2011 PAVEMENT CONDITION ANNUAL REPORT

MnDOT/OMRR-PM--2012-01

Office of Materials and Road Research

Pavement Management Unit

Your Destination...Our Priority

Cover Photo:
Near Reference Post 85.8 on MNTH 23 north of the city of Marshall.

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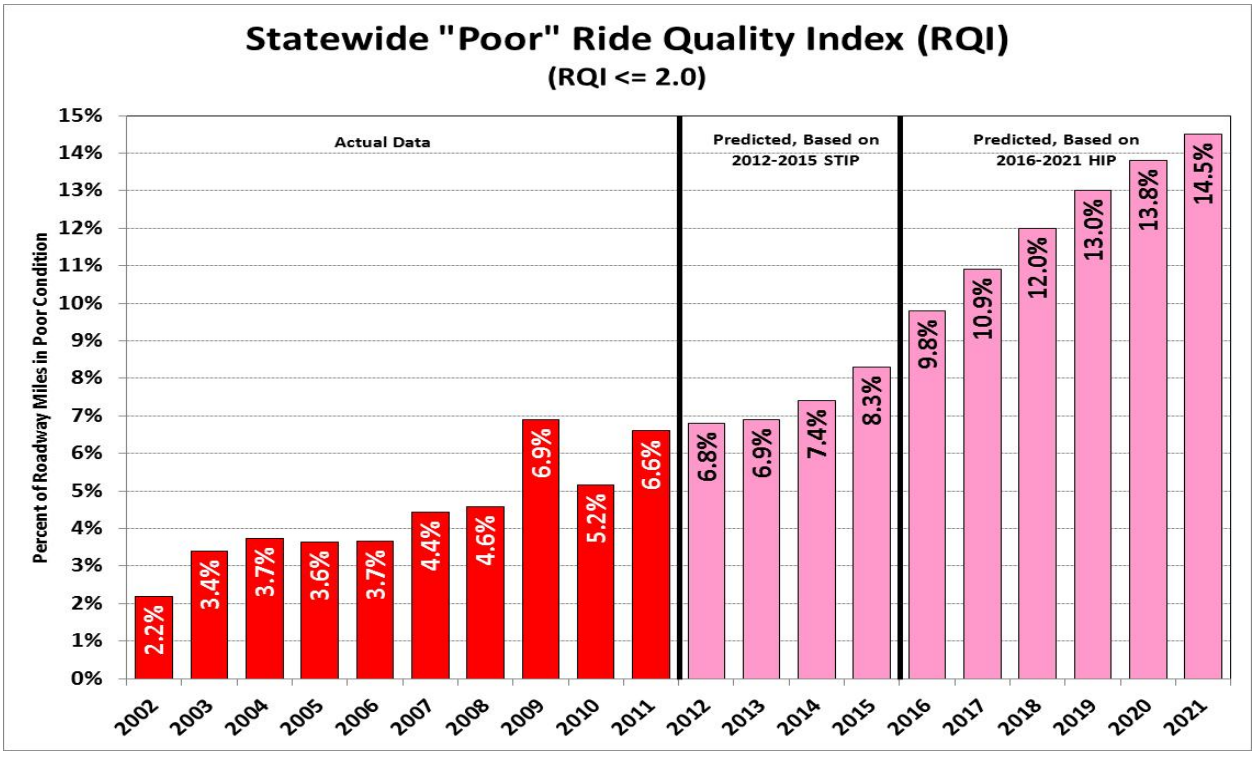
EXECUTIVE SUMMARY

The pavement performance of MnDOT's highway system is determined annually from the data collected by the Pavement Management Unit. Here are some of the key points from the 2011 pavement condition data.

- Statewide, both the Principal Arterial (PA) and Non-Principal Arterial (NPA) systems declined in condition in 2011 with less miles in Good condition and more miles in Poor.
- Five of the eight ATPs (1, 6, 7, 8, M) did not meet any pavement smoothness targets in 2011. Only ATP-2 met all of the targets.
- Based on the 2012-2015 STIP (which includes the Better Roads for a Better Minnesota projects), there will be 243 more miles in Poor condition by 2015 than there are today, a 26% increase.
- Based on the 2016-2021 Mid-Range HIP, there will be 1,129 more miles in Poor Condition by 2021 than there are today, a 120% increase.
- The Mid-Range HIP spending plan is 39% of what is needed to meet the pavement targets by 2021 and 70% of what is needed to simply maintain the expected 2015 STIP conditions.
- There were 232 miles of pavement that unexpectedly fell into Poor in 2011. These were roads that were patched in 2010, indicating the life of the patch was only one year.
- Based on the STIP and HIP, the NPA system will fall to the GASB 34 threshold by 2021. The PA system is expected to fall to the threshold a year or two later. Falling below the GASB 34 thresholds may result in the State's bond rating being downgraded.



INTRODUCTION

This report is prepared annually by the Minnesota Department of Transportation (MnDOT) Pavement Management Unit to provide information concerning trunk highway pavement performance. It briefly discusses statewide performance trends and how they compare with established targets. In addition, comparisons are made between the eight Area Transportation Partnerships (ATP) used in statewide planning.

The two indices used to measure pavement performance in MnDOT's 20-year Transportation Plan are the Ride Quality Index (RQI), a measure of pavement smoothness, and Remaining Service Life (RSL), an estimate of the time until the pavement will reach the end of its design life and require major rehabilitation. In addition, the Pavement Quality Index (PQI) is a composite index reflecting both pavement smoothness and cracking. It is used to determine if the state highway system is meeting performance thresholds established for the Government Accounting Standards Board, Standard 34 (GASB 34). Each of these three indices will be discussed in this report.

BACKGROUND

MnDOT's trunk highway system consists of approximately 12,000 centerline miles of pavement. This system consists of bituminous, concrete, and composite pavement with a wide range of condition, age, and performance. Each year, the Pavement Management Unit collects pavement roughness and digital image data on the entire trunk highway system, in both directions, and calculates surface distress quantities on approximately 60% of the system.

DATA COLLECTION

The pavement roughness and surface distress data (cracks, ruts, faults, etc.) are collected using a sophisticated digital inspection vehicle (shown below). This van films the right-of-way using two digital cameras, one looking straight ahead and one looking off to the right. For pavement distress measurements, a scanning laser, and a 3D laser/camera system are used to provide images of the pavement surface, from which the type, severity, and amount of cracking can be determined. The van is also equipped with laser height sensors that measure the longitudinal pavement profile, from which pavement roughness, rutting, and faulting are calculated.

Pavement condition data is used to monitor the performance of the system, to help in the selection of projects, and to identify pavements that need future maintenance and/or rehabilitation. The van is driven over every mile of trunk highway annually, in both directions.

MnDOT PAVEMENT CONDITION INDICES AND MEASURES

MnDOT's pavement condition data is reduced to several indices for reporting the statewide pavement performance measures: Ride Quality Index (RQI), Surface Rating (SR), Pavement Quality Index (PQI), and Remaining Service Life (RSL). Each index captures a different aspect of the pavement's health and can be used to rank pavement sections and to predict future maintenance and rehabilitation needs. They are briefly described below.

RQI: Ride Quality Index

The RQI is MnDOT's ride, or smoothness, index. It uses a zero to five rating scale, rounded to the nearest tenth. The higher the RQI, the smoother the road is. The RQI is intended to represent the rating that a typical road user would give to the pavement's smoothness as felt while driving his/her vehicle. Most new construction projects have an initial RQI slightly over 4.0. Pavements are normally designed for a terminal RQI value of 2.5. When a road has reached its terminal RQI value it doesn't mean the road can't be driven on, but rather that it has deteriorated to the point where most people feel it is uncomfortable and a major rehabilitation is likely needed.

The RQI is calculated from the pavement's longitudinal profile, measured by the front mounted lasers on the digital inspection vehicle. A mathematical simulation, called the International Roughness Index (IRI), is then run to estimate the amount of vertical movement a standard vehicle would experience if driven down the road. The IRI is the roughness index used by every state DOT in the U.S. as well as most countries in the world. In the past, MnDOT has taken a rating panel of 30 to 40 people out in the field and driven them over hundreds of test sections to get their perception of the smoothness of various pavement sections. Following right behind them was the digital inspection vehicle. This provides us with a direct correlation between the IRI, as measured by the van, and the perceived roughness, as felt by the rating panel.

SR: Surface Rating

Pavement distresses are those defects visible on the pavement surface. They are symptoms, indicating some problem or phenomenon of pavement deterioration such as cracks, patches and ruts. The type and severity of distress a pavement has can provide great insight into what its future maintenance and/or rehabilitation needs will be.

MnDOT uses the Surface Rating, or SR, to quantify pavement distress. The distress identification procedure used to determine the SR is done by technicians using computer workstations in the Pavement Management Unit of the Office of Materials and Road Research, located in Maplewood, MN. The workstations allow the operators to view and analyze the digital images captured by the van. The van captures four images that are shown on four monitors simultaneously. The front, side and two down views help the operator determine the type, severity, and amount of each defect.

Because of the time involved determining the SR, MnDOT does not conduct continuous distress surveys. Instead, the first 500 feet of each mile and section are rated (≈10% sample). On undivided roadways, only the outside lane in the increasing direction (north or east) is rated when the SR is measured. On divided routes, the outside lane in both directions is rated.

The percentage of each distress in the 500-foot sample is determined and multiplied by a weighting factor. The weighting factors are higher for higher severity levels of the same distress and higher for distress types that indicate more serious problems exist in the roadway such as alligator cracking and broken panels. The weighting factors are then combined to determine the Surface Rating, or SR. The SR ranges from 0.0 to 4.0, and is reported to the nearest tenth. A higher SR means a better condition. A road with no defects is rated at 4.0. A road in need of major rehabilitation or reconstruction will generally have an SR near 2.0.

PQI: Pavement Quality Index

The PQI is a composite index, equal to the square root of the product of RQI and SR. As such, it gives an overall indication of the condition of the pavement, taking into account both the pavement smoothness and cracking.

RSL: Remaining Service Life

The RSL is an estimate, in years, until the RQI will reach a value of 2.5, generally considered to be the end of a pavement's design life. Most pavements will need some type of major rehabilitation or reconstruction when the RQI has reached this value. The RSL is determined from pavement deterioration curves applied to the current data. A curve is fitted through the historical RQI data for each pavement section and the year the RQI will reach 2.5 is estimated. If there is inadequate historical data to make this calculation, default models, based on statewide pavement performance, are used. Rehabilitation activities with long service lives will add a considerable number of years to the RSL of a pavement. Short-term fixes, such as patching, may increase the pavement smoothness for a short time, but do not result in many additional years of RSL.

Each year, the RSL is calculated for all highway segments. From these values, a length-weighted Average Remaining Service Life (ARSL) is calculated for the entire trunk highway system as well as for each ATP. The ARSL provides a measure of whether the fixes being applied to the trunk highway system are mostly long-term or short-term.

PERFORMANCE CATEGORIES

MnDOT currently categorizes pavement condition, as measured by the RQI, into five equal categories as shown in Table 1. When reporting performance measures, the top two and bottom two categories are combined and referred to as "Good" and "Poor," respectively. These terms will be used for the remainder of this report.

Table 1. Ride Quality Index (RQI) Performance Categories

Descriptive Category	RQI Range	Performance Measure Category
Very Good	5.0 – 4.1	**Good**
Good	4.0 – 3.1	
Fair	3.0 – 2.1	
Poor	2.0 – 1.1	**Poor**
Very Poor	1.0 – 0.0	

PERFORMANCE TARGETS

Using the traffic functional class designation of each segment of highway, all pavement sections are assigned to one of two traffic functional groups, Principal Arterial (PA) or Non-Principal Arterial (NPA), when reporting statewide pavement performance measures. The Interstate

system is considered to be part of the PA system. The current trunk highway system mileage is comprised of 53% PA and 47% NPA.

Performance targets have been established based on historical RQI values for both functional groups as shown in Table 2. The RQI targets are based on the percent of miles in the "Good" and "Poor" categories as described below.

Table 2. Ride Quality Index (RQI) Targets by Functional Group

Functional Group	Ride Quality Index (RQI)	
	"Good" RQI (RQI > 3.0)	**"Poor" RQI (RQI ≤ 2.0)**
Principal Arterial	70% or more	2% or less
Non-Principal Arterial	65% or more	3% or less

STATEWIDE HISTORICAL RQI TRENDS

Statewide, the smoothness of both the PA and NPA systems declined in 2011, with fewer miles in the "Good" category and more miles in the "Poor" category compared to 2010. Some ATPs, showed marginal improvements in 2011.

2002 - 2011 "Good" RQI Trend (Figure 2)

From 2010 to 2011, the percent of statewide miles on the PA system in "Good" condition decreased from 70.2 percent to 67.3 percent. The percent of miles on the NPA system in "Good" condition also decreased from 59.8 percent to 58.6 percent. This means there are approximately 300 fewer miles in "Good" condition statewide in 2011 compared to 2010.

Every ATP except one had a decrease in the percent of miles on the PA system in "Good" condition in 2011. Only ATP-1 improved over 2010; however, they still are not meeting the target. All other ATPs had a decrease, ranging from 0.7 to 9.0 percent. ATP-7 had the largest decrease in percent of miles on the PA system in "Good" condition (-9.0%) followed by ATP-4 (-7.1%). ATP-2 and ATP-4 showed a decrease in the percent of miles in "Good" condition, but still met the target of 70 percent or more.

Five out of the eight ATPs had a decrease in the percent of miles in "Good" condition on the NPA system ranging from 3.0 to 10.0 percent. ATP-7 had the largest decrease (-10.0%). Together with their decrease in miles on the PA system, ATP-7 has 150 fewer miles in Good condition in 2011 than they had last year. The three remaining ATPs (ATP-2, 4, and 6) had an increase in the percent of miles in "Good" condition ranging, from 1.8 to 8.6. Only ATP-2 and ATP-3 met the NPA "Good" target.

Based on the current 2012-2015 program, the percent of miles in "Good" condition on the PA system is expected to increase from its current value of 67.3 percent to 68.7 percent by 2015. The percent of miles in "Good" condition is also expected to increase on the NPA system from its current value of 58.6 percent to 60.5 percent by 2015.

2002 - 2011 "Poor" RQI Trend (Figure 3)

From 2010 to 2011, the percent of statewide miles on the PA system in "Poor" condition increased from 3.7 percent to 4.8 percent. The NPA system also had an increase in the percent of miles in "Poor" condition, increasing from 6.8 percent to 8.6 percent. This means there are about 200 more miles in Poor condition in 2011 compared to 2010.

On the PA system, only two ATPs showed a decrease in the percent of miles in "Poor" condition in 2011. ATP-2 and ATP-4 showed a decrease in the percent of miles in "Poor." All other ATPs saw an increase in the percent of miles in "Poor" condition, ranging from 0.8 percent to 4.6 percent. ATP-8 had the largest increase (+4.6%). Only ATP-2 and ATP-4 met the PA "Poor" target.

On the NPA system, only two ATPs showed a decrease in the number of miles in "Poor" condition in 2011. Both ATP-2 and ATP-6 decreased the number of miles in "Poor" by 0.4 percent in 2011. Only ATP-2 is met the NPA "Poor" target. All other ATPs increased the percent of miles in "Poor" condition in 2011, ranging from 1.1 percent to 5.3 percent.

Based on the 2012-2015 STIP, the percent of miles in the "Poor" RQI category is expected to increase from 4.8 to 5.7 percent, on the PA system, and from 8.6 to 11.2 percent on the NPA system. Statewide, this is an increase of about 240 miles in just four year. This is more than twice the target amount on the PA system and more than three times the target amount on the NPA system. Once a pavement falls into the "Poor" category it normally will require major rehabilitation or reconstruction to restore any meaningful amount of service life. These types of repairs are very expensive, thus making it much harder to recover once the amount of miles in this condition gets very high.

RQI COMPARISON by ATP

In 2011, only ATP-2 met all four of the RQI targets. ATP-3 met one of the four targets and was close on two others. ATP-4 met two of the four and missed the other two. For the last three years, ATP-1, 6, and Metro have not met any of the RQI targets.

"Good" RQI Comparison (Figures 4, 6, and 7)

As shown in Figure 6, compared to last year, every ATP had a decrease in "Good" roads on the PA system except for ATP-1, which had a slight increase. ATP-2 and 4 met the target of having at least 70% of the PA system in "Good" condition in 2011. This is the sixth year in a row this occurred in ATP-2 and 4. ATP-3 is within 1% of the PA "Good" target.

Figure 7 compares the "Good" roads on the NPA system from 2010 and 2011. While ATP-2, 4, and 6 had a slight increase in the number of miles in "Good" condition, all other ATPs had a decrease. In 2011, only ATP-2 and 3 met the target of having 65% or more of the NPA system in "Good" condition.

Only ATP-2 met the "Good" RQI targets on *both* the PA and NPA system in 2011. Last year, ATP-3 met both "Good" targets; however, this year ATP-3 did not but are very close to meeting both targets. This is shown in Table 3 and Figure 4.

"Poor" RQI Comparison (Figures 5, 8, and 9)

Figures 8 and 9 show how the 2010 conditions compare to 2011 by PA and NPA. ATP-2 and 4 met the target of having 2% or less of the PA system in "Poor" condition in 2011. Only ATP-2 met the target of having 3% or less of the NPA system in "Poor" condition.

On the PA system, only ATP-2 (-0.4%) and ATP-4 (-1.1%) had a decrease in the number of miles in "Poor" condition compared to last year. ATP-8 had the largest increase (+4.6%). They now have the second highest percentage of their PA system in "Poor" condition (behind ATP-1). Last year, ATP-8 had the second lowest.

On the NPA system, only ATP-2 (-0.4%) and ATP-6 (-0.4%) had a decrease in the number of miles in "Poor" condition compared to last year. ATP-7 had the largest increase in "Poor" roads on the NPA system (+5.3%), nearly twice as many miles as they had last year.

As shown in Table 3 and Figure 5, only ATP-2 met the "Poor" RQI targets on *both* the PA and NPA system.

RQI TARGET SUMMARY

Table 3 provides a visual picture of which ATPs met the pavement targets in 2011. It uses the following legend:

- Green = Met the target
- Red = Missed the target
- Yellow = Missed the target, but was "close"

"Close" means within 1% of target for the "Poor" RQI category and within 5% for "Good."

There was a slight decline from 2010 in which 9 of the 32 targets were met (Green) and 7 were close (Yellow). In 2011, only 7 of the "Good" targets were met (Green) and 5 were close (Yellow). This indicates a move away from targets.

Table 3. Overview of Ride Quality Index (RQI) Targets by ATP

ATP	Ride Quality Index (RQI) Targets Met in 2011			
	Good RQI (RQI > 3.0)		Poor RQI (RQI ≤ 2.0)	
	PA (target = 70% or more)	NPA (target = 65% or more)	PA (target = 2% or less)	NPA (target = 3% or less)
1	**65.8**	**48.5**	**8.3**	**11.0**
2	**85.4**	**85.7**	**0.6**	**1.0**
3	**69.0**	**75.9**	**4.4**	**3.2**
4	**74.1**	**55.1**	**1.8**	**7.6**
6	**65.1**	**49.5**	**5.9**	**18.1**
7	**57.6**	**45.4**	**4.2**	**11.4**
8	**61.0**	**53.1**	**6.8**	**5.7**
M	**65.5**	**49.5**	**4.4**	**12.1**

AVERAGE REMAINING SERVICE LIFE (ARSL)

As mentioned earlier, the Average Remaining Service Life (ARSL) is defined as the number of years until the RQI reaches a value of 2.5 or less. This is the point where most people begin to complain that a road's roughness is objectionable.

2002 - 2011 ARSL Trend (Figure 10)

The 2011 ARSL was 9.7 years on the PA system and 7.4 years on the NPA system. These are both lower than last year's averages of 10.1 and 7.7 years, respectively.

ARSL Comparison (Figure 11)

By ATP, the ARSL ranges from 8.0 to 11.0 years on the PA system and from 5.2 to 11.8 years on the NPA system. ATP-2 has the highest ARSL on both the PA and NPA systems. ATP-7 has the lowest ARSL on both the PA and NPA systems. Only four ATPs had an increase in the

ARSL on their PA or NPA systems in 2011. ATP-1 had the greatest improvement on the PA system (+0.5 years) and ATP-6 had the greatest improvement on the NPA system (+1.2 years).

ACCURACY OF PREDICTED PAVEMENT CONDITIONS

Each year, a prediction of the following year's pavement condition is done using the pavement management system. This is done for several reasons, including reassuring management that the pavement management system is working correctly and that it can be relied on as a tool for predicting future needs, provide managers with insight into the impact different funding scenarios will have on pavement conditions, and to alert the legislature of any worrisome trends that might be on the horizon.

The pavement sections not scheduled for any work in the 2012-2015 STIP use one of two types of deterioration curves to predict future condition. If there is enough historical data since the last rehabilitation on a section, a regression curve is fitted through the data. This curve is then used to predict the expected RQI for the section. If there is not enough historical data, or if the regression through the historical data results in an unrealistic curve, then a default curve is used to predict the future RQI. Default curves were developed for all pavement fixes in the pavement management system in the mid-1980's and subsequently updated in 1992 and 2008. The curves are based on historical statewide performance.

For the pavement sections that *are* scheduled for work during the 2012-2015 STIP, adjustments are made to the construction year to better predict the expected results. Since the pavement management van operator cannot wait until all of the work is completed each year, some projects will not have begun, some will still be under construction, and some will be completed when the van is in the area collecting data. The following adjustments are made to the construction year in the STIP to estimate the status of construction projects when the van is in each district:

<u>D-6, 7, and Metro:</u>
The construction year for all pavement projects listed in the STIP is increased by one year. This is done because these three districts are normally tested early in the spring, when almost none of the construction projects slated for the year has begun. It won't be until the van returns the following year that the impact of this work is measured.

<u>D-3 and 4:</u>
No changes are made to the construction year for projects in the STIP since these two districts are normally tested late in the fall, when most of their pavement projects are completed for the year. Thus, the van will likely be driven on the new, improved, surface and the impacts of the pavement work will be reflected.

<u>D-1, 2, and 8:</u>
Half of the projects in these districts have the construction year increased by one year. This is done because at the time the van is filming the pavements, some of their projects will be completed, some will be under construction, and others will not have begun. Since there is no way to predict which ones will be complete when the van is there and which ones will not, the projects are randomly chosen.

Table 4 compares the predicted 2011 pavement conditions with the actual conditions, using the method described above.

Table 4. Comparison of Predicted 2011 versus Actual 2011 RQI

PA System RQI Category	Actual 2010 Data	Predicted 2011 Data *	Actual 2011 Data
Good RQI (RQI > 3.0)	70.2%	69.8%	67.3%
Poor RQI (RQI ≤ 2.0)	3.7%	3.5%	4.8%
NPA System RQI Category	**Actual 2010 Data**	**Predicted 2011 Data ***	**Actual 2011 Data**
Good RQI (RQI > 3.0)	59.8%	59.0%	58.6%
Poor RQI (RQI ≤ 2.0)	6.8%	7.0%	8.6%

***Predictions based on the 2011-2014 STIP and Better Roads projects, with adjustments to construction year as described above.

As Table 4 shows, the actual 2011 conditions were worse than the predicted 2011 conditions (using 2010 data and the 2011 STIP projects).

There were 232 miles of pavement that were not expected to be in "Poor" condition because they were patched last year. However, due to the extremely wet winter and the temporary nature of the patching, their RQI deteriorated to 2.0, or less, in 2011 causing them to fall into "Poor". There were also 25 miles that were not patched last year that simply deteriorated more rapidly than expected, resulting in them falling into "Poor". This results in 257 more miles in "Poor" condition in 2011 than expected.

GOVERNMENT ACCOUNTING STANDARDS BOARD, STATEMENT 34 (GASB 34)

The GASB, a private, nonprofit organization, was established in 1984 by the Financial Accounting Foundation. The Foundation oversees GASB, provides funding, and appoints the members of GASB's board. The Foundation has a similar relationship with GASB's sister organization, the private-sector, standard-setting Financial Accounting Standards Board. GASB's span of influence covers over 84,000 state, county, and other local governmental units. Also impacted by GASB's financial reporting standards are organizations such as public utilities, municipal hospitals, and state universities. GASB, which does not impact the federal government, establishes concepts and standards that guide the preparation of external financial reports. GASB establishes generally accepted accounting principles that are utilized by auditors charged with evaluating state and local government financial statements.

In June 1999, the Governmental Accounting Standards Board (GASB) established a new financial reporting standard that fundamentally changed the way state and local governments report their financial results. Among other provisions, GASB Statement 34 (GASB 34), "Basic Financial Statements—and Management's Discussion and Analysis—for State and Local Governments," requires that major infrastructure assets acquired or having major additions or improvements in fiscal years beginning after June 15, 1980, be capitalized in financial statements. In addition, the cost of using the assets must be reflected. (Source: U.S. Department of Transportation, Federal Highway Administration, Office of Asset Management, Primer: GASB 34 (November 2002).

One of the primary purposes of GASB 34 is to demonstrate to the public, and others, that the agency is maintaining its infrastructure in an acceptable condition and does not have an undisclosed liability looming in the future.

In terms of determining the cost of using the assets, GASB allows governments to report either a depreciation expense or apply an alternative modified/preservation approach. Governments may use the modified approach in lieu of depreciating their assets if they have a systematic approach to managing their assets that, at a minimum, meets the following four requirements:

- Having a current inventory of eligible assets
- Documenting the condition of those assets via a reproducible assessment procedure
- Demonstrating that assets are being preserved at a level predetermined by the government
- Estimating the actual cost to maintain and preserve the assets.

MnDOT has chosen to use the modified/preservation approach since it can meet all the requirements listed above. For the purposes of GASB 34, MnDOT established that the state highway system will be maintained, at a minimum, at the following levels:

- Principal Arterial System: Average PQI of 3.0 or higher
- Non-Principal Arterial System: Average PQI of 2.8 or higher

Figure 12 shows how actual and predicted pavement conditions, based on the 2012-2015 STIP, compare with the established GASB 34 levels.

ADDITIONAL INFORMATION

Additional information about the condition and performance of the state highway system, including color-coded maps showing the various indices, can be obtained from the Pavement Management Unit's website:

http://www.dot.state.mn.us/materials/pvmtmgmt.html

Or by contacting:

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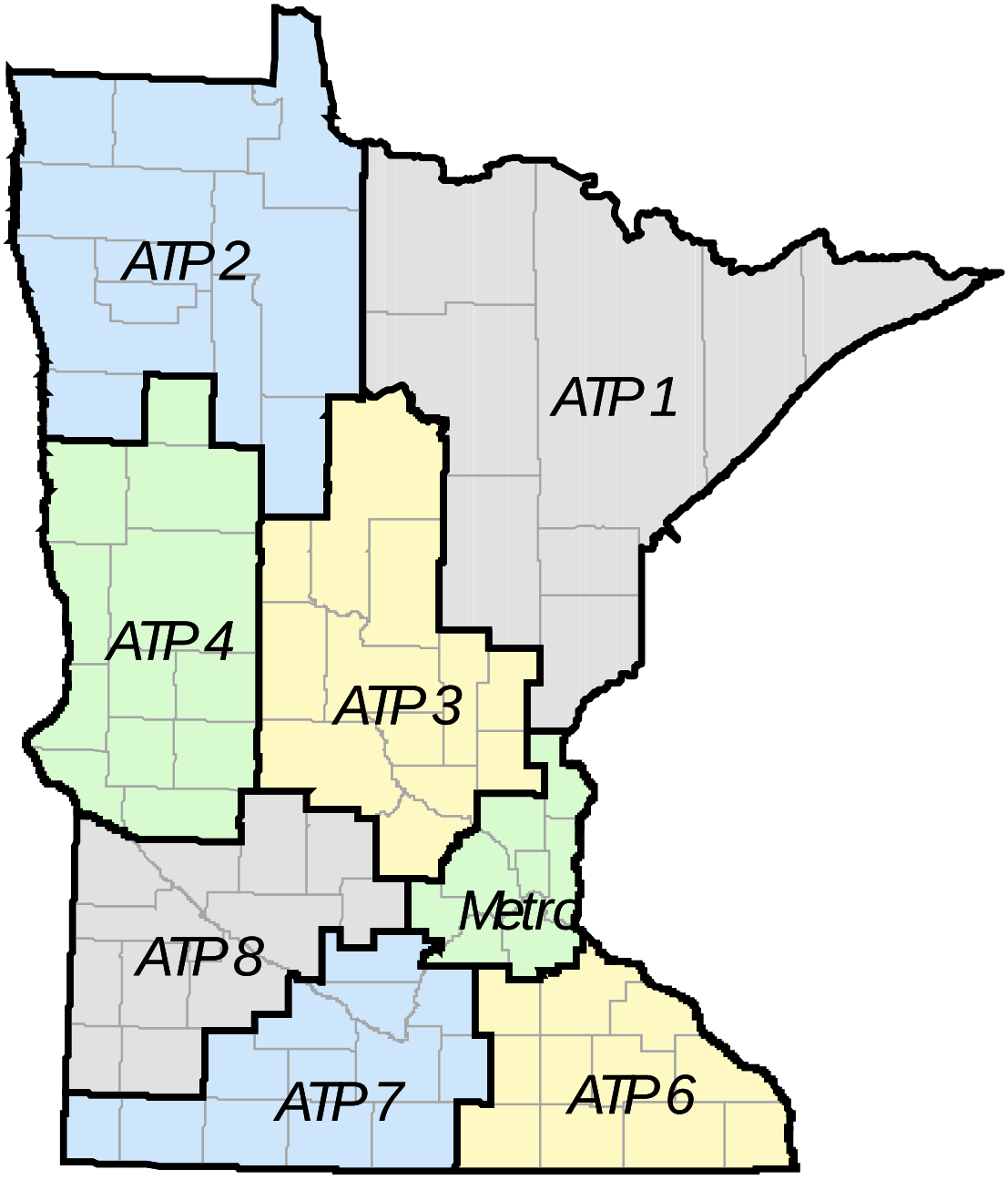


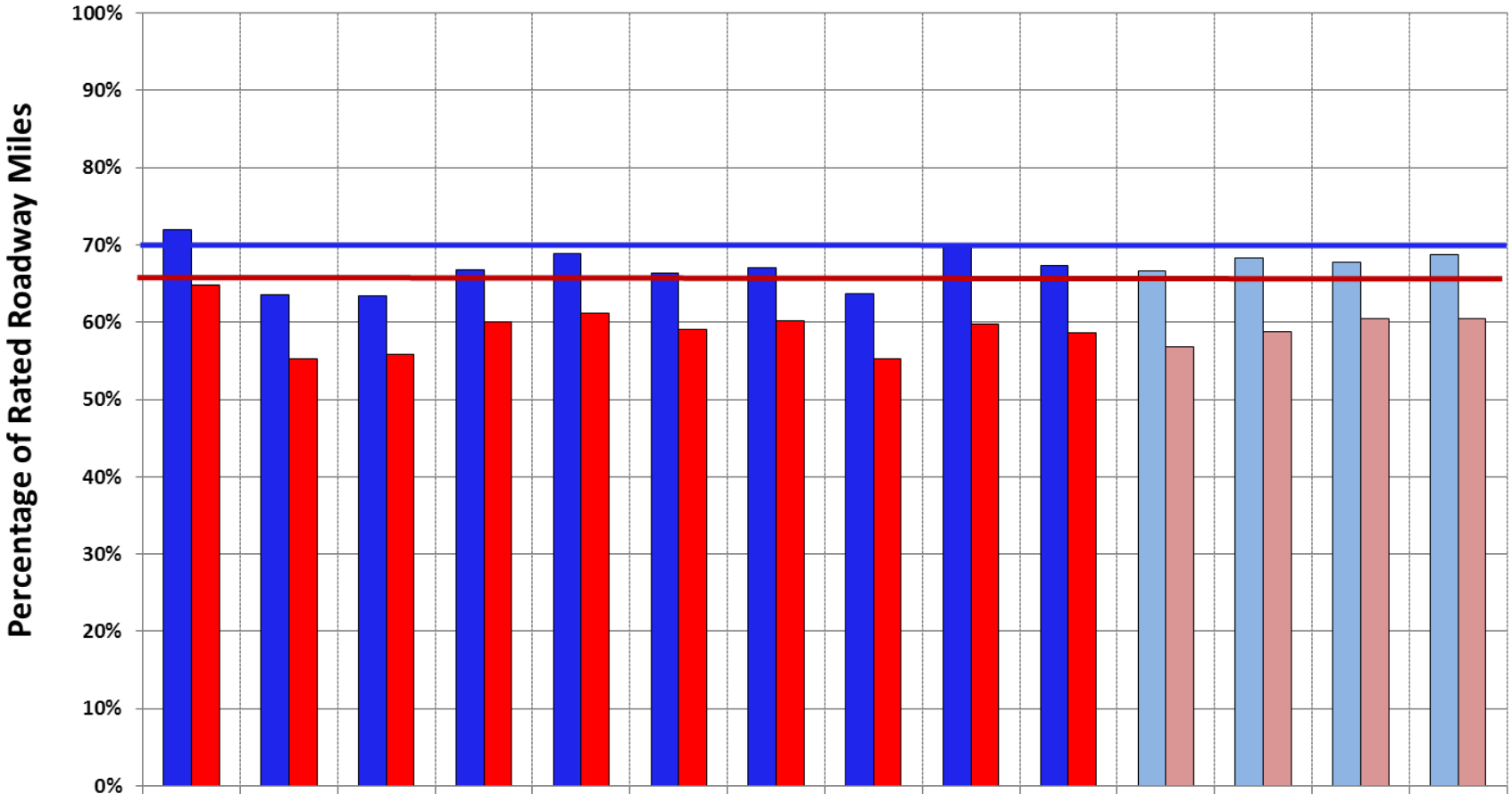
Figure 1. MnDOT's Area Transportation Partnership (ATP) Boundaries

Figure 2

Statewide "Good" Ride Quality Index

(miles with an RQI greater than 3.0)

Actual 2002 – 2011, Predicted 2012 - 2015



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Principal Art.	72.0%	63.6%	63.4%	66.8%	68.9%	66.3%	67.0%	63.7%	70.2%	67.3%	66.6%	68.3%	67.8%	68.7%
Non-Principal Art.	64.8%	55.3%	55.9%	60.1%	61.1%	59.1%	60.2%	55.3%	59.8%	58.6%	56.8%	58.8%	60.5%	60.5%

Principal Arterial Target = 70 percent or more

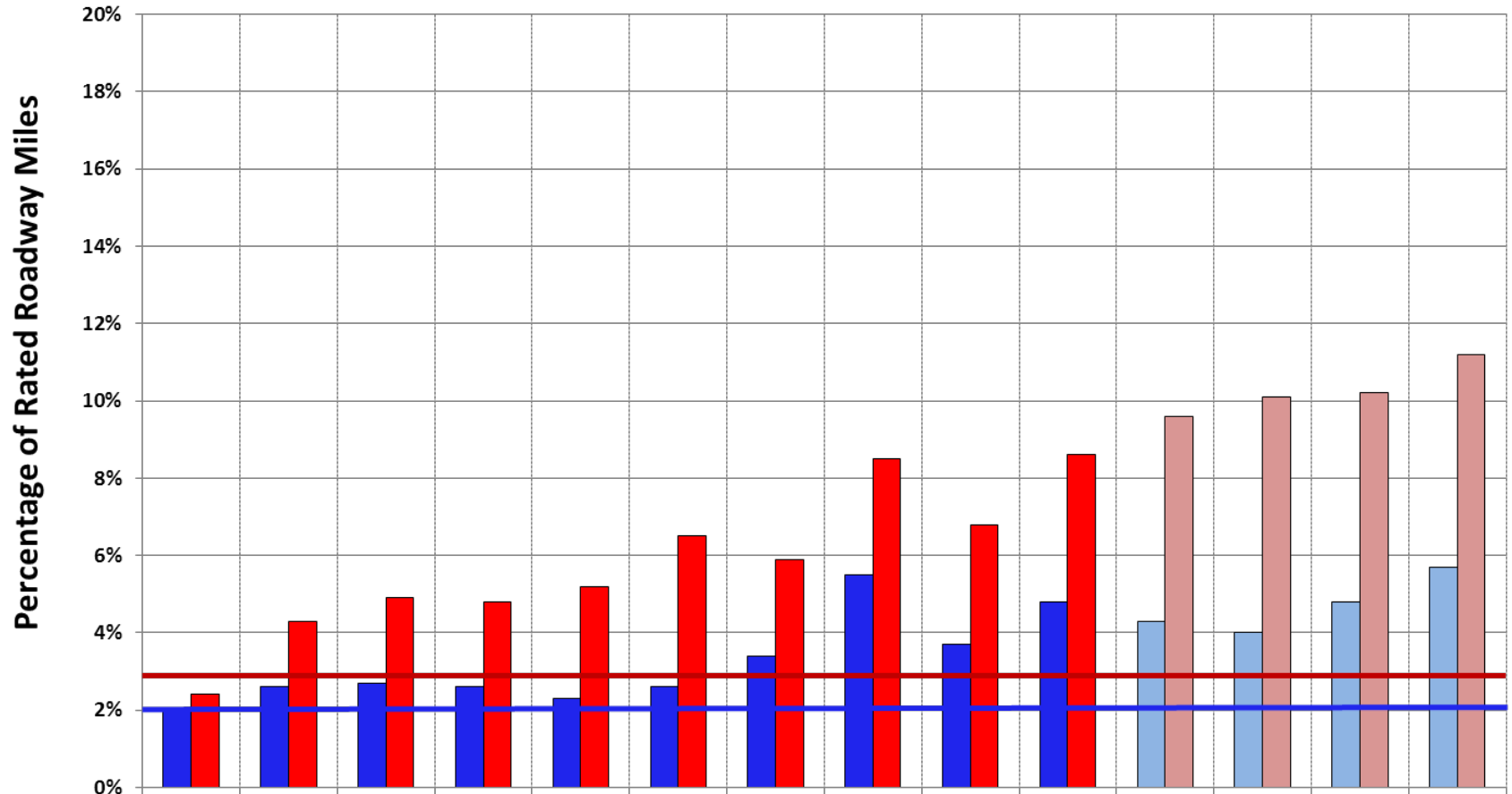
Non-Principal Arterial Target = 65 Percent or more

Figure 3

Statewide "Poor" Ride Quality Index

(miles with an RQI of 2.0 or less)

Actual 2002 – 2011, Predicted 2012 - 2015

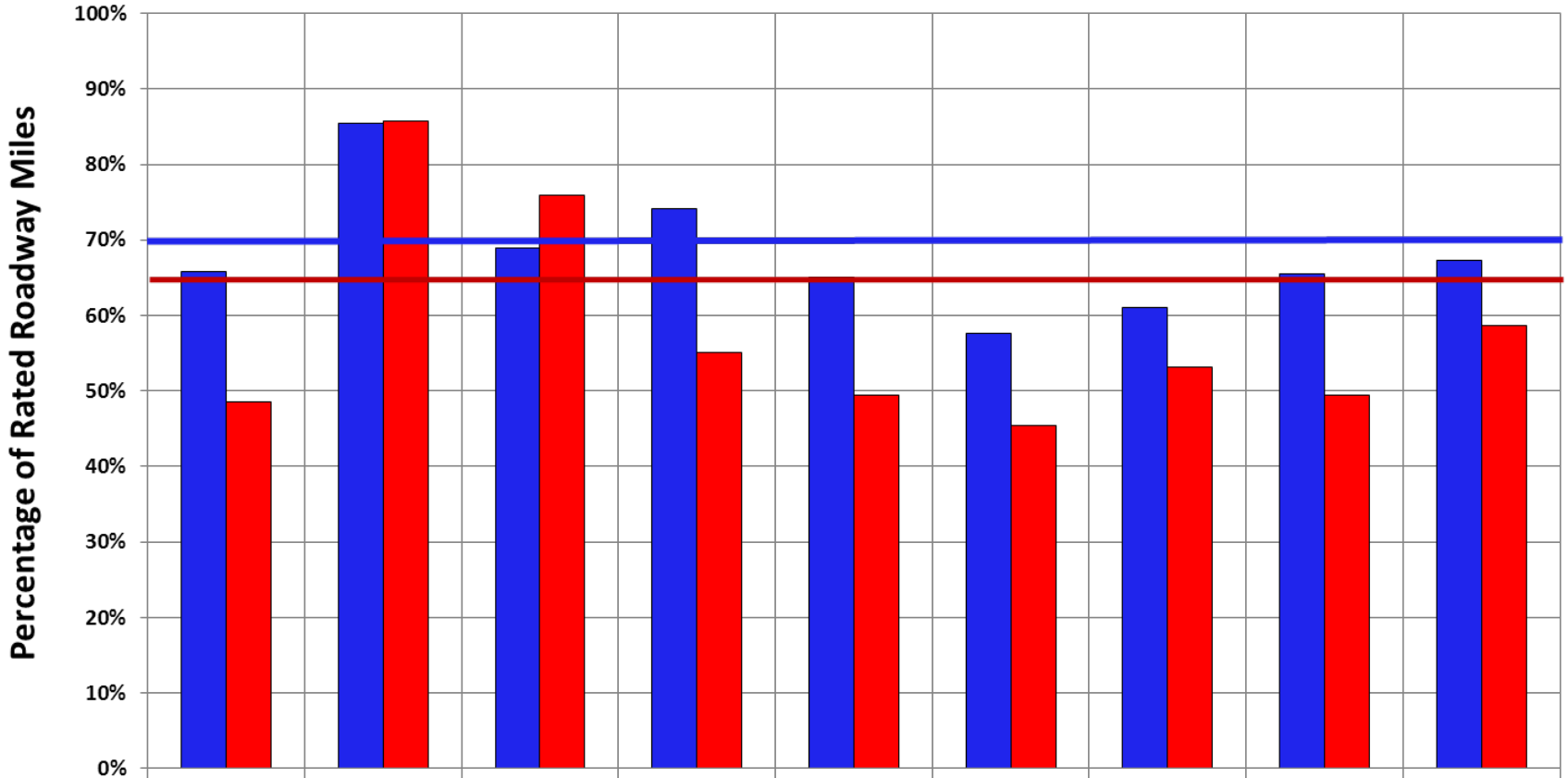


	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Principal Art.	2.0%	2.6%	2.7%	2.6%	2.3%	2.6%	3.4%	5.5%	3.7%	4.8%	4.3%	4.0%	4.8%	5.7%
Non-Principal Art.	2.4%	4.3%	4.9%	4.8%	5.2%	6.5%	5.9%	8.5%	6.8%	8.6%	9.6%	10.1%	10.2%	11.2%

Principal Arterial Target = 2 percent or less

Non-Principal Arterial Target = 3 percent or less

Figure 4
"Good" Ride Quality Index
(miles with an RQI greater than 3.0)
Comparison of 2011 Data by ATP

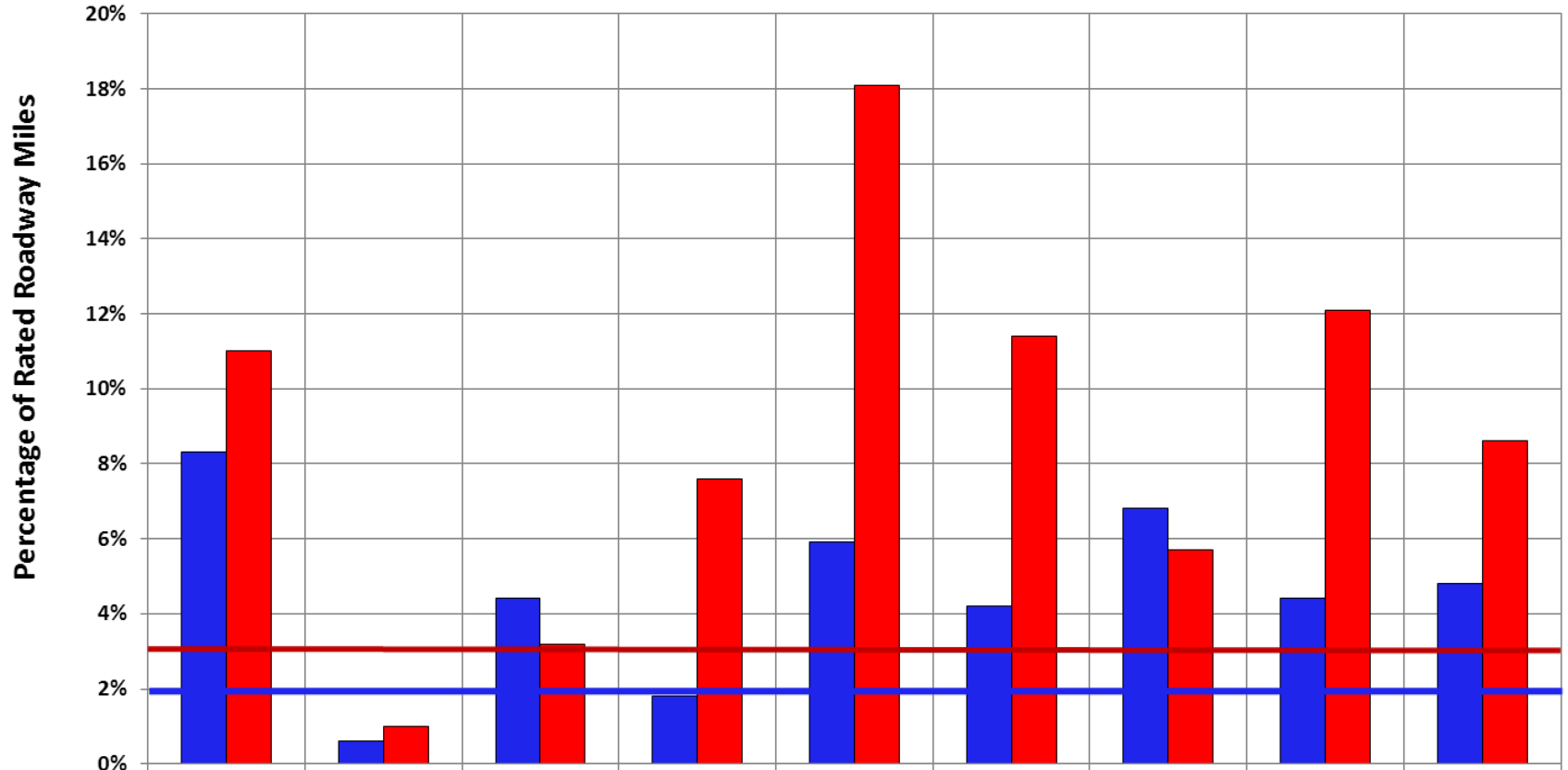


	ATP-1	ATP-2	ATP-3	ATP-4	ATP-6	ATP-7	ATP-8	Metro	State
Principal Art.	65.8% ▲	85.4% ▼	69.0% ▼	74.1% ▼	65.1% ▼	57.6% ▼	61.0% ▼	65.5% ▼	67.3% ▼
Non-Principal Art.	48.5% ▼	85.7% ▲	75.9% ▼	55.1% ▲	49.5% ▲	45.4% ▼	53.1% ▼	49.5% ▼	58.6% ▼

▲ = Better than 2010 ▼ = Worse than 2010

Principal Arterial Target = 70 percent or more
Non-Principal Arterial Target = 65 Percent or more

Figure 5
"Poor" Ride Quality Index
(miles with an RQI of 2.0 or less)
Comparison of 2011 Data by ATP



	ATP-1	ATP-2	ATP-3	ATP-4	ATP-6	ATP-7	ATP-8	Metro	State
Principal Art.	8.3% ▼	0.6% ▲	4.4% ▼	1.8% ▲	5.9% ▼	4.2% ▼	6.8% ▼	4.4% ▼	4.8% ▼
Non-Principal Art.	11.0% ▼	1.0% ▲	3.2% ▼	7.6% ▼	18.1% ▲	11.4% ▼	5.7% ▼	12.1% ▼	8.6% ▼

▲ = Better than 2010 ▼ = Worse than 2010

Principal Arterial Target = 2 percent or less
Non-Principal Arterial Target = 3 percent or less

Figure 6
Principal Arterial "Good" Pavement Condition (RQI >3.0)

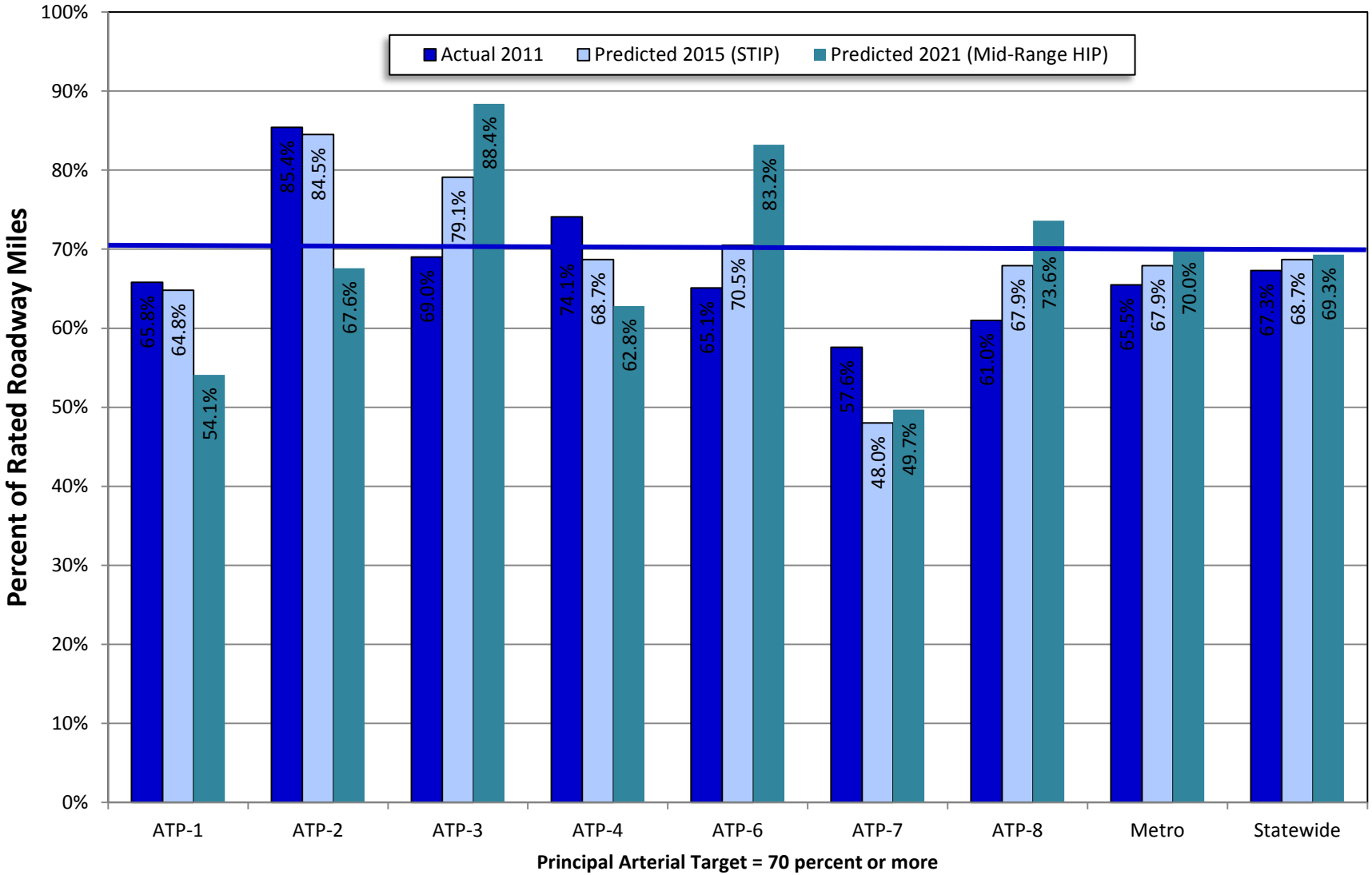


Figure 7
Non-Principal Arterial "Good" Pavement Condition (RQI >3.0)

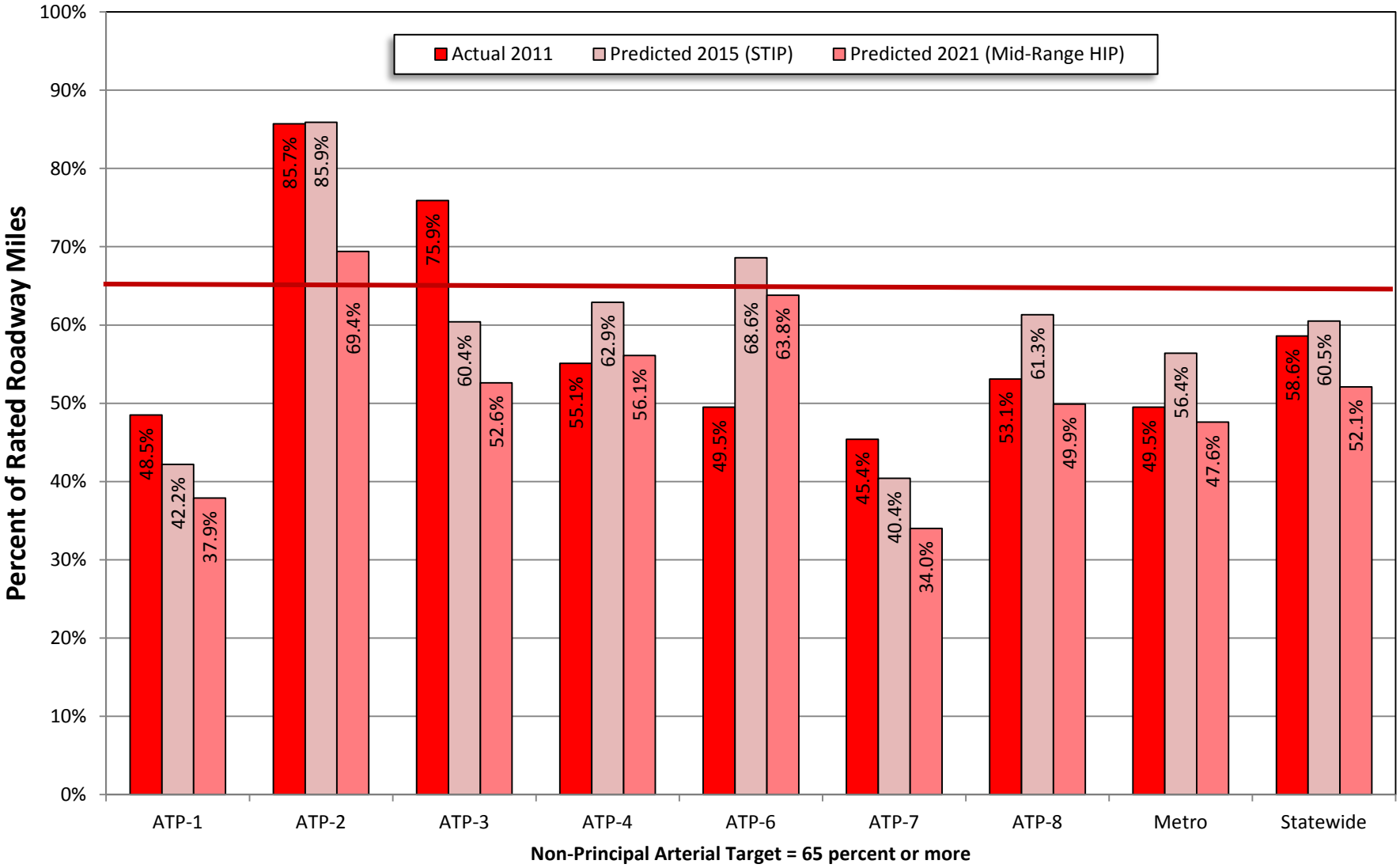


Figure 8
Principal Arterial "Poor" Pavement Condition
(RQI ≤ 2.0)

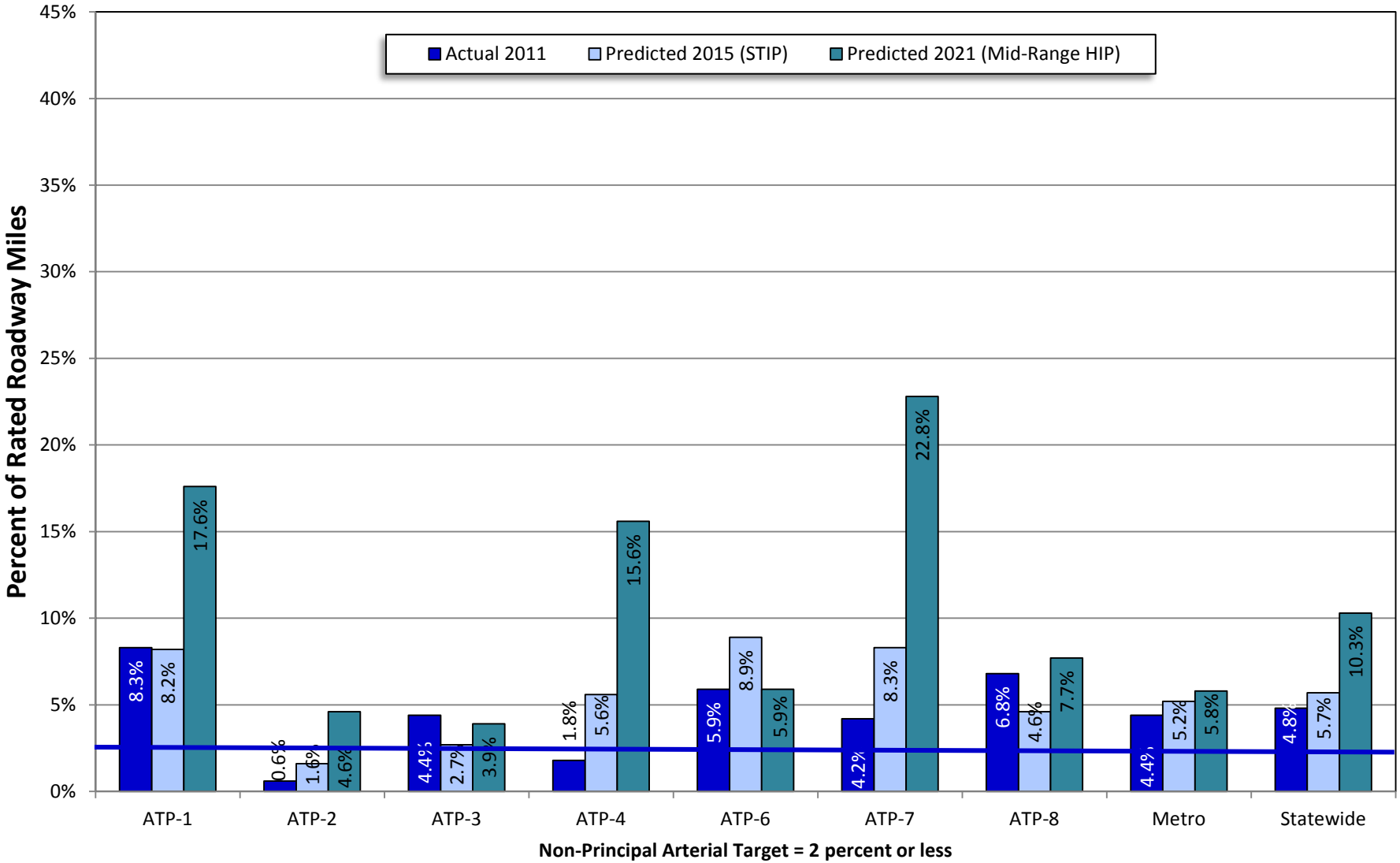


Figure 9
Non-Principal Arterial "Poor" Pavement Condition
(RQI ≤ 2.0)

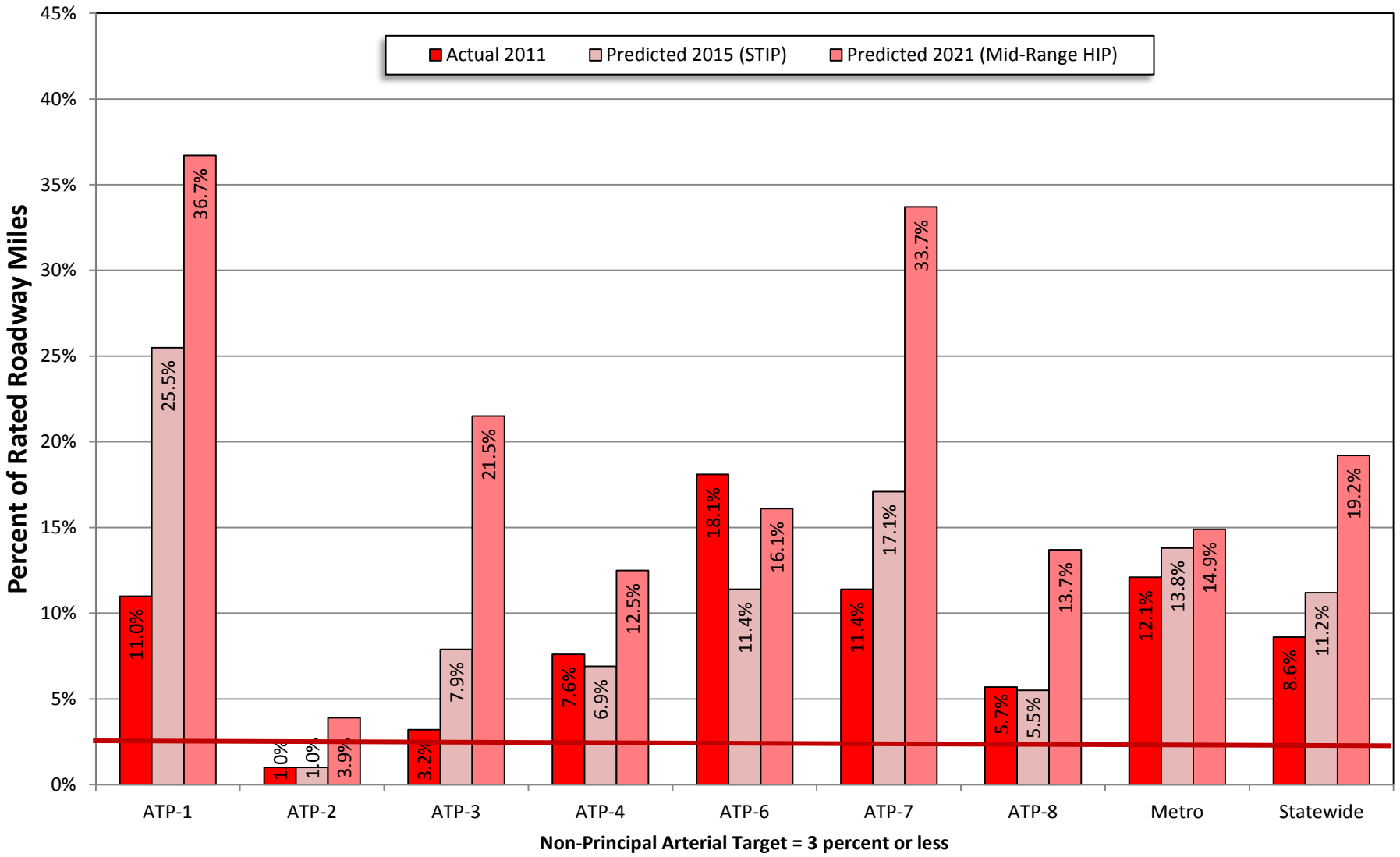
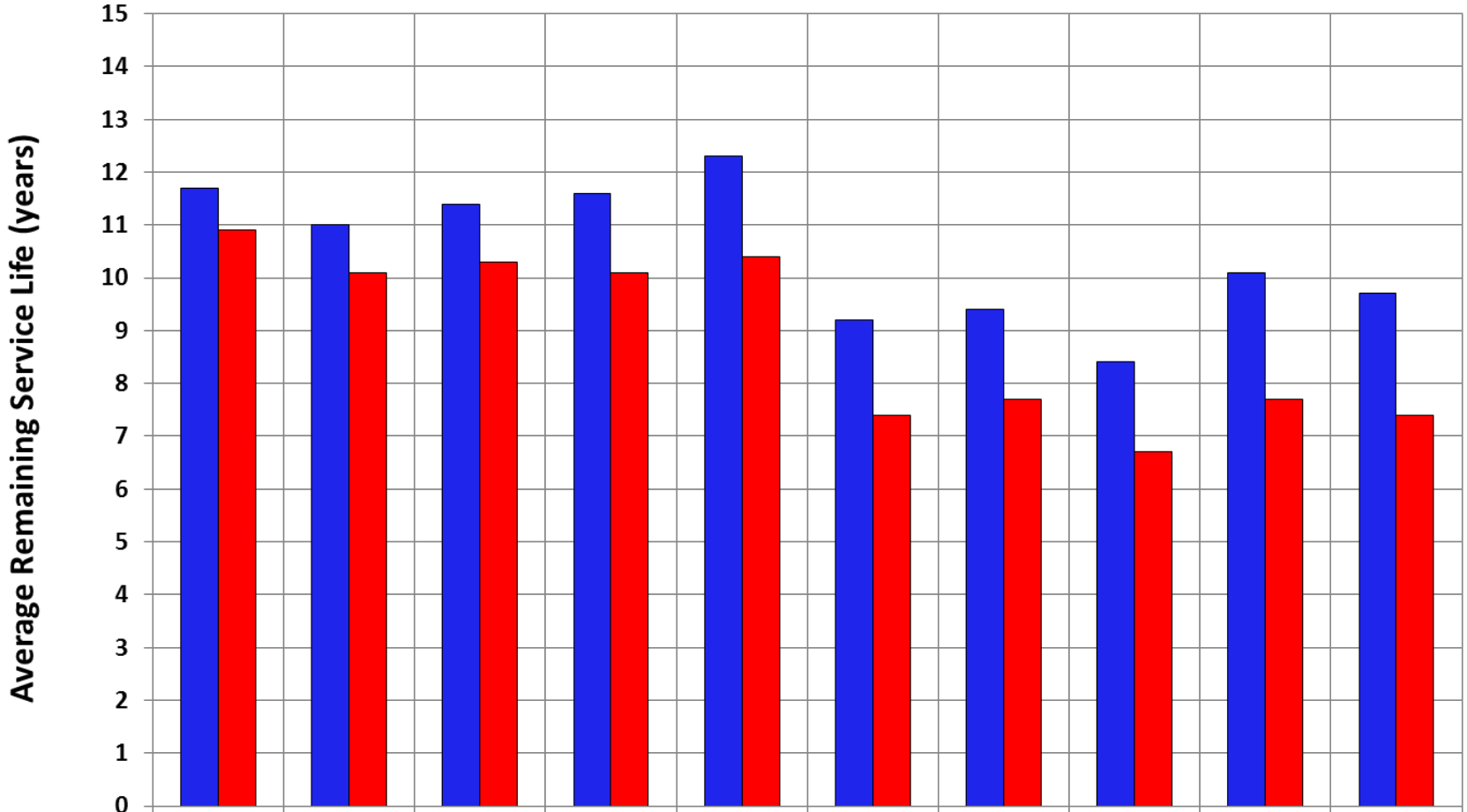


Figure 10
Statewide Average Remaining Service Life (ARSL)
(years until RQI reaches 2.5)



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Principal Art.	11.7	11.0	11.4	11.6	12.3	9.2	9.4	8.4	10.1	9.7
Non-Principal Art.	10.9	10.1	10.3	10.1	10.4	7.4	7.7	6.7	7.7	7.4

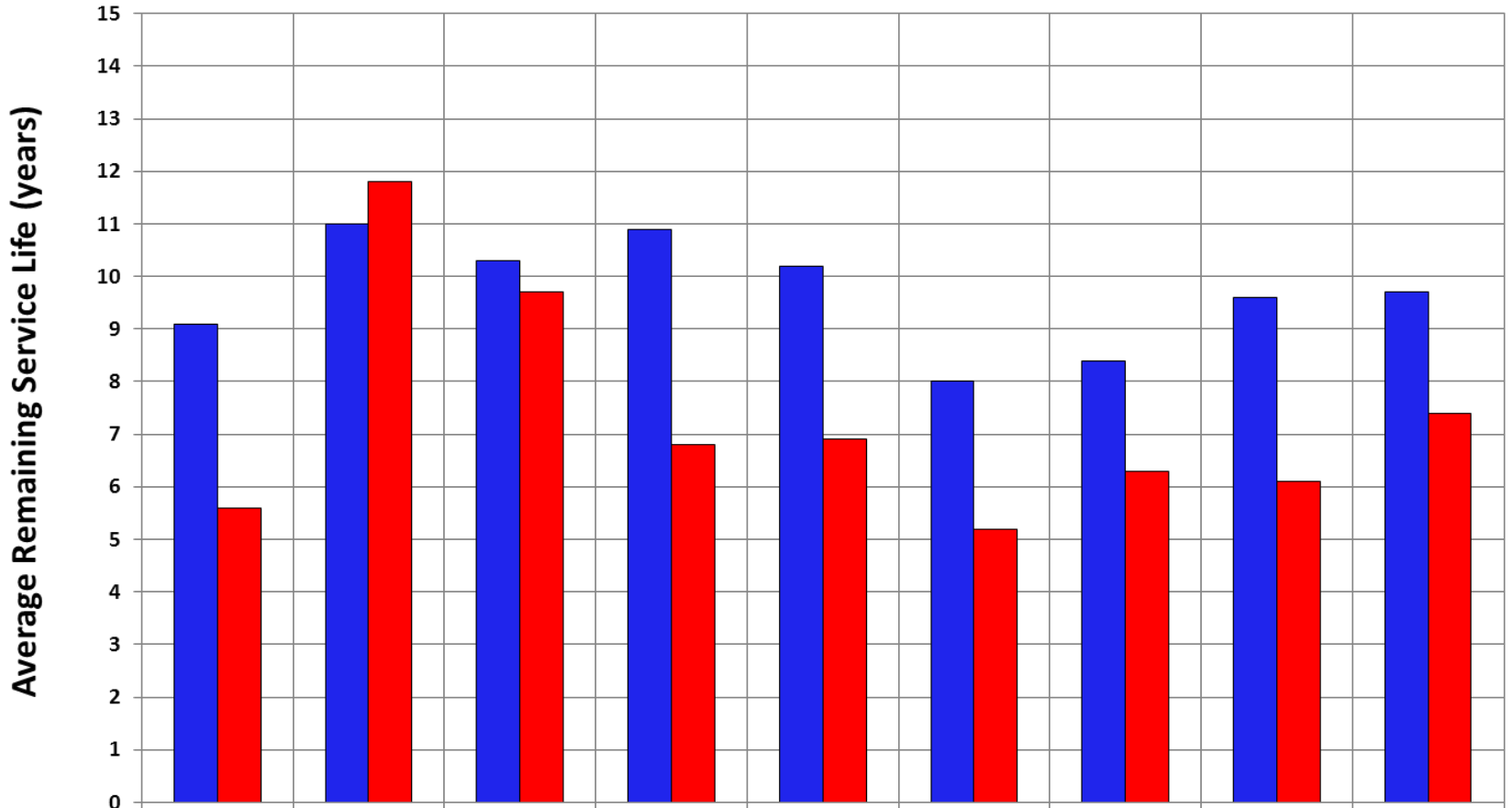
No official targets have been established for ARSL

Figure 11

Average Remaining Service Life (ARSL)

(years until RQI reaches 2.5)

Comparison of 2011 Data by ATP



	ATP-1	ATP-2	ATP-3	ATP-4	ATP-6	ATP-7	ATP-8	Metro	State
Principal Art.	9.1	11.0	10.3	10.9	10.2	8.0	8.4	9.6	9.7
Non-Principal Art.	5.6	11.8	9.7	6.8	6.9	5.2	6.3	6.1	7.4

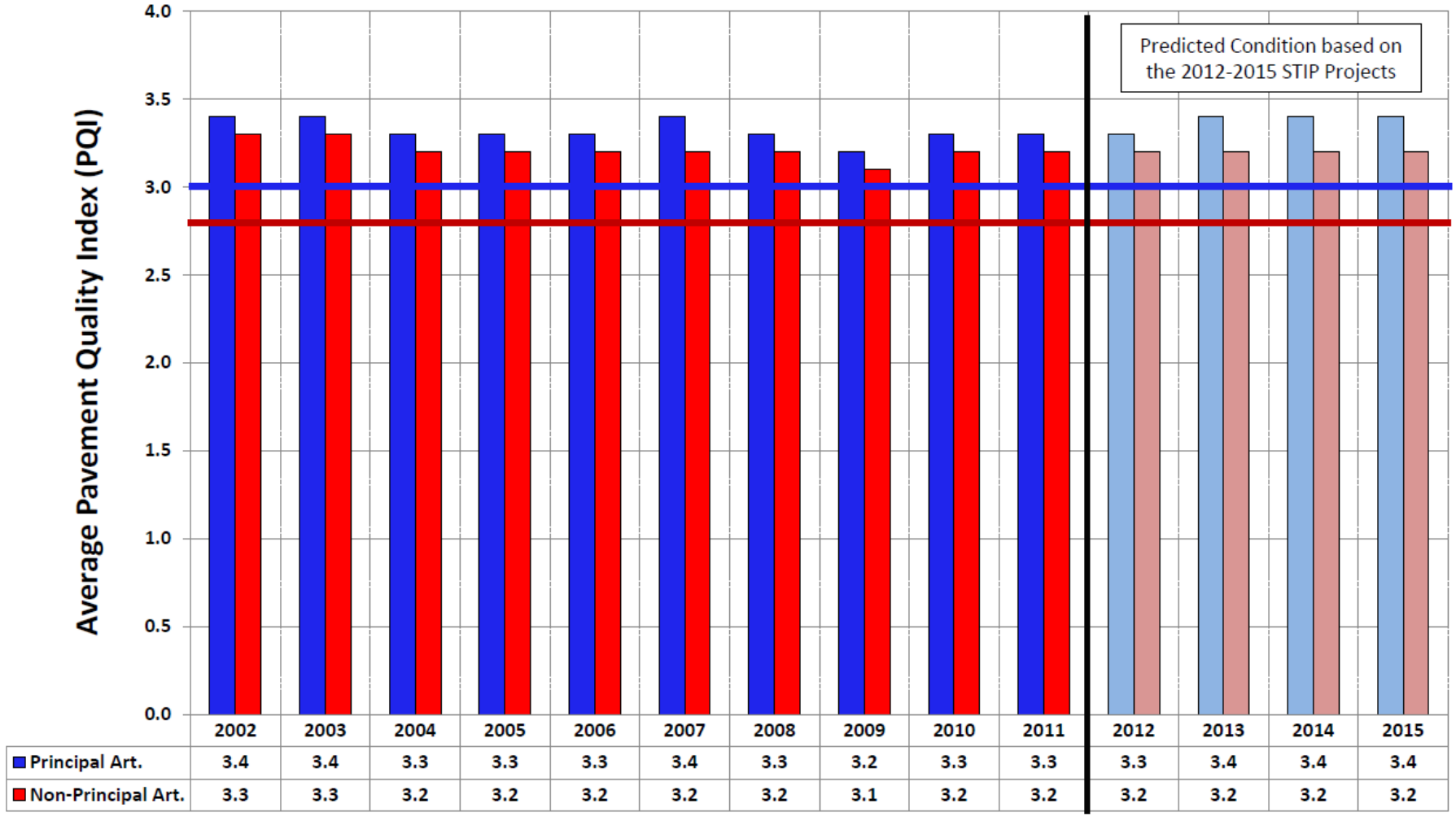
No official targets have been established for ARSL

Figure 12

Statewide Average Pavement Quality Index (PQI)

for GASB 34 Reporting

(PQI = Combined Index of Pavement Smoothness and Cracking)



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Principal Art.	3.4	3.4	3.3	3.3	3.3	3.4	3.3	3.2	3.3	3.3	3.3	3.4	3.4	3.4
Non-Principal Art.	3.3	3.3	3.2	3.2	3.2	3.2	3.2	3.1	3.2	3.2	3.2	3.2	3.2	3.2

Principal Arterial Threshold: Average PQI ≥ 3.0

Non-Principal Arterial Threshold: Average PQI ≥ 2.8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