Reported Infrastructure Needs by County[30]

Infrastructure needs reported in the current inventory were identified as regional or multi-jurisdictional. This refinement facilitates comparisons across counties by excluding from county totals infrastructure needs that serve substantial numbers of non-residents. Examples 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.

Factors That May Explain Reported Infrastructure Needs

- Population
- Population gain
- Population density
- Land area
- Fiscal capacity or wealth—i.e., can we afford it?

The largest infrastructure needs are in counties with the largest population gains—smallest reported needs not so easily explained.

With regional projects factored out, the ten counties reporting the largest infrastructure needs in dollar terms are the ten counties with the largest population gains during the 1990s. Eight of those ten counties are also among the ten largest in 2000. The bottom ten counties are not as easily explained. Only three of the ten counties reporting the least needs are among the ten with the least population gain, and only five of them are among the ten with the smallest 2000 populations. Compare Tables 9, 11 and 14.

As with the last inventory, differences in reported needs cannot be fully explained without considering factors related to local fiscal capacity. 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 in the box at right. Fiscal capacity was measured in terms of tax base and per capita income. Tax base measures included total sales and taxable property value. Per capita 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 gain and the sales tax base 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	**Highly Significant**	**Significant**	**Not Significant**
2000 Population	1	0	2
Population Gain	3	0	0
Population Density*	1	n/a	n/a
Taxable Sales	3	0	0
Taxable Property Value	2	0	1
Per Capita Income	2	0	1
Land Area*	1	n/a	n/a

* 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.

30 For detailed information on each county, see Appendix D.

Higher costs per capita are associated with larger population gains.

As shown in Table 11, the cost per capita for the ten counties with the largest population gains exceeds that for the ten with the smallest gains by more than $1,400 ($3,077 versus $1,666) indicating that high growth comes at a price. While the top ten counties for the greatest population gains collectively report much higher than average needs per capita, only four of the ten (Davidson, Knox, Williamson and Sevier) are among the ten counties reporting the very highest needs per capita. (See Table 12.) The relationship between population gain and infrastructure needs per capita is not entirely clear from the inventory and bears further investigation.

Table 11. Infrastructure Improvement Needs Reported by Counties with the Largest and Smallest Population Gains, Excluding Projects Identified as Regional—Five-year Period July 2001 through June 2006

Rank	County	1990 Population	2000 Population	Population Gain	Total Estimated Cost	Cost Per Capita
1	Shelby	826,330	897,472	71,142	$ 1,976,869,579	$ 2,203
2	Rutherford	118,570	182,023	63,453	569,704,507	$ 3,130
3	Davidson	510,784	569,891	59,107	2,772,467,905	$ 4,865
4	Knox	335,749	382,032	46,283	1,506,710,455	$ 3,944
5	Williamson	81,021	126,638	45,617	488,697,057	$ 3,859
6	Montgomery	100,498	134,768	34,270	281,654,180	$ 2,090
7	Sumner	103,281	130,449	27,168	301,269,774	$ 2,309
8	Hamilton	285,536	307,896	22,360	491,221,305	$ 1,595
9	Wilson	67,675	88,809	21,134	263,525,000	$ 2,967
10	Sevier	51,043	71,170	20,127	244,213,967	$ 3,431
Top Ten Subtotal		**2,480,487**	**2,891,148**	**410,661**	**$ 8,896,333,729**	**$ 3,077**
All Others[31]		**2,290,349**	**2,685,016**	**394,667**	**$ 5,354,334,908**	**$ 1,994**
86	Moore	4,721	5,740	1,019	6,500,000	$ 1,132
87	Perry	6,612	7,631	1,019	17,640,000	$ 2,312
88	Grundy	13,362	14,332	970	29,082,800	$ 2,029
89	Lake	7,129	7,954	825	2,536,000	$ 319
90	Clay	7,238	7,976	738	20,480,000	$ 2,568
91	Obion	31,717	32,450	733	34,605,000	$ 1,066
92	Van Buren	4,846	5,508	662	28,455,000	$ 5,166
93	Pickett	4,548	4,945	397	14,320,000	$ 2,896
94	Haywood	19,437	19,797	360	26,841,500	$ 1,356
95	Hancock	6,739	6,786	47	7,969,500	$ 1,174
Bottom Ten Subtotal		**106,349**	**113,119**	**6,770**	**$ 188,429,800**	**$ 1,666**
Grand Total		**4,877,185**	**5,689,283**	**812,098**	**$14,439,098,437**	**$ 2,538**

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

Table 12. Population Factors for the Ten Counties Reporting Highest and Lowest Infrastructure Needs per Capita
Excluding Projects Identified as Regional, Five-year Period July 2001 Through June 2006

Rank	County	Population 1990	Population 2000	Population Change	Growth Rate	Land Area [square miles]	Population Density	Total Reported Cost	Cost Per Capita
1	Stewart	9,479	12,370	2,891	30.5%	458	27	$ 69,034,000	$ 5,581
2	Van Buren	4,846	5,508	662	13.7%	273	20	28,455,000	$ 5,166
3	Bedford	30,411	37,586	7,175	23.6%	474	79	186,961,000	$ 4,974
4	Davidson	510,784	569,891	59,107	11.6%	502	1,135	2,772,467,905	$ 4,865
5	Knox	335,749	382,032	46,283	13.8%	508	751	1,506,710,455	$ 3,944
6	Hardin	22,633	25,578	2,945	13.0%	578	44	99,975,087	$3,909
7	Williamson	81,021	126,638	45,617	56.3%	583	217	488,697,057	$ 3,859
8	Marion	24,860	27,776	2,916	11.7%	500	56	99,829,840	$ 3,594
9	Sevier	51,043	71,170	20,127	39.4%	592	120	244,213,967	$3,431
10	Loudon	31,255	39,086	7,831	25.1%	229	171	132,207,225	$ 3,382
Top Ten Subtotal		**1,102,081**	**1,297,635**	**195,554**	**17.7%**	**4,697**	**276**	**$ 5,628,551,536**	**$ 4,338**
All Others[32]		**3,567,198**	**4,147,306**	**580,108**	**16.3%**	**32,280**	**128**	**$ 8,671,776,866**	**$ 2,091**
86	Sequatchie	8,863	11,370	2,507	28.3%	266	43	10,610,750	$ 933
87	Crockett	13,378	14,532	1,154	8.6%	265	55	13,415,000	$ 923
88	Carroll	27,514	29,475	1,961	7.1%	599	49	26,328,148	$ 893
89	White	20,090	23,102	3,012	15.0%	377	61	17,125,000	$ 741
90	Hardeman	23,377	28,105	4,728	20.2%	668	42	20,748,000	$ 738
91	Tipton	37,568	51,271	13,703	36.5%	459	112	25,523,973	$ 498
92	Weakley	31,972	34,895	2,923	9.1%	580	60	12,057,000	$ 346
93	Lake	7,129	7,954	825	11.6%	163	49	2,536,000	$ 319
94	Lauderdale	23,491	27,101	3,610	15.4%	470	58	6,498,000	$ 240
95	Benton	14,524	16,537	2,013	13.9%	395	42	3,928,164	$ 238
Bottom Ten Subtotal		**207,906**	**244,342**	**36,436**	**17.5%**	**4,243**	**58**	**$ 138,770,035**	**$ 568**
Grand Total		**4,877,185**	**5,689,283**	**812,098**	**16.7%**	**41,220**	**138**	**$14,439,098,437**	**$ 2,538**

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

High growth rates do not necessarily mean high costs per capita.

Much attention is given to county growth rates, and infrastructure costs are often thought to be higher in areas with high growth rates. However, only two counties, Williamson and Sevier, are among both the ten reporting the greatest infrastructure needs per capita and the ten with the highest growth rates. Compare Tables 12 and 13.

Table 13. Cost of Needed Infrastructure Improvements Reported by the Ten Counties with the Highest and Lowest Population Growth Rates —Excluding Projects Identified as Regional—Five-year Period July 2001 through June 2006

Rank	County	1990 Population	2000 Population	Population Gain	Total Estimated Cost	Cost Per Capita
1	Williamson	81,021	126,638	56.3%	$ 488,697,057	$ 3,859
2	Rutherford	118,570	182,023	53.5%	569,704,507	$ 3,130
3	Sevier	51,043	71,170	39.4%	244,213,967	$ 3,431
4	Meigs	8,033	11,086	38.0%	22,375,000	$ 2,018
5	Tipton	37,568	51,271	36.5%	25,523,973	$ 498
6	Cumberland	34,736	46,802	34.7%	120,194,351	$ 2,568
7	Jefferson	33,016	44,294	34.2%	56,551,041	$ 1,277
8	Montgomery	100,498	134,768	34.1%	281,654,180	$ 2,090
9	Hickman	16,754	22,295	33.1%	64,460,000	$ 2,891
10	Cheatham	27,140	35,912	32.3%	86,305,500	$ 2,403
Top Ten Subtotal		**508,379**	**726,259**	**42.9%**	**$ 1,959,679,576**	**$ 2,698**
All Others[33]		**3,960,473**	**4,532,708**	**14.4%**	**$ 11,812,081,645**	**$ 2,606**
86	Grundy	13,362	14,332	7.3%	29,082,800	$ 2,029
87	Carroll	27,514	29,475	7.1%	26,328,148	$ 893
88	Dyer	34,854	37,279	7.0%	62,362,158	$ 1,673
89	Unicoi	16,549	17,667	6.8%	40,221,910	$ 2,277
90	Sullivan	143,596	153,048	6.6%	169,187,052	$ 1,105
91	Anderson	68,250	71,330	4.5%	162,478,148	$ 2,278
92	Gibson	46,315	48,152	4.0%	108,261,000	$ 2,248
93	Obion	31,717	32,450	2.3%	34,605,000	$ 1,066
94	Haywood	19,437	19,797	1.9%	26,841,500	$ 1,356
95	Hancock	6,739	6,786	0.7%	7,969,500	$ 1,174
Bottom Ten Subtotal		**408,333**	**430,316**	**5.4%**	**$ 667,337,216**	**$ 1,551**
Grand Total		**4,877,185**	**5,689,283**	**16.7%**	**$ 14,439,098,437**	**$ 2,538**

Among the high growth counties in Table 13, based on growth rates, Tipton County stands out as the one with the lowest reported needs per capita. In fact, its cost per capita is less than 20 percent of the cost per capita for that group as a whole. It is not clear why Tipton County's reported infrastructure needs are low. Population growth rates, while they are given much

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

attention, may not be the best predictor of infrastructure needs. Based on the data in the current infrastructure needs inventory, absolute population increases are much better predictors of high reported needs.

The bottom ten counties for total reported needs are not as easily explained as the top ten counties.

Eight counties appear both in the top ten for total infrastructure needs reported and in the top ten for population. This consistency might indicate that there is a strong relationship between total population or population density and infrastructure needs. However, both TACIR's statistical analysis (see Table 10) and inspection of the data indicate that this is not the case. Counties in the top and bottom groups in Tables 14 and 15 fall both well above and well below the statewide figure of $2,538 per capita.

Table 14. Infrastructure Improvement Needs Reported by Most and Least Populous Counties—Excluding Projects Identified as Regional—Five-year Period July 2001 through June 2006

Rank	County	2000 Population	Percent of Total	Total Estimated Cost	Percent of Total	Cost Per Capita
1	Shelby	897,472	15.8%	$ 1,976,869,579	13.7%	$ 2,203
2	Davidson	569,891	10.0%	2,772,467,905	19.2%	$ 4,865
3	Knox	382,032	6.7%	1,506,710,455	10.4%	$ 3,944
4	Hamilton	307,896	5.4%	491,221,305	3.5%	$ 1,595
5	Rutherford	182,023	3.2%	569,704,507	3.9%	$ 3,130
6	Sullivan	153,048	2.7%	169,187,052	1.2%	$ 1,105
7	Montgomery	134,768	2.4%	281,654,180	2.0%	$ 2,090
8	Sumner	130,449	2.3%	301,269,774	2.1%	$ 2,309
9	Williamson	126,638	2.2%	488,697,057	3.4%	$ 3,859
10	Washington	107,198	1.9%	204,916,724	1.4%	$ 1,912
Top Ten Subtotal		**2,991,415**	**52.6%**	**$ 8,762,698,538**	**60.7%**	**$ 2,929**
All Others[34]		**2,624,997**	**46.1%**	**$ 5,530,638,599**	**38.3%**	**$ 2,107**
86	Jackson	10,984	0.2%	12,873,800	0.1%	$ 1,172
87	Houston	8,088	0.1%	14,107,000	0.1%	$ 1,744
88	Clay	7,976	0.1%	20,480,000	0.1%	$ 2,568
89	Lake	7,954	0.1%	2,536,000	0.0%	$ 319
90	Perry	7,631	0.1%	17,640,000	0.1%	$ 2,312
91	Trousdale	7,259	0.1%	20,880,000	0.1%	$ 2,876
92	Hancock	6,786	0.1%	7,969,500	0.1%	$ 1,174
93	Moore	5,740	0.1%	6,500,000	0.0%	$ 1,132
94	Van Buren	5,508	0.1%	28,455,000	0.2%	$ 5,166
95	Pickett	4,945	0.1%	14,320,000	0.1%	$ 2,896
Bottom Ten Subtotal		**72,871**	**1.3%**	**$ 145,761,300**	**1.0%**	**$ 2,000**
Grand Total		**5,689,283**	**100.0%**	**$14,439,098,437**	**100.0%**	**$ 2,538**

Five counties appear among the bottom ten on both lists (i.e., the least needs and the smallest populations). One of those five (Lake) also appears among the ten with the least needs per capita in Table 12. Interestingly, two of the ten counties with the lowest population densities (Stewart and Van Buren) and two of those with the highest densities (Davidson and Knox) are

34 For information about the middle 75 counties, see Appendix D.

Table 15. Infrastructure Improvement Needs Reported by the Most and Least Densely Populated Counties—Excluding Projects Identified as Regional —Five-year Period July 2001 through June 2006

Rank	County	2000 Population	Land Area [sq. mi.]	Population per Square Mile	Total Estimated Cost	Cost Per Capita
1	Shelby	897,472	755	1,189	$ 1,976,869,579	$ 2,203
2	Davidson	569,891	502	1,135	2,772,467,905	$ 4,865
3	Knox	382,032	508	751	1,506,710,455	$ 3,944
4	Hamilton	307,896	542	568	491,221,305	$ 1,595
5	Sullivan	153,048	413	371	169,187,052	$ 1,105
6	Hamblen	58,128	161	361	134,069,058	$ 2,306
7	Washington	107,198	326	329	204,916,724	$ 1,912
8	Rutherford	182,023	619	294	569,704,507	$ 3,130
9	Bradley	87,965	329	268	211,260,900	$ 2,402
10	Montgomery	134,768	539	250	281,654,180	$ 2,090
Top Ten Subtotal		**2,880,421**	**4,695**	**613**	**$ 8,318,061,665**	**$ 2,888**
All Others[35]		**2,699,883**	**32,585**	**83**	**$ 5,832,002,000**	**$ 2,160**
86	Clay	7,976	236	34	20,480,000	$ 2,568
87	Humphreys	17,929	532	34	29,145,000	$ 1,626
88	Fentress	16,625	499	33	41,880,000	$ 2,519
89	Hancock	6,786	222	31	7,969,500	$ 1,174
90	Bledsoe	12,367	406	30	27,485,000	$ 2,222
91	Pickett	4,945	163	30	14,320,000	$ 2,896
92	Stewart	12,370	458	27	69,034,000	$ 5,581
93	Wayne	16,842	734	23	32,626,272	$ 1,937
94	Van Buren	5,508	273	20	28,455,000	$ 5,166
95	Perry	7,631	415	18	17,640,000	$ 2,312
Bottom Ten Subtotal		**108,979**	**3,939**	**28**	**$ 289,034,772**	**$ 2,652**
Grand Total		**5,689,283**	**41,220**	**138**	**$14,439,098,437**	**$ 2,538**

among the ten reporting the greatest needs per capita. Compare Tables 12 and 15. These top ten and bottom ten comparisons do not appear to support the notion that higher population densities correlate to lower infrastructure costs per capita, but no conclusions can be drawn in that regard without examining the 75 counties in the middle.

35 For information about the middle 75 counties, see Appendix D.

When population factors do not explain the relatively low costs reported by some counties, local tax base factors may.

As with the previous inventory, 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 75 counties in the middle based on population represent nearly 38 percent[36] of the total reported outside of the four largest counties in the state. In order to better understand the more general patterns across all counties, TACIR staff applied some relatively straightforward statistical correlation and regression analyses similar to those used to develop the education fiscal capacity indices used to allocate the local share of Tennessee's education funding formula.[37] These analyses may also suggest other factors that may account for the presence of some counties in the bottom ten when population factors do not. They certainly suggest areas for more in-depth analysis than could be accomplished with the resources currently available for this project.

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

Both the total number and the total cost reported for infrastructure needs by county are highly correlated (> 0.90)[38] with population, increases in population and the population living in urban areas. However, both are equally highly correlated with local tax base variables and per capita income. And of course, there is a high correlation between the population variables and the tax base variables. 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 2000 population, its population growth between 1990 and 2000, the proportion of its population considered urban, its property tax base, its sales tax base and its per capita income.[39] Three different models were used to analyze this information, and the results for all were consistent.[40]

As indicated by Table 10, population gain and taxable sales had the most consistent and the strongest relationship to reported infrastructure needs in terms of estimated costs for the current inventory. This is a change from the results reported for the previous inventory. At that time, the total estimated costs were most strongly related to the property tax base. The reason for this change is not clear; however, it may be the result of several factors, including better reporting and the exclusion of regional projects. All three regression models produced better results with the current inventory than with the last, indicating that the inventory itself may be of higher quality.

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

37 The Tennessee Advisory Commission on Intergovernmental Relations, *Local Fiscal Capacity for Funding Education in Tennessee* (July 1994).

38 The highest possible correlation is 1.00.

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

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

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 $22.2 and $22.4 billion rather than the $20.5 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.