

DRAFT

5.0 GREENVILLE ONLY

PAVEMENT SECTIONS INVESTIGATED FOR GREENVILLE

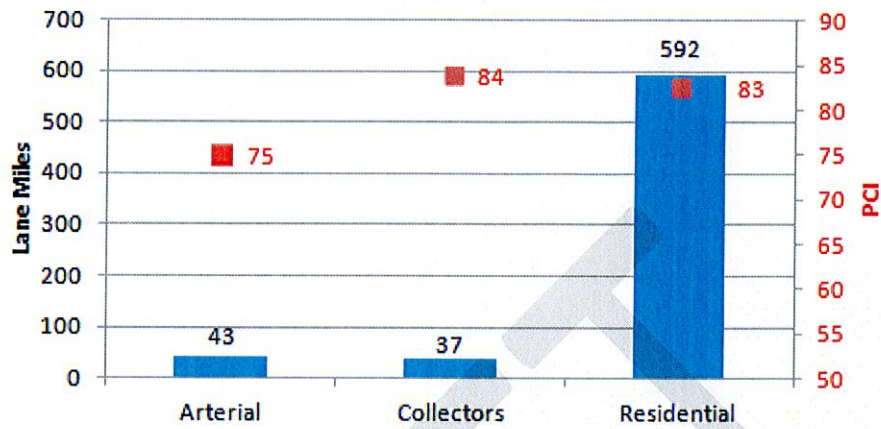
The network in Greenville can be broken down into three functional classes: those streets classified as arterials, those classified as collectors, and the remaining streets classified as residential. The bar graph below shows the number of lane miles for each group and the related PCI's. The average PCI for the arterials is somewhat lower than the other two groups. The lane miles for the residential streets makes up 88% of the total network.

Functional Class	Length (Miles)	Lane Miles	Percentage (Lane Mile)	Weighted Average PCI
Arterial	11.44	43.04	6.40%	74.82
Collectors	9.21	37.44	5.57%	83.84
Residential	246.87	591.70	88.03%	82.58
Totals	267.52	672.18	100%	82.15

Total Roads Inspected and Percentages

Greenville has 672 lane miles divided into three functional classes. Figure 5.0.1 summarizes the information regarding the network.

**Lane Miles and Weighted Average PCI
by Functional Class**
Total Lane Miles = 672



**Figure 5.0.1 - Pavement Lane Miles and Average PCI
by Functional Class**

City of Greenville Network for 2014 by M&R Category

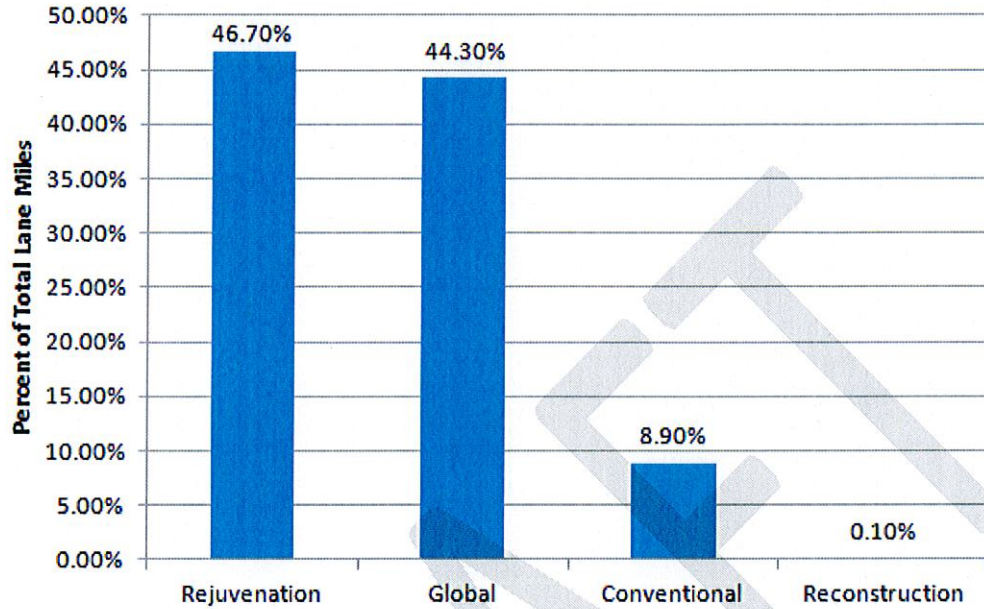
M&R Category	PCI	Lane Miles	Lane Mile %	Unit Cost	2014 Cost
Rejuvenation	86-100	313.98	46.70%	N/A	\$0
Global	66-85	41.4* 256.62	6.2%* 38.1%	\$0* \$30,600	\$0* \$7,852,572
Conventional	31-65	59.53	8.90%	\$56,000	\$3,333,680
Reconstruction	0-30	0.65	0.10%	\$238,000	\$154,700
Total		672.18	100%		\$11,340,952

*Arterials and Collectors did not receive a Global treatment

Percent of Total Lane Miles by M&R Category

Year = 2014

Total = 672 Lane Miles

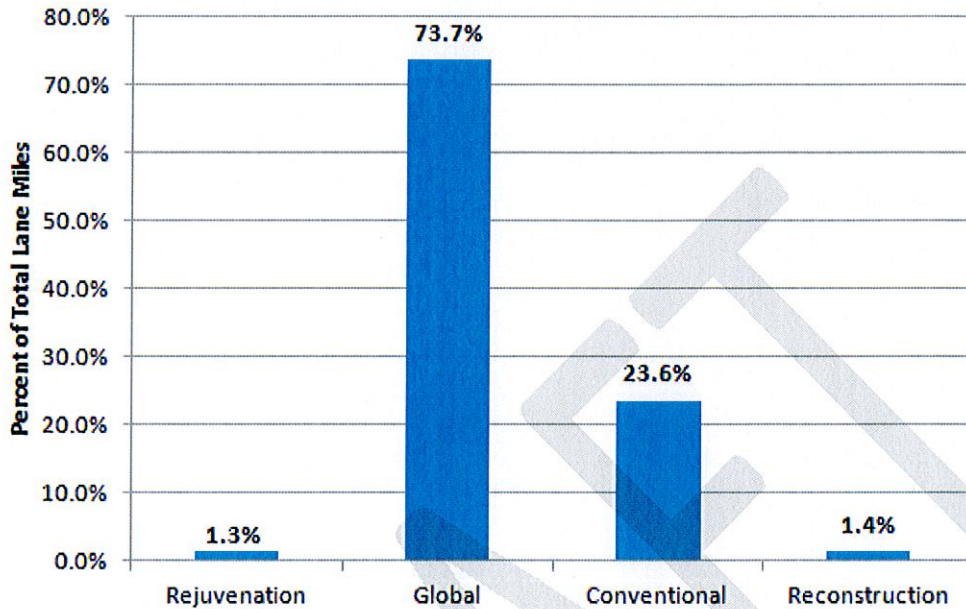


City of Greenville Network for 2019 by M&R Category (Do Nothing)

M&R Category	PCI	Lane Miles	Lane Mile %	Unit Cost	2014 Cost
Rejuvenation	86-100	8.79	1.3%	N/A	\$0
Global	66-85	47.54* 447.94	7.0%* 66.7%	\$0* \$30,600	\$0* \$13,706,964
Conventional	31-65	158.81	23.6%	\$56,000	\$8,893,360
Reconstruction	0-30	9.1	1.4%	\$238,000	\$2,165,800
Total		672.18	100.0%		\$24,766,124

*Arterials and Collectors did not receive a Global treatment

Do Nothing (Year = 2019)
Percent of Total Lane Miles by M&R Category
 Year = 2019
 Total = 672 Lane Miles



5.1 GREENVILLE BUDGET ANALYSIS (M&R Only)

The analysis below has the following set of assumptions:

- The dollar figures were not adjusted for inflation.
- Until Greenville has sufficient years of data to develop their own performance curves, deducts will be assigned based on an average of the APWA/MicroPAVER model and the NC DOT Curve. Please refer to section 3.1 for details.
- Last year's maintenance budget was around \$900K
- City staff estimates the annual budget should be \$2-3M

The following section contains the budget analysis:

- 5.1.1 Worst-first approach for Network using \$1.0 Million annual budget
- 5.1.2 Worst-first approach for Network using \$2.5 Million annual budget
- 5.1.3 Worst-first approach for Network using \$2.5 Million annual budget using Liquid Road Credit Approach

The Greenville staff requested that Transmap conduct a sensitivity analysis using the worst-first approach to maintenance of the system. This analysis focused on the 2014 conventional and global M&R Categories, and was completed using Excel Spreadsheets.

5.1.1 Greenville Network using a \$1.0M Annual Budget

This section shows the impact of an annual \$1.0M budget, worst-first, has on the network level average PCI.

Year	Weighted Average PCI	Change in PCI	Actual Cost	# of sections	Lane-Miles (Total Lane Miles= 672)
2014	82.15				
2015	81.16	drop 0.99	\$1,004,771	78	13.64
2016	80.29	drop 0.87	\$1,002,781	95	17.91
2017	79.30	drop 0.99	\$1,006,335	97	17.97
2018	78.30	drop 1.00	\$1,024,353	83	18.29
2019	77.22	drop 1.08	\$1,007,091	83	17.98
Total		4.93	\$5,045,331	436	85.79

** Liquid Road applied to 'Local' roads only

Table 5.1.1: \$1.0M Annual Budget, based on a worst-first selection.

5.1.2 Greenville Network using a \$2.5M Annual Budget

This section shows the impact of an annual \$2.5M budget, worst-first, has on the network level average PCI. Liquid Road was used, however, no credit was applied to the weighted average PCI.

Year	Weighted Average PCI	Change in PCI	Actual Cost	# of sections	Lane-Miles (Total Lane Miles= 672)
2014	82.15				
2015	82.98	gain 0.83	\$2,510,714	216	40.53
2016	83.47	gain 0.49	\$2,499,541	220	44.63
2017	82.93	drop 0.54	\$2,498,808	288	57.05
2018	81.00	drop 1.93	\$2,503,006	399	79.55
2019	79.35	drop 1.65	\$2,502,773	398	78.83
Total		drop 2.80	\$12,514,842	1,521	300.59

** Liquid Road applied to 'Local' roads only

Table 5.1.2: \$2.5M Annual Budget, based on a worst-first selection.

5.1.3 Greenville Network using a \$2.5M Annual Budget using the Liquid Road Credit Approach

This section shows the impact of an annual \$2.5M budget, worst-first, has on the network level average PCI.

Year	Weighted Average PCI	Change in PCI	Actual Cost	# of sections	Lane-Miles (Total Lane Miles= 672)
2014	82.15				
2015	82.98	gain 0.83	\$2,510,714	216	40.53
2016	83.47	gain 0.49	\$2,499,541	220	44.63
2017	83.65	drop 0.54	\$2,498,808	288	57.05
2018	83.37	drop 1.93	\$2,503,006	399	79.55
2019	82.86	drop 0.65	\$2,502,773	398	78.83
Total		drop 1.80	\$12,514,842	1,521	300.59

** Liquid Road applied to 'Local' roads only

Table 5.1.3: \$2.5M Annual Budget, Liquid Road Credit Approach based on a worst-first selection

Figure 5.0.2 below shows the comparison of the budgets using worst-first approach. The \$2.5M budget with the Liquid Road credit approach (blue line) is used for illustrative purposes. It uses a little more engineering judgement up front while a similar technique is embedded in the MicroPAVER Software.

The credit approach procedure is applied when a portion of the budget is spent on a seal coat. A seal coat, by definition, provides a 5 year stabilization or hold on the PCI. In this case, if the pavement sections on residential streets had a PCI between 66 and 85, the Heavy Duty Seal Coat such as Liquid Road was the preferred maintenance repair. Instead of holding the PCI at the same numerical value for the remainder of the analysis period, it gives credit to the M&R repair and then applies the standard deduct value for the next five years.

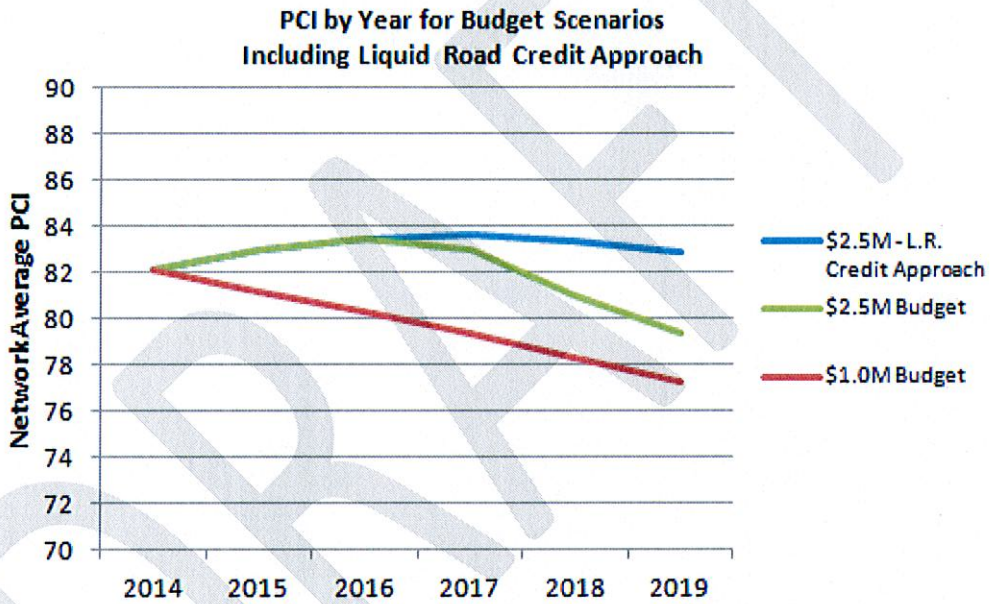


Figure 5.0.2

5.2 GREENVILLE SUMMARY

Table 5.1.1 shows that the \$1M annual budget allows the average network PCI to drop 4.93 points in the 5-year period. If sufficient funds are not provided, there will be an additional cost for maintenance treatments in the future. The PCI of pavements will drop from the Global M&R Category into the Conventional M&R Category. Transmap recommends using the APWA preventative maintenance approach to start reversing this trend.

With only 0.65 lane miles of streets in the M&R Reconstruction Category (PCI 0-30), the staff is doing a great job maintaining the City streets. However, at the current budget level, the PCI will continue to slowly decline. The City staff should consider ways to obtain additional funds to allocate to repairs while attempting to keep the remainder of the network in or above the Global M&R Category. Money spent on timely pavement preservation techniques, such as Liquid Road, crack seal/slurry seal or chip seal allows Greenville to keep their higher scoring roadways at a high level of service without a significant increase in backlog.

The \$2.5M annual budget shows an increase in network PCI, then a few years of network stabilization, followed by a drop in PCI in 2017, 2018 and 2019. However, the big advantage in the \$2.5M annual budget is that the maintenance repairs impacts approximately 300 lane miles of streets while the \$1.0M budget only provides for approximately 86 lane miles of repairs. Also, using a preventative maintenance procedure like Liquid Road will extend the life of the pavement on residential roads.

The \$2.5M annual budget, with the Liquid Road Credit Approach, shows an increase in network PCI, then network stabilization at a PCI approximately 83. The \$2.5M annual budget, has the same advantages as denoted in the previous paragraph.

Greenville should be able to see dramatic and sustained improvement in the condition of its street network, concurrent with its use of regular pavement condition surveys. The system enables the staff to forecast future needs, conduct research that contributes to improved pavement performance, and maximize pavement investments by objectively prioritizing roadway preservation and improvement projects.

In addition, the Pavement Management System provides a rational basis for communicating with the internal and external customers about stewardship of the City's infrastructure. The staff has the tools to blend reliable data for use in their analysis and to foster two-way communication of the results with decision makers.

It has been Transmap's pleasure to work with the Greenville staff to begin the development of a Pavement Management System. We are certain that the information provided is useful in keeping the network in optimum condition given budget constraints.