2006
Pavement Condition
Executive Summary

EXECUTIVE SUMMARY

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INTRODUCTION

This report is prepared annually by the Minnesota Department of Transportation (Mn/DOT) 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 Mn/DOT'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.

BACKGROUND

Mn/DOT's highway system consists of approximately 11,900 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 system 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 to the right). This van films the pavement surface using four digital cameras, one looking straight ahead, one looking to the side and two looking straight down. The two down-looking cameras are used to evaluate the pavement surface distress. In addition to the cameras, the van is equipped with lasers that measure the longitudinal pavement profile, roughness, rutting and faulting. In 2005, a brand new van was put into service. This new van uses an improved rut measurement system. 2006 was the first year that testing was done in all eight districts with this new van. Last year, Districts 6, 7, and Metro were tested using the older 2001 van. Although the vans are certified for accuracy each year, some of the increase in RQI measured in 2006 in those Districts is likely due to differences between the old and new van.

Pavement condition data is used to monitor the performance of the system, to help in the selection of projects and identify pavements that need future maintenance and/or rehabilitation. Each year, the Pavement Management Unit prepares an annual report summarizing the

pavement condition of the trunk highway system. Copies of the annual report are available from the Office of Materials, Pavement Management Unit website: http://www.mrr.dot.state.mn.us/pavement/PvmtMgmt/pavemgmt.asp.

In this report, comparisons are made between the eight Area Transportation Partnerships, or ATPs. Figure 1 shows the boundaries of the ATPs, which follow county boundaries and may be different from construction district and maintenance area boundaries.

Mn/DOT PAVEMENT CONDITION INDICES and MEASURES

Mn/DOT's pavement condition data is reduced to two indices for reporting the statewide pavement performance measures: Ride Quality Index (RQI) 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 Mn/DOT'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. This does not mean the road cannot be driven on but rather that it has deteriorated to a point where most people feel it is uncomfortable and a major rehabilitation is needed.

RSL: Remaining Service Life

The RSL estimates the number of years until the RQI will reach a value of 2.5, generally considered to be the end of the 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. 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 section. Short-term fixes, which may increase the pavement smoothness, do not result in many additional years of RSL.

In the previous years, the RSL has been reported using a High (RSL of 12 years or more) and Low (RSL of 3 years or less) category with performance measures established for each category. Reporting RSL in this manner does not provide any additional insight into pavement performance since the predicted RQI is calculated each year based on the STIP. In addition, the impact of any preventive maintenance activities done on roads in the High RSL category cannot be shown, since the percent in the High category does not change (even though the RSL has been improved). A better way to show RSL is to report the Average RSL (ARSL) of the PA and NPA systems. The ARSL shows the impact of work done on roads in "Good" condition (higher ARSL) as well as the impact of not spending enough on preservation (lower ARSL). This is how the RSL will be presented in this report. The Office of Materials was also instructed to investigate alternative ways of capturing the RSL of the system other than strictly pavement roughness.

PERFORMANCE CATEGORIES

Mn/DOT currently categorizes pavement condition, as measured by the RQI into five equal categories as shown in Table 1.

Table 1. RQI Performance Categories

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

PERFORMANCE TARGETS

All pavements 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 is comprised of 52% PA and 48% NPA.

Performance targets have been established for both functional groups as shown in Table 2. The RQI targets are based on the percent of miles in the Good & Very Good (RQI > 3.0) and the Poor & Very Poor (RQI <= 2.0) categories as described in Table 1.

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

Overall, the smoothness of the PA system, as measured by the RQI, improved in 2006 (although it did not meet the targets). The percent of the PA system in the "Good" RQI category increased while the percent in the "Poor" category decreased. This is the second year in a row this has happened. The NPA system also had an increase in the "Good" RQI category but this was offset, in part, by an increase in the amount of miles in the "Poor" category.

1997 - 2006 "Good" RQI Trend (Figure 2)

For the second straight year there was a noticeable improvement in the number of miles on both the PA and NPA systems in the "Good" RQI category. Although neither target was met in 2006, the conditions are getting very close to the established targets of 70%, or more, on the PA system and 65%, or more, on the NPA system.

The pavement projects in the 2007 to 2010 STIP are expected to keep the amount of miles in the "Good" RQI category near the 2006 levels. By the end of the 2007 to 2010 STIP, the PA system is expected to be slightly above the target while the NPA system comes within a few percent. This prediction is based on the pavement projects in the STIP as of December 2006

and does not reflect any adjustments that may be needed as a result of the recent drop in the state revenue forecast.

1997 - 2006 "Poor" RQI Trend (Figure 3)

There were mixed results in terms of the percent of the system in the "Poor" RQI category in 2006. The percent of the PA system in "Poor" condition decreased while the percent of the NPA system increased. The PA system, currently at 2.3%, is getting close to the target of 2%, or less, and decreased for the second straight year. On the other hand, the percent of the NPA system in "Poor" condition increased to 5.2%, the highest level ever measured.

The 2007 to 2010 STIP is expected to result in increased miles in the "Poor" RQI category on both the PA and NPA systems. The number of miles in the "Poor" category is expected to decline in 2007 on both the PA and NPA systems but then increase steadily through 2010. By 2010 it is expected that the percent of miles in the "Poor" RQI category will increase almost 39% on the PA system and 27% on the NPA system.

As mentioned above, the predictions are based on pavement projects in the STIP as of December 2006 and do not reflect any adjustments that will likely be needed as a result of the recent drop in the state revenue forecast. If the districts decrease the amount or scope of pavement projects in the STIP the resulting pavement conditions will be worse that predicted.

RQI COMPARISON by ATP

This section will discuss how each of the eight ATPs compare with each other based on the data from the 2006 condition survey.

"Good" RQI Comparison (Figure 4)

ATP-2, 3, 4 and 8 met the target of having at least 70% of the PA system in the "Good" RQI category, the same as last year. ATP-7 only missed the target by 0.4% (69.6%).

ATP-3, 4, 7, and 8 met the target of having 65% or more of the NPA system in the "Good" RQI category.

ATP-3, 4, and 8 met the "Good" RQI targets on both the PA and NPA system.

"Poor" RQI Comparison (Figure 5)

Only ATP-6 and 7 failed to meet the target of having no more than 2% of the PA system in the "Poor" category.

ATP-3, 4, 7, and 8 met the target of having 3% or less of the NPA system in the "Poor" category.

ATP-3, 4, and 8 met the "Poor" RQI targets on both the PA and NPA system.

While Metro and ATP-6 still have the highest percent of their NPA system in the "Poor" category, 9.1% and 12.7% respectively, they both improved from 2005 (13.8% and 13.3%).

AVERAGE REMAINING SERVICE LIFE (ARSL)

In addition to improved RQI, the Average Remaining Service Life (ARSL) of the PA system had its largest increase since 2001. The ARSL on the NPA system remained basically unchanged.

1997 - 2006 Average RSL Trend (Figure 6)

The average remaining service life of the PA system in 2006 was 12.3 years, up from last year's value of 11.6 years. This is the largest increase in ARSL on the PA system since 2001.

The average remaining service life on the NPA system in 2006 was 10.4 years, a slight increase from last year's value of 10.1 years. The ARSL on the NPA system has remained virtually the same since 2003.

Average Remaining Service Life (ARSL) Comparison (Figure 7)

As one would expect, the PA system has a higher ARSL than the NPA system in nearly all ATPs. Only ATP-7 has a higher ARSL on the NPA system than the PA system.

Of all the ATPs, ATP-6 has the lowest ARSL on both the PA and NPA system.

While most ATPs have close to the same ARSL on the PA and NPA system, generally 1 to 2 years difference, ATP-2 has a considerable difference. Their PA system has an ARSL six years higher than it's NPA system (16.4 versus 10.1).

RQI TARGET SUMMARY

The table below provides a visual picture of which ATPs met the pavement targets in 2006. 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 and within 5% for "Good".

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

ATP	Ride Quality Index (RQI) Targets Met in 2006			
	Good RQI (RQI > 3.0)		Poor RQI (RQI <= 2.0)	
	PA	NPA	PA	NPA
1				
2				
3				
4				
6				
7				
8				
M				

ACCURACY OF RQI PREDICTIONS

Each year, the anticipated work program is entered into Mn/DOT's pavement management software in order to predict what the likely condition of the trunk highway system will be the following year.

In 2005, based on the 2006-2008 STIP, it was anticipated that the percent of the PA system in the "Good" RQI category would increase while the percent of the NPA in the "Good" RQI category would remain about the same. The percent of the PA system in the "Poor" RQI category was predicted to decrease while the percent of the NPA system increased. This is what happened. Although the exact percentages in each category varied slightly from the predicted values, the RQI trends were accurately predicted.

The predicted pavement condition will nearly always be better than the actual condition because the predicted condition assumes all of the pavement projects scheduled for 2006 are completed. When the pavement condition was measured, not all projects were started, completed, or still planned for 2006. As a result, the pavement condition measured on these pavement sections will be the condition prior to the work rather than after, which is what the prediction model is calculating.

Table 3 shows a comparison of the predicted 2006 RQI, based on the 2005 data and the 2006-2008 STIP (from last year's report) and what was actually measured in 2006.

Table 3. Comparison of 2006 Predicted and Actual RQI

Principal Arterial System			
System Performance Measure	**2005 Data**	**Predicted 2006 Data**	**2006 Data**
Good RQI (RQI > 3.0)	66.8%	71.8%	68.9%
Poor RQI (RQI <= 2.0)	2.6%	1.8%	2.3%
Non-Principal Arterial System			
Performance Measure	**2005 Data**	**Predicted 2006 Data**	**2006 Data**
Good RQI (RQI > 3.0)	60.1%	60.0%	61.1%
Poor RQI (RQI <= 2.0)	4.8%	5.1%	5.2%

ADDITIONAL INFORMATION

For additional information about the condition and performance of the state highway system or to obtain a copy of the formal annual report, contact:

David Janisch
Pavement Management Engineer
1400 Gervais Avenue, Mailstop 645
Maplewood, MN 55109
(651) 366-5567
dave.janisch@dot.state.mn.us

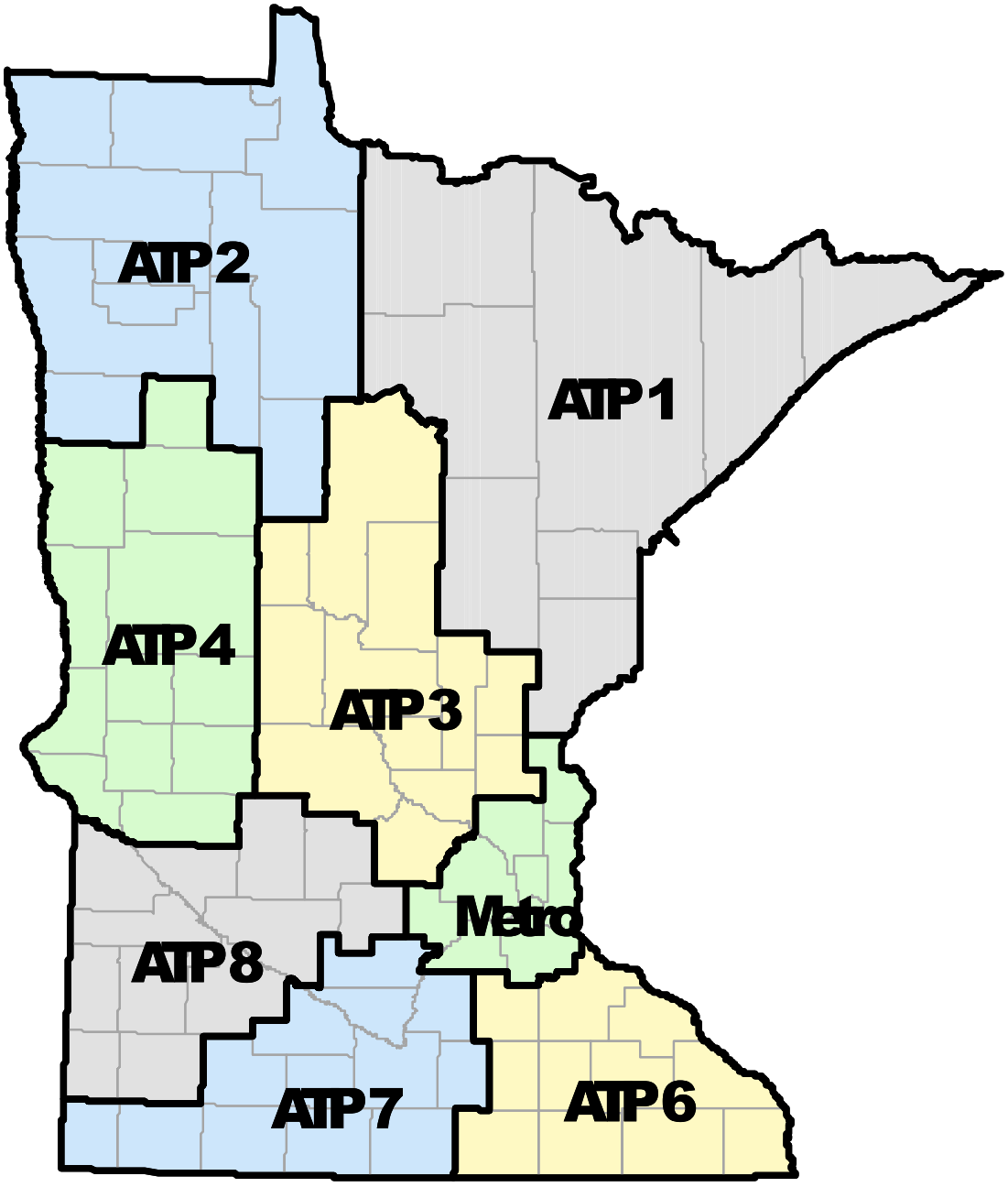


Figure 1. Mn/DOT's Area Transportation Partnership (ATP) Boundaries.

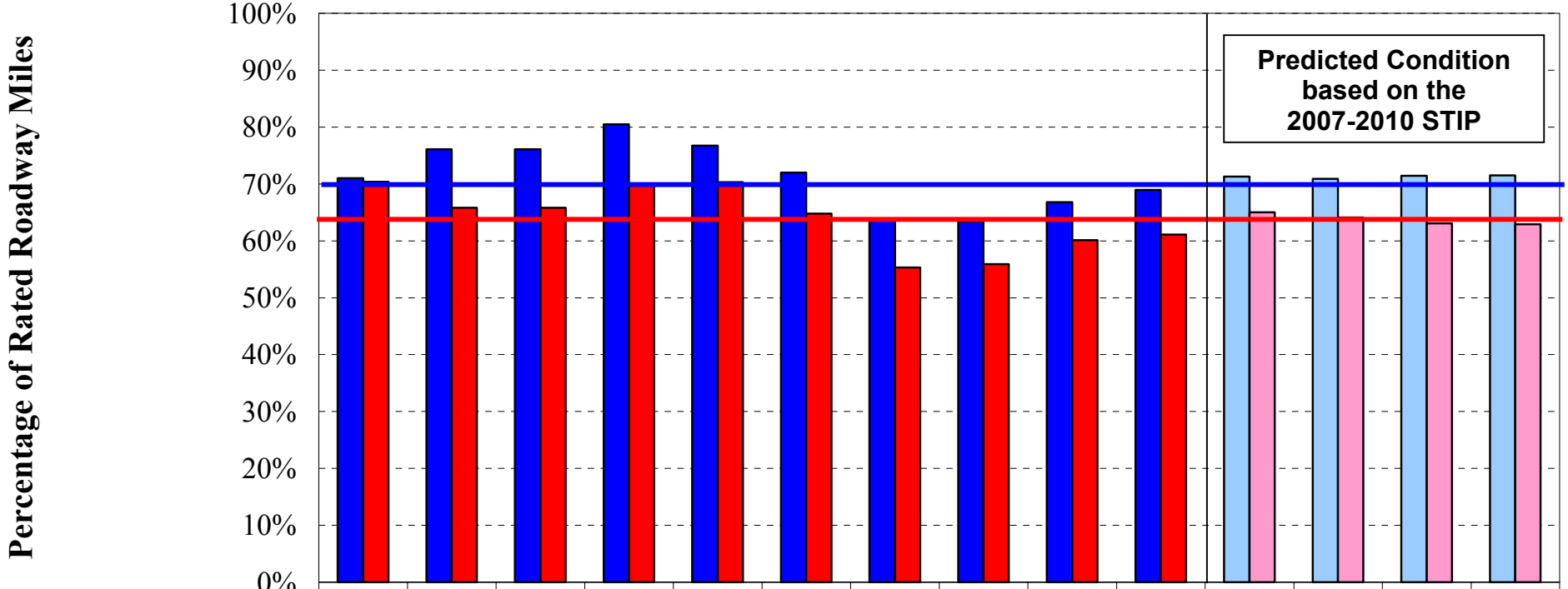
Figure 2

Statewide "Good" Ride Quality Index

(RQI above 3.0)

1997 - 2006

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



	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Principal Art.	71.0%	76.1%	76.1%	80.5%	76.7%	72.0%	63.6%	63.4%	66.8%	68.9%	71.3%	70.9%	71.4%	71.5%
Non-Principal Art.	70.4%	65.8%	65.8%	69.7%	70.3%	64.8%	55.3%	55.9%	60.1%	61.1%	65.0%	64.1%	63.1%	62.9%

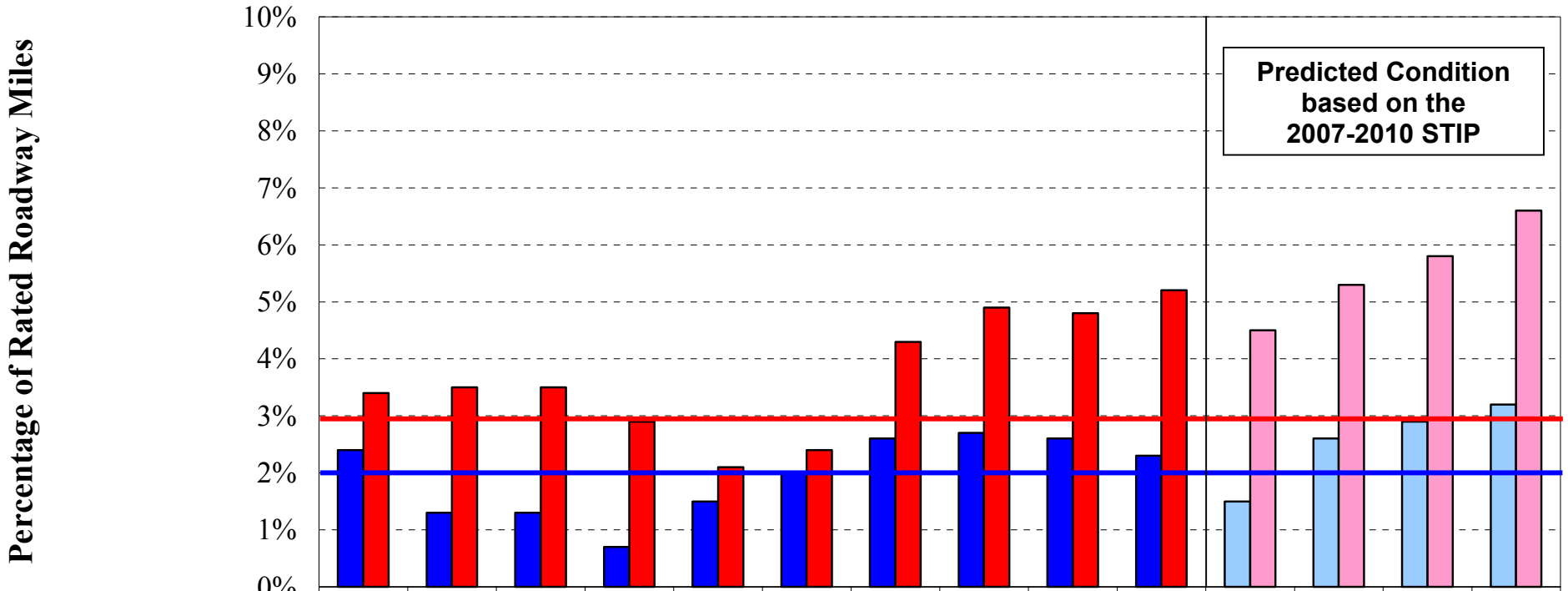
Figure 3

Statewide "Poor" Ride Quality Index

(RQI of 2.0 or less)

1997 - 2006

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



	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Principal Art.	2.4%	1.3%	1.3%	0.7%	1.5%	2.0%	2.6%	2.7%	2.6%	2.3%	1.5%	2.6%	2.9%	3.2%
Non-Principal Art.	3.4%	3.5%	3.5%	2.9%	2.1%	2.4%	4.3%	4.9%	4.8%	5.2%	4.5%	5.3%	5.8%	6.6%

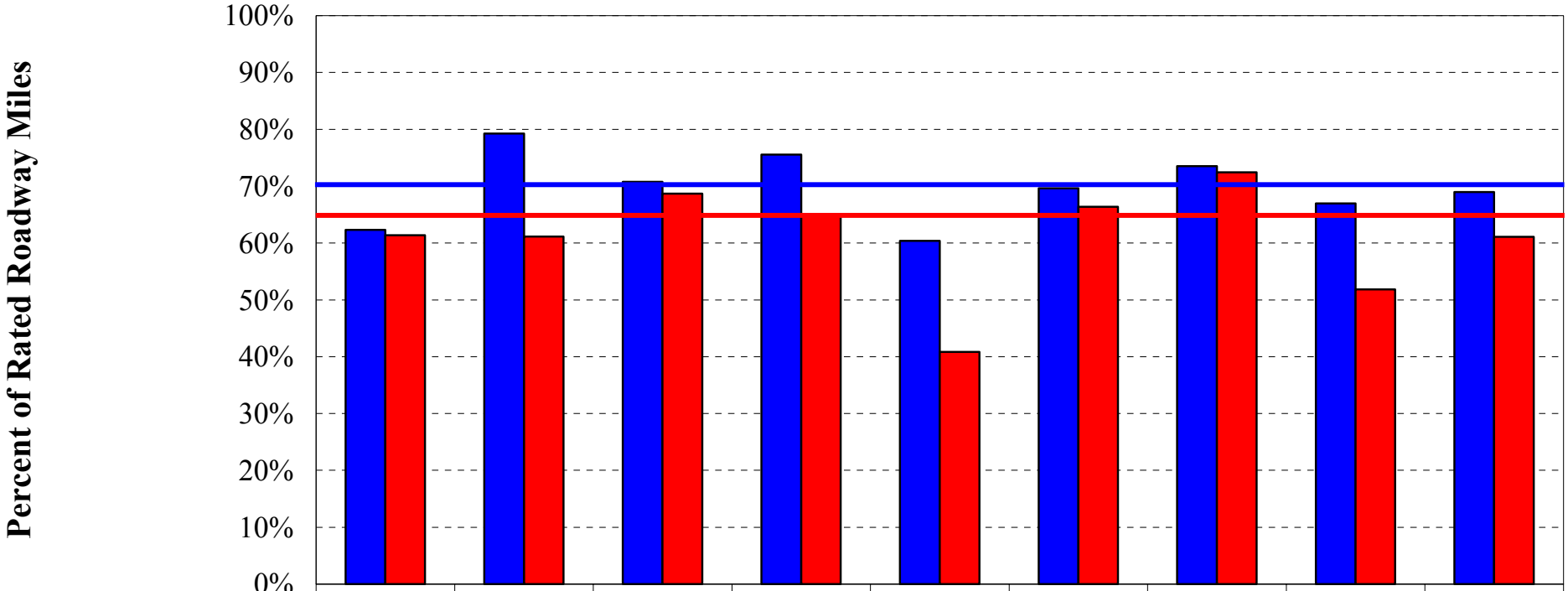
Figure 4

"Good" Ride Quality Index

(RQI above 3.0)

Comparison of 2006 Data by ATP

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



	ATP 1	ATP 2	ATP 3	ATP 4	ATP 6	ATP 7	ATP 8	Metro	State
Principal Art.	▲ 62.3%	▼ 79.3%	▼ 70.8%	▼ 75.5%	▲ 60.4%	▲ 69.6%	▲ 73.5%	▲ 67.0%	▲ 68.9%
Non-Principal Art.	▼ 61.4%	▼ 61.2%	▲ 68.7%	▼ 65.0%	▲ 40.8%	▲ 66.4%	▲ 72.4%	▲ 51.8%	▲ 61.1%

▲ = Better than 2005
▼ = Worse than 2005

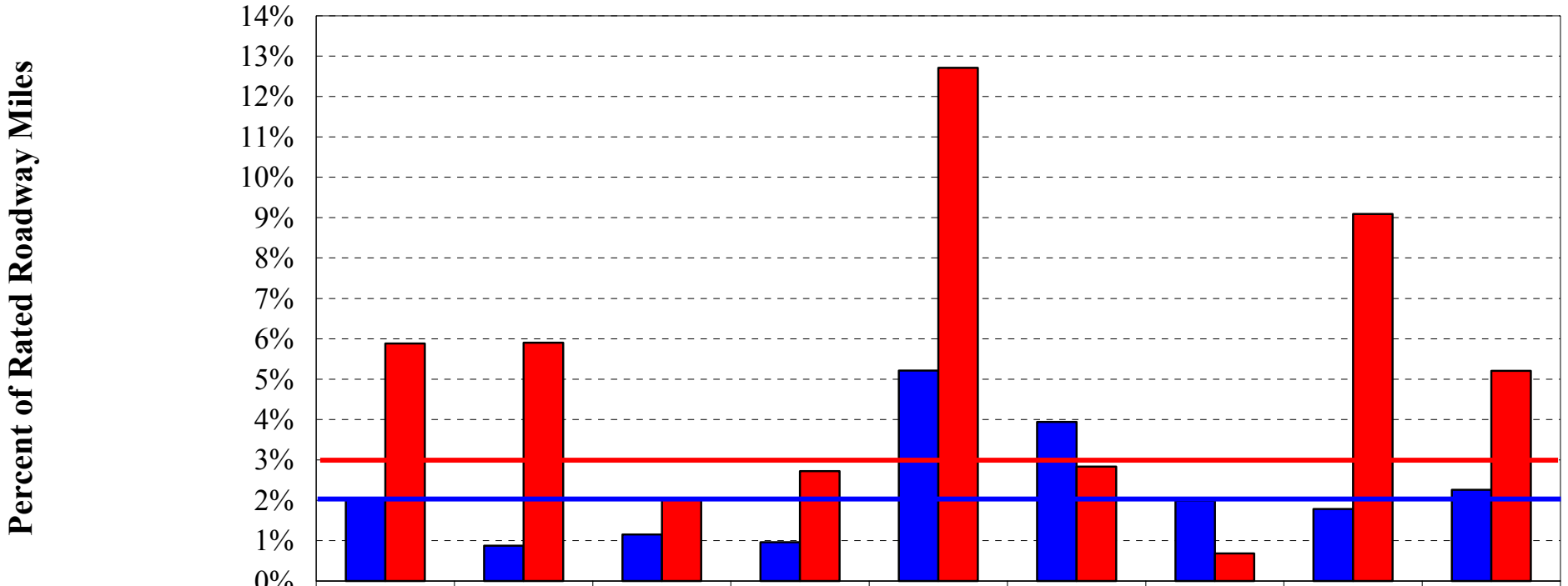
Figure 5

"Poor" Ride Quality Index

(RQI of 2.0 or less)

Comparison of 2006 Data by ATP

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



	ATP 1	ATP 2	ATP 3	ATP 4	ATP 6	ATP 7	ATP 8	Metro	State
Principal Art.	▲ 2.0%	▼ 0.9%	▼ 1.2%	▲ 1.0%	▲ 5.2%	▲ 3.9%	▼ 2.0%	▲ 1.8%	▲ 2.3%
Non-Principal Art.	▼ 5.9%	▼ 5.9%	▼ 2.0%	▼ 2.7%	▲12.7%	▲ 2.8%	▼ 0.7%	▲ 9.1%	▼ 5.2%

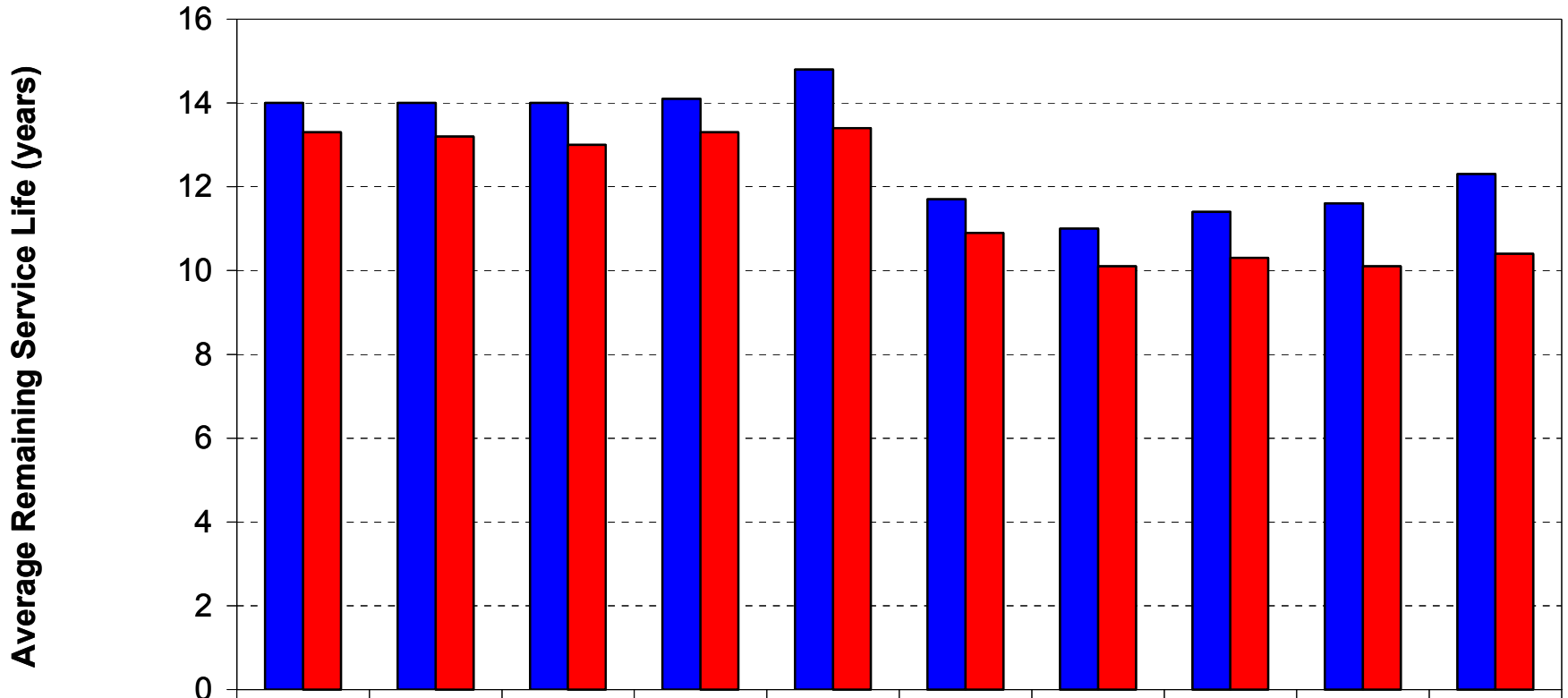
▲ = Better than 2005
▼ = Worse than 2005

Figure 6

Statewide Average Remaining Service Life (ARSL)

(Years until RQI reaches 2.5)

1997 - 2006



	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Princ. Arterial	14.0	14.0	14.0	14.1	14.8	11.7	11.0	11.4	11.6	12.3
Non-Princ. Arterial	13.3	13.2	13.0	13.3	13.4	10.9	10.1	10.3	10.1	10.4

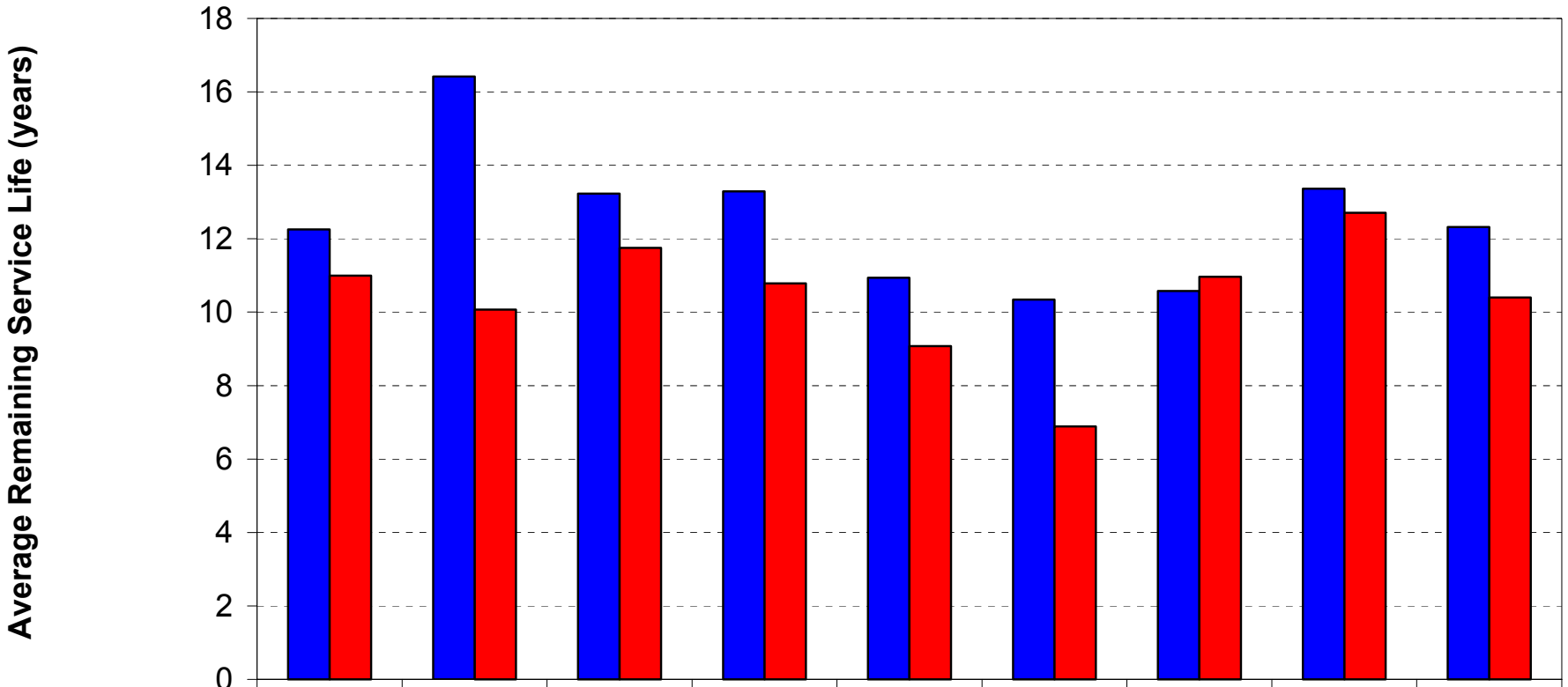
No official targets have been established for ARSL

Figure 7

Average Remaining Service Life

(Years until RQI reaches 2.5)

Comparison of 2006 Data by ATP



	ATP-1	ATP-2	ATP-3	ATP-4	Metro	ATP-6	ATP-7	ATP-8	State
Princ. Arterial	▲ 12.3	▲ 16.4	13.2	▲ 13.3	▲ 10.9	▲ 10.3	▲ 10.6	▲ 13.4	▲ 12.3
Non-Princ. Arterial	▼ 11.0	▼ 10.1	▲ 11.8	▲ 10.8	▲ 9.1	▲ 6.9	▲ 11.0	▼ 12.7	▲ 10.4

▲ = Better than 2005
▼ = Worse than 2005