THE ROAD TO RUIN

STATE HIGHWAY PAVEMENTS:

ARE WORSENING CONDITIONS ON THE HORIZON?

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JOHN J. SHUFON

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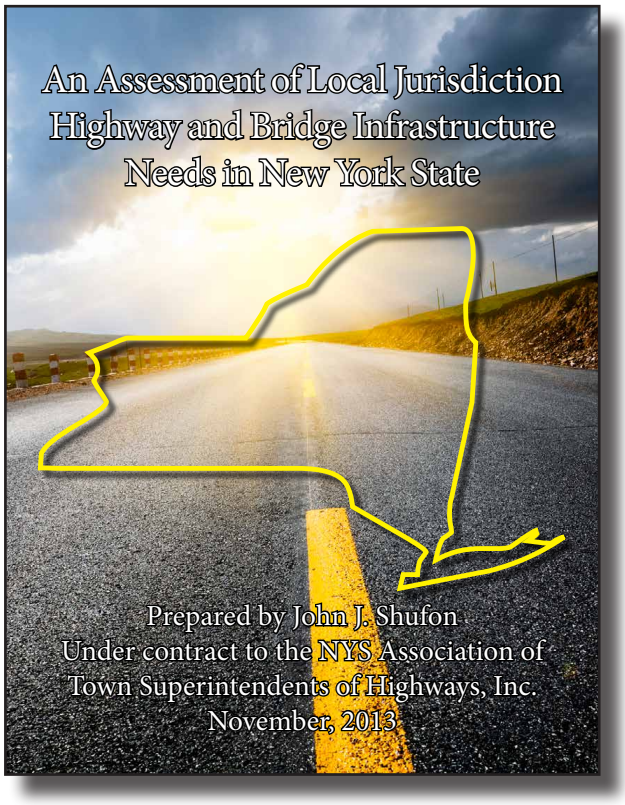
INVEST IN NEW YORK STATE'S INFRASTRUCTURE.

OUR FUTURE AND ECONOMY ARE BUILT ON IT.

ABOUT THE AUTHOR

This report was authored by John J. Shufon. John has 35 years of experience with the New York State Department of Transportation (NYSDOT) in the collection, analysis, and forecasting of infrastructure data. In 1991, he was appointed the Department's first pavement manager where he developed the condition survey still in use today as well as several technical tools used in the pavement program development process. He is published in pavement management, management systems and asset management, and for 15 years served as the Department's chief technical analyst in conducting a variety of needs studies for use in budget requests and capital program development. John retired from the Department in 2006 as the Director of the Data Analysis and Forecasting Bureau. Since then, working under contract to the New York State Association of Town Highway Superintendents, he prepared the 2007 and 2013 needs studies addressing local jurisdiction pavements and bridges.



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INTRODUCTION

The New York State Highway System is a complex network of roadways owned by the State and maintained by the New York State Department of Transportation (NYSDOT). The system is comprised of approximately 15,000 centerline miles, 39,000 lane miles and carries over 70 billion vehicle miles of travel (VMT) annually. The main purpose of this highway network is to provide safe and reliable mobility to the State's citizenry as they travel to work, to school, to the store, etc. State Highways, which include the non-toll portion of the Interstate System, are also vital to the efficient movement of goods. According to the most recent commodity flow survey conducted by the federal government, almost one trillion dollars in goods is shipped annually by truck to and from sites located in New York State [1]. Most of this shipping occurs over the State Highway System. Simply put, State Highways are critical to the economic well-being of New York State.

Given the importance of this highway system, pavement conditions must be maintained at the highest level in order to ensure maximum serviceability to the motoring public. Results from NYSDOT annual condition surveys indicate the **near term** trend in surface ratings for State Highways is stable. This means the Department has done a good job in maintaining the system given a very limited budget for pavement repair.

There are other measures, however, which do not bode well for future conditions. The purpose of this report is to provide an analysis of these measures and to discuss trends which portend a significant worsening of pavement conditions. The paper concludes with recommendations on program funding levels necessary to stabilize and even improve pavement conditions over the **long term**.

PAVEMENT CONDITION TRENDS

Each year the NYSDOT conducts an assessment of the pavement condition of the State Highway System. The survey is conducted by regional rating teams who are trained in the use of carefully developed photographic scales of pavement surface condition. The surface scale was developed so each scale point represents a pavement in need of a general repair strategy such as preventive maintenance or rehabilitation[2]. Surface ratings are reported by condition classification where pavements rated 1-5 are poor, pavements rated 6 are fair, 7 and 8 are good and 9 and 10 are reported as excellent. In general, pavements rated poor and fair are candidates for repair.

Figure 1 presents the 20 year trend in the percentage of pavements rated poor plus fair. It should be noted that the 2017 condition survey results were not available at the time of this writing.

As can be seen from the figure, the percentage of pavements rated poor plus fair has decreased from 2012. This is most likely due to the implementation of the New York Works Program. This program provided $230 million over and above the existing resource level and resulted in an additional 2,157 miles of resurfacings[3]. The problem is that New York Works was a one-shot and most of the additional accomplishment was maintenance type work. These pavements are now deteriorating and will soon fall en masse into the fair range where work is needed.

Figure 1
State Highway Surface Condition Trend
% Poor + Fair by Year

[1] Source: NYSDOT Pavement Condition Reports

PAVEMENT CONDITION TRENDS

Table 1
Pavements Rated 7 and Average Surface Ratings
2012-2016 [1]

Year	Lanes Miles Rated 7	Average Surface Rating
2012	13,679	6.98
2013	13,289	6.99
2014	14,306	6.99
2015	14,946	6.92
2016	15,643	6.93

[1] Source: NYSDOT Pavement Condition Surveys

This contention is supported by the data contained in Table 1. This table provides the number of lane miles rated "7," a data item which is masked when condition levels are reported by range. Notice the buildup in mileage from 13,679 in 2012 to 15,643 in 2016, a difference of almost 2,000 lane miles. These are the pavement sections ready to drop into the fair range. In addition, the average surface score for all State Highways surveyed decreased from 6.98 in 2012 to 6.93 in 2016. This may not seem like a huge drop, but given the extremely large number of observations (i.e. highway sections surveyed), this drop in condition is statistically significant.

Lastly, NYSDOT annually computes the cost to repair the entire backlog of work required by State Highways. The backlog is estimated using the surface rating and other condition variables for each highway section, as well as a treatment matrix and the most recent repair costs. In 2016, the cost to repair the backlog was estimated at $5.5 billion up from $4.3 billion just two years prior in 2014[4]. During this time period, highway construction costs were stable[5]. Thus, the growing backlog of work is another measure which indicates overall pavement conditions are worsening, not improving as suggested in Figure 1.

THE PAVING CYCLE

The paving cycle (PC) is the number of years necessary to resurface or repair a highway network at the rate given in a pavement program. It is calculated by dividing the total system lane mileage by the number of miles proposed to be treated. For example, if a region with a 3,000 lane mile system resurfaced 200 lane miles each year, the paving cycle is 15. Preventive maintenance non-paving actions such as crack sealing are not included in this calculation.

The paving cycle is a measure of program magnitude and was first introduced to the Department as part of a goal-setting effort back in the late 1990s[6]. It is a measure that has been used over the years in the establishment of pavement program goals. In fact, the Commissioner of Transportation in a 2010-2015 budget address to the legislature stated, "In order to address fiscal constraints, the paving cycle was lengthened from 12 years to 14 years (12 years is considered the national average). The pavement treatments selected were not always optimum to preserve pavement life. The Department's goal is to re-establish the paving cycle of 12 years or less[7]."

Table 2 presents the NYSDOT paving cycle for the 5 year period ending in 2016. Notice the increase in the paving cycle from 8.6 years to 22.9 years in 2016. It is highly unlikely that pavement conditions can be maintained over the long term given this dramatic decline in paving activity. In

Table 2
NYSDOT Paving Program and Calculated Paving Cycle
2012-2016 [1]

Year	System Extent (Lane Miles)	Paving Program ($ Millions)	Lane Miles Resurfaced	Paving Cycle
2012	38,567	614	4,473	8.6
2013	38,698	317	2,885	13.4
2014	38,717	327	2,752	14.1
2015	38,698	394	2,311	16.7
2016	38,711	325	1,687	22.9
Average	**38,678**	**395**	**2,822**	**13.7**

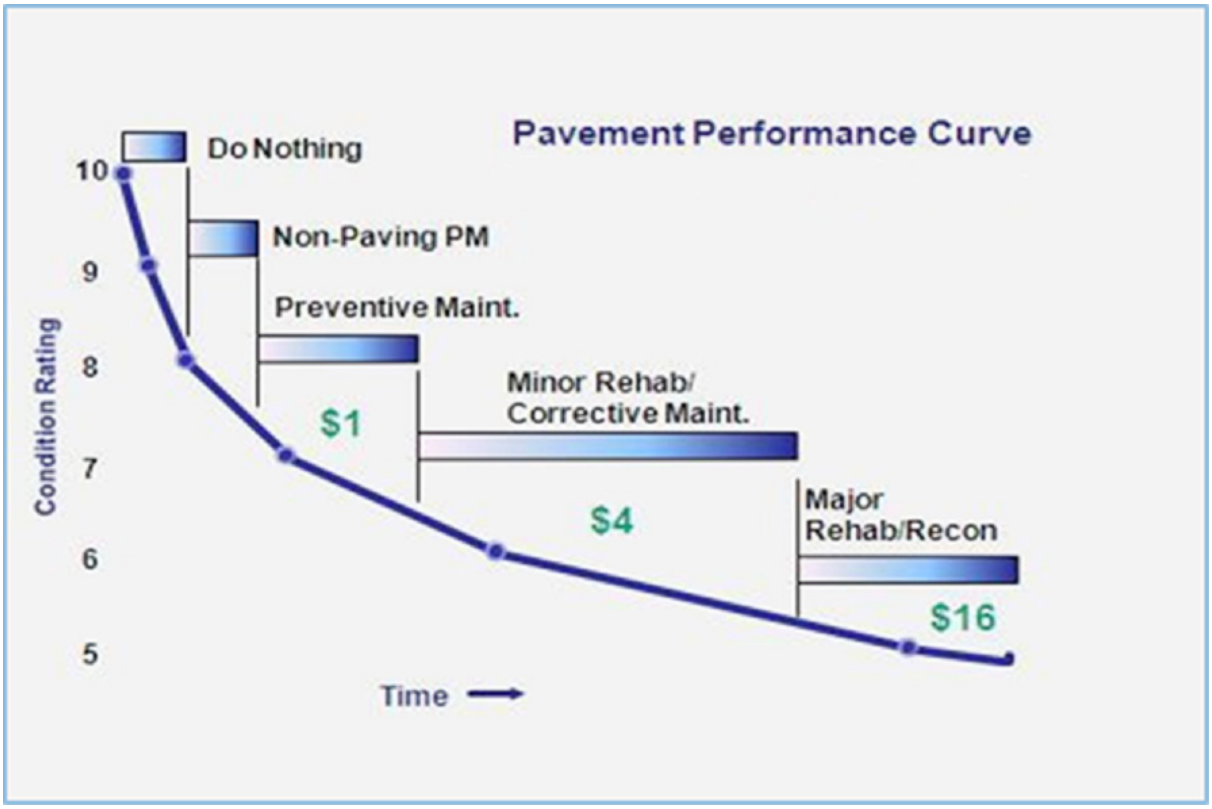
[1] Source: NYSDOT Pavement Reports 2012 - 2016

THE PAVING CYCLE

addition, the 1,687 lane miles resurfaced in 2016 is far below the recommended 3,000 lane miles that need to be paved annually to meet a 12 year paving cycle. **The paving cycle for 2016 is at the highest level ever recorded.**

It is important to note that paving cycles such as the 2015 and 2016 levels allow thousands of miles of pavement in fair condition to deteriorate into the poor range. Deferring treatment increases repair costs exponentially as the pavement structure accumulates more and more damage. This will result in ever more strain on future pavement budgets. Figure 2 shows the NYSDOT pavement performance curve and the relative increase in treatment costs as conditions worsen.

Figure 2



Source: NYSDOT presentation, Liquid Asphalt Distributors Assoc. Conference, November, 2017

AVERAGE TREATMENT LIFE

The average treatment life (TL) is the weighted average service life of all pavement treatments in a paving program. This measure, also introduced in the aforementioned goal-setting activity, is a measure of program strength or "rigor." The higher the percentage of longer lasting repairs such as rehabilitation or "renewal," the higher the average treatment life of the program. Consistent with the Department's pavement design manual, service life values used in the average treatment life calculation are 18 years for renewal, 10 years for corrective maintenance, and 8 years for preventive maintenance[8].

Table 3 presents the results of the calculations for 2012-2016. The values shown suggest a trend toward the lower cost maintenance type treatments. This is not a bad strategy for the near term and it is obvious from Figure 1 that it has been successful over the past few years. There are, however, drawbacks to a program which relies heavily on thin overlays. For example, these repairs must be applied at the proper condition level in order to reach the desired design life. If applied as a "band aid" to pavements rated poor or fair or pavements with structural distresses, these treatments may only last a few years. In addition, preventive maintenance paving actions generally do not add strength to the pavement structure nor do they address safety deficiencies such as substandard clear zones or poor alignment.

Renewal projects, on the other hand, add structural strength to the pavement which significantly slows the deterioration process. In addition, these projects comply with rigorous design standards which were developed to ensure a safe and efficient highway system for the motoring public.

Table 3
NYSDOT Paving Program and Calculated Average Treatment Life
2012 – 2016 [1]

Year	Total Lane Miles Resurfaced	Renewal Treatments	Corrective Maintenance Treatments	Preventative Maintenance Treatments	Average [2] Treatment Life
2012	4,473	224	939	3,310	8.9
2013	2,885	115	346	2,424	8.6
2014	2,752	165	1,349	1,238	9.6
2015	2,311	231	1,109	971	10.0
2016	1,687	186	995	506	10.3
Average	**2,822**	**184**	**948**	**1,690**	**9.3**

[1] Source: NYSDOT Pavement Condition Reports 2012 – 2016
[2] Average Treatment Life Calculation assumes pavements were treated at appropriate condition levels.

THE RATIO OF TREATMENT LIFE OVER PAVING CYCLE

Table 4
NYSDOT Paving Cycle and Average Treatment Life 2012 - 2016

Year	Paving Cycle (PC) (Years)	AVG. Treatment Life (TL) (Years)	TL/PC
2012	8.6	8.9	1.0
2013	13.4	8.6	0.6
2014	14.1	9.6	0.7
2015	16.8	10.0	0.6
2016	22.9	10.3	0.5
Average	**13.7**	**9.3**	**0.7**

The average treatment life measure taken alone means little. For example, if a region's total paving program consisted of just one mile of rehabilitation, the average treatment life of the program would be very high. Thus, the treatment life measure must be used in conjunction with the paving cycle. Table 4 presents the ratio of treatment life to paving cycle over the 5 year period from 2012-2016.

As can be seen from the table, the only year the treatment life exceeded the paving cycle was 2012 due to the one-shot New York Works Program. All other years the ratio was much lower. **The bottom line here is that over the last 5 years, on the average, State Highways were resurfaced once every 13.7 years and the treatments lasted only 9.3 years. This is a telling statistic**. If this imbalance is allowed to continue, system-wide conditions will worsen significantly and over time create an even larger backlog of pavements needing work.

RECOMMENDED RESOURCE NEEDS

Table 5 presents resource needs for two pavement program scenarios. The first column of the table shows the paving accomplishments of the 2016 program by treatment type. The second column, Scenario 1, is the amount of resurfacing which must be accomplished to lower the paving cycle to the standard 12 years at the same project mix as the 2016 program. Notice the treatment life remains the same at 10.3 years. Implementation of this scenario will maintain pavement conditions over the short term similar to the effects of the New York Works Program. The cost to implement Scenario 1 (with 3,226 lane miles repaired in a 12-year cycle) is estimated at $520 million annually, an increase of $195 million over the 2016 funding level.

Scenario 2 retains the 12-year paving cycle with 3,226 lane miles repaired, but increases the average treatment life to 12 years as well. This is accomplished by decreasing thin overlays and increasing the long lasting "renewal" projects to twenty five percent of the program. This strategy will result in an improvement in pavement conditions over the long term as well as provide a safer highway environment. Cost to implement Scenario 2 is $710 million per year, an increase of $385 million per year over the 2016 expenditure.

Table 5
Alternative Paving Program Scenarios and Resource Needs

	2016 Program Levels	Scenario 1	Scenario 2
Lane Miles (LM) Repaired	1,687	3,226	3,226
LM Renewal/% of Program	186/11%	355/11%	800/25%
LM Corrective Maint./% of Program	995/59%	1,903/59%	1,903/59%
LM Preventative Maint./% of Program	506/30%	968/30%	523/16%
Paving Cycle (Years)	22.9	12	12
Average Treatment Life (Years)	10.3	10.3	12
Resource Needs ($ Millions)	**$325**	**$520**	**$710**

CONCLUSION

In conclusion, the answer to the question posed in the title to this report is a resounding **yes**. There are several indicators suggesting State Highway pavement conditions are going to worsen and worsen considerably. These indicators include a buildup of pavements rated "7," just above the condition level where work is needed; a significant decrease in the system-wide average surface ratings over the last 5 year period; a heavy reliance on thin overlays coupled with a record high paving cycle in 2016; and an ever growing backlog of pavement needs estimated most recently at $5.5 billion.

The State Highway System is essential to the movement of people and goods in New York State. These highways are critical to commerce and economic development and as such should be maintained at the highest level of serviceability. The problem is that funding levels are too low, driving up the paving cycle and forcing NYSDOT to rely on thin overlays to maintain the highway network.

Funding for pavements must be increased to address the backlog of work and to provide a long term improvement in pavement conditions. An additional $195 million over the 2016 funding level of $325 million is necessary just to keep conditions stable over the short term. An additional $385 million over the 2016 level will not only restore a 12 year paving cycle but will result in improving conditions over the long term as well as a safer highway system for all New Yorkers.

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Who is REBUILD NY NOW?

Rebuild New York Now is a broad-based coalition seeking to raise public awareness about the issues impacting New York State's infrastructure. The coalition actively engages federal and state elected officials to support public policies that promote safe roads, bridges, schools, hospitals, water treatment and other vital infrastructure. Over a three-year span, Rebuild NY Now has averaged nearly $14,000 in infrastructure project funding for every dollar spent on campaigning. The last three campaigns have averaged a $4.16 billion return in each executive budget. Social media initiatives have put millions of eyes on the concerns surrounding New York State's infrastructure. With the experience of three successful campaigns over three years, Rebuild NY Now has redefined sustainable fundraising and grassroots campaign operations.