population Gain	Total Estimated Cost	Cost Per Capita
1	Rutherford	118,570	190,143	71,573	$ 753,667,886	$3,964
2	Shelby	826,330	896,013	69,683	3,636,291,463	$4,058
3	Davidson	510,786	565,352	54,566	2,989,633,250	$5,288
4	Williamson	81,021	133,825	52,804	575,752,999	$4,302
5	Knox	335,749	385,572	49,823	842,662,485	$2,185
6	Montgomery	100,498	135,023	34,525	456,246,802	$3,379
7	Sumner	103,281	134,336	31,055	353,948,513	$2,635
8	Wilson	67,675	91,696	24,021	328,544,625	$3,583
9	Sevier	51,050	73,703	22,653	301,727,049	$4,094
10	Blount	85,962	108,270	22,308	259,789,338	$2,399
Top Ten Subtotal		**2,280,922**	**2,713,933**	**433,011**	**$ 10,498,264,410**	**$3,868**
All Others[30]		**2,487,635**	**2,911,298**	**423,663**	**$ 6,859,922,195**	**$2,356**
86	Grundy	13,362	14,288	926	28,880,400	$2,021
87	Houston	7,018	7,916	898	12,447,000	$1,572
88	Perry	6,612	7,504	892	18,882,000	$2,516
89	Clay	7,238	7,918	680	45,430,000	$5,738
90	Lake	7,129	7,764	635	3,236,000	$417
91	VanBuren	4,846	5,477	631	30,085,000	$5,493
92	Obion	31,717	32,346	629	34,439,000	$1,065
93	Pickett	4,548	5,048	500	14,978,000	$2,967
94	Haywood	19,437	19,761	324	55,846,000	$2,826
95	Hancock	6,739	6,768	29	12,040,888	$1,779
Bottom Ten Subtotal		**108,646**	**114,790**	**6,144**	**$ 256,264,288**	**$2,232**
Grand Total		**4,877,203**	**5,740,021**	**862,818**	**$ 17,614,450,893**	**$3,069**

Growth Rates Receive Considerable Attention, But Seem to Have Little to Do With Infrastructure Needs

The total infrastructure needs reported for each county seems to be much more closely related to population, sheer numbers of new residents (gain) and population density. Population gain—total number of new residents—should not be confused with growth rate—percentage change in population. Only three of the ten counties with the highest population growth rates (Rutherford, Williamson and Wilson, all adjacent to Davidson County) were among the ten reporting the greatest infrastructure needs. All three were among the ten with the greatest population gains. Only one of the slowest growing counties in terms of growth rates (Hancock) was among the ten reporting the least need for new or improved infrastructure. It was also among the ten with the smallest populations and the ten with the smallest population gains. (See Tables 9 and 11 through 13).

[30] For information about the middle 75 counties see Appendix D.

Table 13. Cost of Needed Infrastructure Improvements Reported for the Ten Counties with the Highest and Lowest Population Growth Rates

—Excluding Projects Identified as Regional—

Five - year Period July 2002 Through June 2007

Rank	County	1990 Population	2001 Population	Population Growth Rate	Total Estimated Cost	Cost Per Capita
1	Williamson	81,021	133,825	65.20%	$ 575,752,999	$4,302
2	Rutherford	118,570	190,143	60.40%	753,667,886	$3,964
3	Sevier	51,050	73,703	44.40%	301,727,049	$4,094
4	Tipton	37,568	52,956	41.00%	40,027,112	$756
5	Meigs	8,033	11,194	39.40%	65,822,375	$5,880
6	Cumberland	34,736	48,058	38.40%	198,774,000	$4,136
7	Jefferson	33,016	45,070	36.50%	53,809,441	$1,194
8	Hickman	16,754	22,740	35.70%	187,444,000	$8,243
9	Wilson	67,675	91,696	35.50%	328,544,625	$3,583
10	Robertson	41,492	56,083	35.20%	157,333,900	$2,805
Top Ten Subtotal		**489,915**	**725,468**	**48.10%**	**$ 2,662,903,387**	**$3,671**
All Others[31]		**3,978,955**	**4,584,743**	**15.20%**	**$ 14,258,462,108**	**$3,110**
86	Carroll	27,514	29,538	7.40%	19,868,388	$673
87	Unicoi	16,549	17,713	7.00%	61,477,025	$3,471
88	Grundy	13,362	14,288	6.90%	28,880,400	$2,021
89	Dyer	34,854	37,121	6.50%	26,704,981	$719
90	Sullivan	143,596	152,787	6.40%	264,723,897	$1,733
91	Anderson	68,250	71,457	4.70%	87,829,063	$1,229
92	Gibson	46,315	48,031	3.70%	101,275,756	$2,109
93	Obion	31,717	32,346	2.00%	34,439,000	$1,065
94	Haywood	19,437	19,761	1.70%	55,846,000	$2,826
95	Hancock	6,739	6,768	0.40%	12,040,888	$1,779
Bottom Ten Subtotal		**408,333**	**429,810**	**5.30%**	**$ 693,085,398**	**$1,613**
Grand Total		**4,877,203**	**5,740,021**	**17.70%**	**$ 17,614,450,893**	**$3,069**

Tipton County, which is immediately north of Shelby County (Memphis) on the Tennessee River, continues to stand out among the high growth counties based on growth rates, as the one reporting the lowest needs per capita. In fact, its cost per capita is only about 20 percent of the cost per capita for that group as a whole, and only six counties reported lower needs per capita (see Table 14). It is not clear why infrastructure needs reported for Tipton County remain low. It may simply serve to illustrate the point that population growth rates, while they are given much attention, are a poor predictor of infrastructure needs.

[31] For information about the middle 75 counties, see Appendix D.

Table 14. Infrastructure Improvement Needs Reported for the Most and Least Densely Populated Counties

—Excluding Projects Identified as Regional—

Five - year Period July 2002 Through June 2007

Rank	County	2001 Population	Land Area [sq. mi.]	Population per Square Mile	Total Estimated Cost	Cost Per Capita
1	Shelby	896,013	755	1,187	$ 3,636,291,463	$4,058
2	Davidson	565,352	502	1,126	2,989,633,250	$5,288
3	Knox	385,572	508	758	842,662,485	$2,185
4	Hamilton	307,377	542	567	561,708,355	$1,827
5	Sullivan	152,787	413	370	264,723,897	$1,733
6	Hamblen	58,337	161	362	82,678,852	$1,417
7	Washington	108,380	326	332	252,587,385	$2,331
8	Rutherford	190,143	619	307	753,667,886	$3,964
9	Bradley	88,850	329	270	159,651,050	$1,797
10	Sumner	134,336	529	254	353,948,513	$2,635
Top Ten Subtotal		**2,887,147**	**4,686**	**616**	**$ 9,897,553,136**	**$3,428**
All Others[32]		**2,743,229**	**32,595**	**84**	**$ 7,381,797,061**	**$2,691**
86	Humphreys	18,114	532	34	58,208,112	$3,213
87	Fentress	16,805	499	34	58,370,000	$3,473
88	Clay	7,918	236	34	45,430,000	$5,738
89	Pickett	5,048	163	31	14,978,000	$2,967
90	Bledsoe	12,516	406	31	37,560,000	$3,001
91	Hancock	6,768	222	30	12,040,888	$1,779
92	Stewart	12,650	458	28	36,699,000	$2,901
93	Wayne	16,845	734	23	22,847,696	$1,356
94	Van Buren	5,477	273	20	30,085,000	$5,493
95	Perry	7,504	415	18	18,882,000	$2,516
Bottom Ten Subtotal		**109,645**	**3,939**	**28**	**$ 335,100,696**	**$3,056**
Grand Total		**5,740,021**	**41,220**	**139**	**$17,614,450,893**	**$3,069**

Population Density Does Not Mean Lower Infrastructure Needs Per Capita Based on the Current Inventory of Needs

Five of the ten counties reporting the greatest need for infrastructure improvements are among the ten most densely populated. As a group, the ten most densely populated counties reported greater needs per capita than the other eighty-five counties. But the ten most sparsely populated counties also reported greater needs per capita as a group than the seventy-five in the middle and were close to the average for all counties. It should be noted that there is considerable variation in reported costs per capita among both the top and the bottom ten for population density that would be obscured if attention were given only to the group averages. (See Table 14.)

[32] For information about the middle 75 counties, see Appendix D.

Table 15. Population Factors for the Ten Counties Reporting Highest and Lowest Infrastructure Needs per Capita

—Excluding Projects Identified as Regional

Five-year Period July 2002 Through June 2007

Rank	County	Population 1990	Population 2001	Change	Growth Rate	Land Area [sq. miles]	Population Density	Total Reported Cost	Cost per Capita
1	Hickman	16,754	22,740	5,986	35.7%	613	37	$ 187,444,000	$ 8,243
2	Meigs	8,033	11,194	3,161	39.4%	195	57	65,822,375	$ 5,880
3	Clay	7,238	7,918	680	9.4%	236	34	45,430,000	$ 5,738
4	McNairy	22,422	24,644	2,222	9.9%	560	44	140,798,062	$ 5,713
5	Van Buren	4,846	5,477	631	13.0%	273	20	30,085,000	$ 5,493
6	DeKalb	14,360	17,552	3,192	22.2%	305	58	95,727,782	$ 5,454
7	Davidson	510,786	565,352	54,566	10.7%	502	1,126	2,989,633,250	$ 5,288
8	Trousdale	5,920	7,345	1,425	24.1%	114	64	36,495,000	$ 4,969
9	Bedford	30,411	38,327	7,916	26.0%	474	81	187,825,000	$ 4,901
10	Smith	14,143	17,988	3,845	27.2%	314	57	86,157,500	$ 4,790
Top Ten Subtotal		**634,913**	**718,537**	**83,624**	**13.2%**	**3,586**	**200**	**$ 3,865,417,969**	**$ 5,380**
All Others[33]		**4,001,229**	**4,738,067**	**736,838**	**18.4%**	**33,178**	**143**	**$ 13,545,162,784**	**$ 2,859**
86	Crockett	13,378	14,547	1,169	8.7%	265	55	14,084,000	$ 968
87	Monroe	30,541	39,846	9,305	30.5%	635	63	33,644,543	$ 844
88	Lauderdale	23,491	27,021	3,530	15.0%	470	57	20,662,000	$ 765
89	Tipton	37,568	52,956	15,388	41.0%	459	115	40,027,112	$ 756
90	White	20,090	23,364	3,274	16.3%	377	62	17,264,000	$ 739
91	Dyer	34,854	37,121	2,267	6.5%	511	73	26,704,981	$ 719
92	Weakley	31,972	34,644	2,672	8.4%	580	60	23,650,952	$ 683
93	Carroll	27,514	29,538	2,024	7.4%	599	49	19,868,388	$ 673
94	Lake	7,129	7,764	635	8.9%	163	48	3,236,000	$ 417
95	Benton	14,524	16,616	2,092	14.4%	395	42	4,728,164	$ 285
Bottom Ten Subtotal		**241,061**	**283,417**	**42,356**	**17.6%**	**4,455**	**64**	**$ 203,870,140**	**$ 719**
Grand Total		**4,877,203**	**5,740,021**	**862,818**	**17.7%**	**41,220**	**139**	**$ 17,614,450,893**	**$ 3,069**

[33] For information about the middle 75 counties, see Appendix D.

The Relationship Between Population Data and Total Reported Needs Is Stronger This Year, But Still Cannot Explain All Differences

With seven counties dominating the top ten lists for total reported infrastructure needs, total population and total population gain, it might seem that population data is sufficient to explain differences across the state in infrastructure needs reported for the ninety-five counties. The relationship for the ten counties reporting the least need is stronger in the current inventory than in the past. Four counties appear among the bottom ten on all three lists. (See Tables 9, 11 and 12.) However, population data alone still cannot explain all of the variation across the state in the needs reported for each county.

While the ten counties with the greatest population gains reported much higher than average needs per capita as a group, only one (Davidson) is among the counties reporting the very highest needs per capita.

Moreover, costs per capita, which are generally expected to be lower in more densely populated areas because of efficiencies and economies of scale, are actually higher in the more heavily populated counties based on top ten, bottom ten comparisons. But as Table 15 illustrates, that pattern does not hold when the counties are ranked in order of reported needs per capita. The ten counties with the highest and the ten with the lowest reported costs per capita both include fast and slow growing counties, and both groups are dominated by counties with population densities well below the state average.

When Population Factors Do Not Explain the Relatively Low Infrastructure Needs Reported for Some Counties, Local Tax Base Factors May

In order to better understand the more general patterns across all counties, TACIR staff apply some relatively straightforward statistical correlation and regression analyses.

As with previous inventories, comparisons of the top ten and bottom ten counties in the current inventory don't shed much light on what's happening in the counties that don't show up in the top and bottom ten, yet the seventy-five counties in the middle based on population represent about thirty-eight percent[34] of the total infrastructure needs reported. In fact, correlation analysis indicates, contrary to the top ten, bottom ten comparisons, that population gain is not particularly strongly related to the total needs reported for the ninety-five counties. In a surprising result, population growth rates bear no relationship at all to reported needs. Other factors, including tax base and wealth measures are far more strongly correlated with needs.

Both the total number and the total cost of infrastructure needs reported for the ninety-five counties are highly correlated (> 0.90)[35] with

[34] This percentage is much less than in the previous inventory, primarily because regional projects have been excluded from the current county-level analysis.

[35]The highest possible correlation is 1.00.

population and the population living in urban areas. However, total costs are even more highly correlated (>0.95) with local tax base variables and income. High correlations mean that patterns of differences (e.g., across counties) for one variable are very similar to patterns of differences for another variable. Multiple linear regression analysis makes it possible to determine which of those variables, when analyzed in combination, are more strongly related to the infrastructure needs reported across the state. This statistical process produces measures of both the strength and the size of the relationships between a single item of interest and a set of items thought to influence that single item. The process in this case was used to compare reported infrastructure needs by county to each county's 2001 population, its population growth between 1990 and 2001, the proportion of its population considered urban, its property tax base, its sales tax base and its personal income.[36]

Regression and correlation analysis allow us to compare several sets of data to determine whether and how they are related.

For the first time in three years, the three regression models used by TACIR staff did not produce consistent results.[37] No single variable was statistically significant in all three models when used to estimate the expected infrastructure needs reported in terms of total cost.[38] As shown in Table 10, the best predictors for this inventory were population, population gain and income.

Another function of multiple linear regression analysis is to make estimates of what a variable might be expected to be based on a set of other variables. This is possible because the analysis produces factors, called coefficients, that can be multiplied by the variables to calculate an expected value for the variable being predicted. Estimates derived by applying the coefficients produced by the cost analysis based on the current inventory and factoring out the influence of development districts, indicate that the current inventory captured around 90 percent of the infrastructure needs in the state, which is consistent with the previous inventory. If the total cost by county is based on the greater of the reported cost or the cost produced by the regression analysis, the statewide total could be anywhere between $24.0 and $24.2 billion rather than the $21.6 billion actually reported. Further analysis is beyond the scope of this report, but this information will assist staff in improving the inventory and may serve as the basis of future staff reports.

[36] The tax base and per capita income variables are an average of the data available for the most recent three years.

[37] Density and land area were used to make counties more comparable, rather than as separate factors, in two of the three models.

[38] That is, no variable had a probability value greater than 0.90 in all three models.