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Highway Ride Quality In the Chicago Region as of 2006

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HIGHWAY RIDE QUALITY IN THE CHICAGO REGION AS OF 2006

1 Executive Summary

CMAP has compiled an overview of highway ride quality conditions for the expressway and principal arterial systems in the Chicago region, using International Roughness Index (IRI) data for the years 2003 and 2006. This combination of roadways includes the National Highway System (NHS) expressway and arterial networks, as well about 500 miles of other principal arterials that have not been formally added to NHS, but remain important in terms of regional mobility. This data will support CMAP's congestion management process performance measurement system, as these highway systems provide the basis for regional mobility.

The Federal Highway Administration (FHWA) has defined "acceptable" ride quality as pavement with IRI values of less than or equal to 170, which is usually measured in terms route-miles and/or vehicle-miles traveled (VMT). FHWA has also emphasized roadways that carry the NHS with regards to national performance measures.

Based on the analysis in this paper, a comparison of regional conditions versus state-wide and national averages indicated that expressway conditions in the Chicago region were below statewide, and slightly above national averages; while principal arterial conditions were below both statewide and national averages. By roadway type, the IRI was considered in an "acceptable" range for 90.5% of expressway route-miles in 2006, up from 88.4% in 2003. For principal arterials, the IRI was "acceptable" for 61.9% of route-miles in 2006, down from 68.2% in 2003. Measured for vehicle-miles travelled (VMT), ride quality was "acceptable" for 92.4% of expressway VMT in 2006, and was "acceptable" for 61.3% of principal arterial VMT.

The paper includes an analysis of ride quality data by county for both expressways and principal arterials.

A review of 2008 data is currently underway, but is not yet complete. However, preliminary analyses indicated that expressway system ride quality continued to improve, while arterial ride quality continued to deteriorate.

2 Introduction

The purpose of this report is to provide an overview of highway ride quality in the Chicago region. To set the stage for this overview, this paper will also include a brief description of roadway characteristics included in this analysis. In order to provide analysis comparable to the analysis contained in USDOT's *FY2006 Conditions and Performance Reports to Congress (2006 C&P Report)*, CMAP staff conducted a review of International Roughness Index (IRI) data from IDOT's Illinois Roadway Information System (IRIS) from the year 2006. CMAP staff extracted data for the CMAP region to develop a database for analysis purposes, and to generate preliminary GIS applications. For comparison purposes, IRI data from FHWA's Highway Performance Monitoring System (HPMS) from the year 2003 was also reviewed. This report is intended to provide a snapshot of pavement ride quality from 2006, to show a basic comparison with FHWA pavement quality data from 2003, and to offer background for the development of performance measures related to ride quality in the seven-county Chicago region.

3 Ride Quality and IRI data

The FHWA 1998 Strategic Plan introduced the term “acceptable ride quality” as a measure of pavement condition. The definition of acceptable ride quality was established as pavement having an IRI value less than or equal to 170 inches per mile. The International Roughness Index was originally established by the World Bank in the 1980’s as a way to uniformly evaluate pavement conditions around the globe. States are currently required to report IRI data for all National Highway System (NHS) routes.

Pavement roughness (unacceptable ride quality) is a major concern that is easily noticed by the motoring public. Pavement roughness causes an increase in vertical stresses on pavement, particularly for heavy vehicles. This stress aggravates pavement fatigue and accelerates overall pavement deterioration. IRI roughness data is easily obtained, and can offer present day pavement performance evaluations as well indicators and/or predictions for future performance. IRI data is obtained from calibrated devices that measure longitudinal roadway profiles as defined in the *HPMS Field Manual*.

IRI data is the primary measure for ride quality for the biannual *C&P Report*, which is intended to provide Congress with an objective national appraisal of the physical conditions and operational performance of the nation’s highways. This report applies a similar perspective to pavement ride quality in the Chicago region. Here, IRI data is reported for expressways and principal arterials only, because of data quality issues for roadways of lower functional classes. To understand the data presented below, a description of the regional expressway and principal arterial functional classes is provided first.

4 Regional Expressway and Principal Arterial System Characteristics

Key data items discussed in the *FY2006 C&P Report* relate to roadway ownership, functional classification, and vehicle-miles traveled (VMT), with a particular focus on National Highway System (NHS) routes. This paper will focus only on the three highest functional classes (FC) of roadways in the region: FC 10 Interstate, FC 20 urban expressways/freeways, and FC 30 other principal arterials. Together, these functional classes comprise approximately 2,200 route-miles in our region, or less than ten percent of the more than 25,000 route-miles in our region.¹

4.1 Roadway Ownership

A review of the 2006 IRIS data item 12, *Jurisdictional Responsibility*, indicated a state-oriented jurisdictional pattern in the Chicago region for expressways and other principal arterials. In the Chicago region, the IRIS database indicated just over 2,200 route-miles of expressways and principal arterial roadways, with 78.9% under IDOT jurisdiction, 9.7% county, 8.4% toll authority/private, and 3.0% municipal, as shown in Exhibit 1. Of course, there are many miles of roads in our region under local jurisdiction, but not at the “other principal arterial” functional class level and above.

¹ District 1 route-miles total 24,274; Kendall County route-miles total 924 miles. Aux Sable township route-miles are unavailable. Source: Illinois Department of Transportation, *Illinois Highway and Street Mileage Statistics*, 2008. http://www.dot.il.gov/travelstats/2008_ILHS.pdf.

Exhibit 1: Roadway Jurisdiction in the Chicago Region:
Interstate, Urban Freeways, and Principal Arterials

Agency Jurisdiction	Functional Class 10, 20 30	
	Route-miles	Percentage
IDOT	1,737	78.9 %
County	214	9.7 %
Muni	66	3.0 %
Federal	0	0.0 %
Private (Toll Authorities)	184	8.4 %
Township	0	0.0 %
Grand Total	2,202	100.0 %

Source: CMAP, using IDOT data

4.2 Urban and Rural Shares

Another facet of functional class involves the urban and rural classification. Rural roadways generally carry lower traffic volumes, and are subjected to less wear and tear, and tend to have better ride quality. Higher traffic volumes carried on urban roadways tend to increase the overall rate of roadway deterioration which results in higher roughness values, and higher levels of unacceptable ride quality. Nationally, ride quality is better on rural roads than on urban roads.

As described in the [FY2006 C&P Report](#), 75.1% of the nation's roadway were classified as rural, with the remaining 24.9% classified as urban roadways that carried over 60% of the national VMT. Similarly, in 2006, the IDOT Travel Statistics classified 70.7% of Illinois roadways as rural. The remaining 29.3% of Illinois roads are urban roadways that carried 74.1% of statewide VMT. As shown in Exhibit 2, 83.8% of roadway route-miles in the Chicago region were classified as urban roadways, and 94.7% of the traffic carried on these roadways is classified as urban. Clearly, higher-classification roadways in the Chicago region are high volume urban roadways that are vital to regional mobility, but which are subjected to a very high degree of wear and tear.

Exhibit 2: Urban and Rural Route-Miles and VMT in the Chicago Region

HPMS Codes		Functional Classification	IRIS Codes	Route-miles	VMT	% Urban Route Miles	% Urban VMT
Rural	Urban						
01	11	Interstate	10	417	48,664,682	83.8%	94.5%
	12	Freeway / Expressway	20	39	2,227,650	100.0%	100.0%
02	14	Other Principal Arterials	30	1,746	42,581,375	83.4%	94.7%
		Regional Total FC 10 20 30		2,202	93,473,707	83.8%	94.7%

Source: CMAP, Using IDOT data

4.3 National Highway System

IRI data is readily available for many, but not all roads. IRI data is typically available for the National Highway System (NHS) and roadways in the Highway Performance Monitoring System sample. The National Highway System consists of the Interstate system, principal arterials, the Strategic Highway Network (STRAHNET) system of defense highways and connectors, and intermodal connectors. According to the [FY2006 C&P Report](#), while the NHS makes up only 4% of total U.S. mileage, the NHS carried more than 44% of total U.S. travel in 2004. As a result, FHWA has emphasized roadways that carry the NHS with regards to national performance measures. Frequently these performance measures are defined in terms of the route-miles and/or vehicle-miles traveled (VMT).

For the purposes of this paper staff analysis will focus only the 3 highest functional classes of roadways in the region Interstate (FC 10), Urban Expressways/Freeways (FC 20), and Principal Arterials (FC 30). This combination of roadways includes the NHS arterial network as well an approximately 500 miles of principal arterials that remain important in terms of regional mobility, but were not formally added to NHS in the 1990's. Pavement conditions for intermodal connectors, another part of the National Highway System, have been will be reviewed in a separate paper to be available shortly.

5 Regional Ride Quality

In the *C&P Reports*, ride quality is usually measured based on IRI and is most often discussed in terms of pavement ride quality that is acceptable or not acceptable (see Exhibit 3). IDOT utilizes the Condition Rating Survey (CRS) system to determine pavement quality state-wide. The CRS system includes numerous inputs, including the IRI data, to determine comprehensive pavement condition assessments. IDOT reports the IRI values to the FHWA, who in turns uses this data to assess ride quality as a measure of pavement condition on a national level.

Exhibit 3: International Roughness Index Criteria for Acceptable Ride Quality

Ride Quality Terms	IRI Rating
Acceptable	<= 170
Not Acceptable	> 170

5.1 Regional Conditions

For the purpose of this report, ride quality is discussed into terms of two groups of roadways: *expressways* (Interstates - FC10 and expressways/freeways - FC 20) and other *principal arterials* (FC 30). In the most basic sense regional expressway condition can be represented by two measures of acceptable ride quality: 90.5% of *expressway* route-miles, and 92.4% of *expressway* VMT, have “acceptable” pavement ride quality. The condition of the principal arterial system can be summarized by noting that 61.9% of *principal arterial* route-miles, and 61.3% of *principal arterial* VMT, have “acceptable” pavement ride quality. The regional extent and basic parameters of acceptable ride quality of the regional expressway and principal arterial systems are shown in Exhibits 4 and 5. Please note these maps show conditions reported by the IRIS 2006 database. Since that time, numerous projects have improved some of our roadways, and some roadways have deteriorated to a less than acceptable condition. However, this data presents a snapshot for future comparison.

Exhibit 4: Chicago Region Expressway System Ride Quality

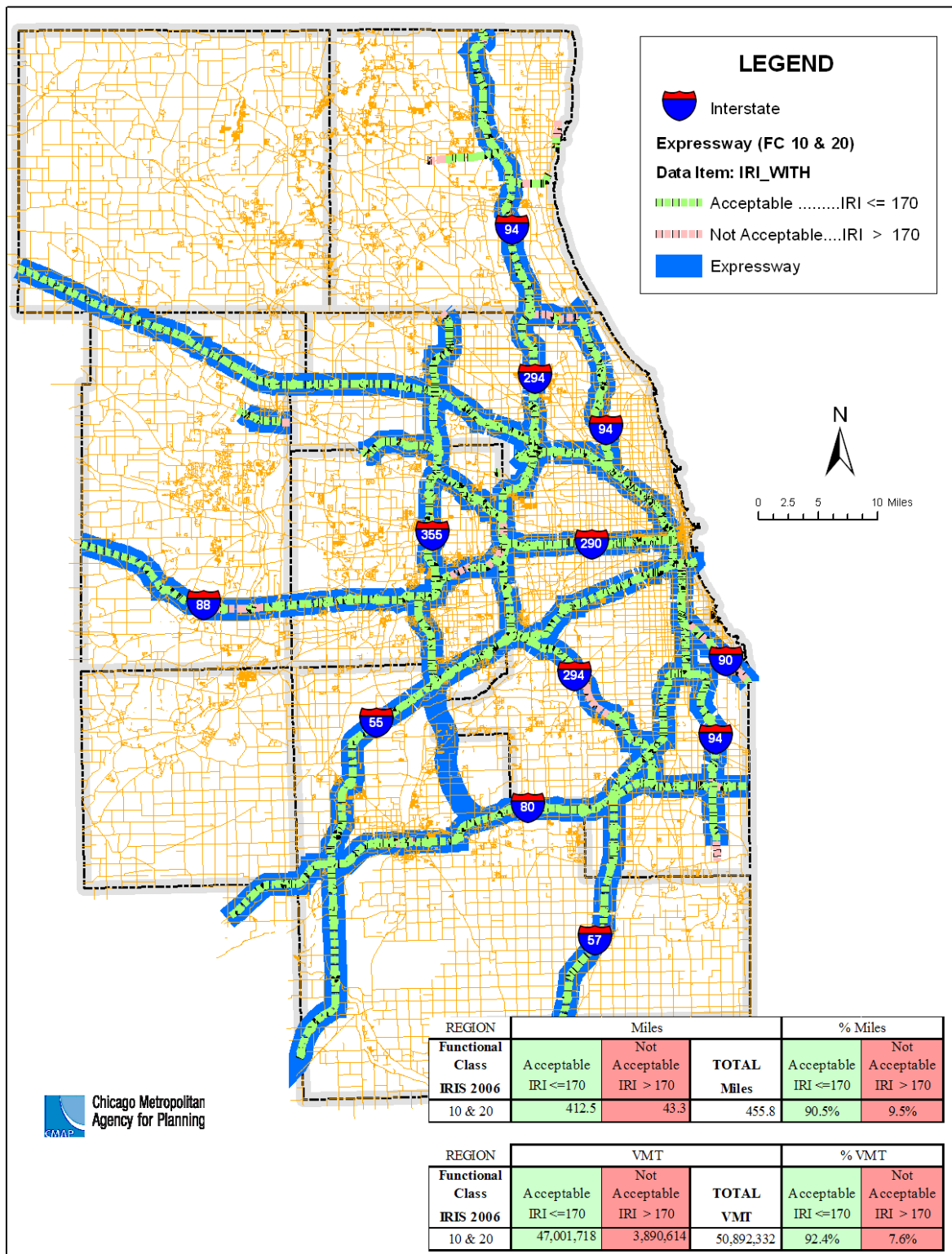
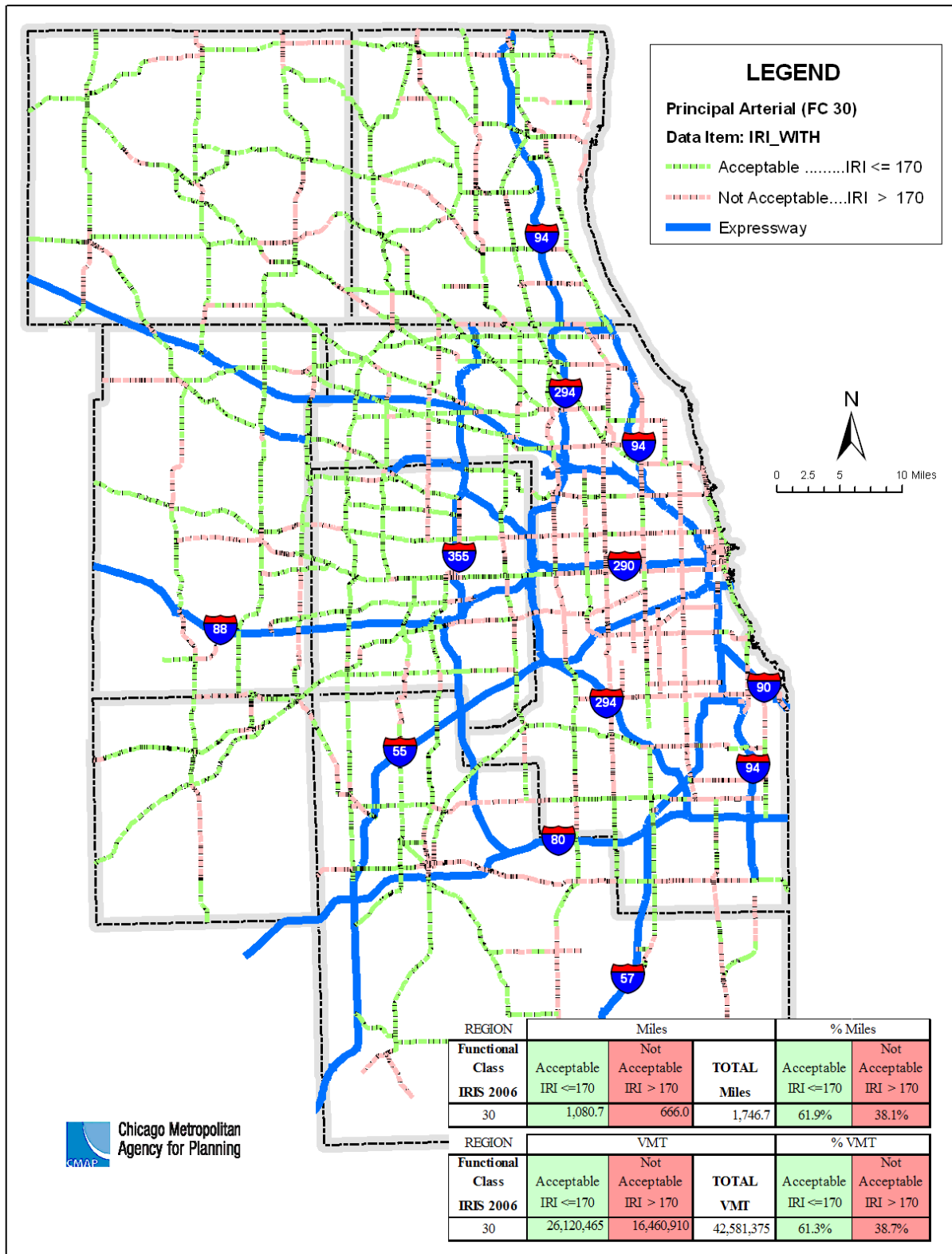


Exhibit 5: Chicago Region Principal Arterial Ride Quality



5.2 Functional Class and Ride Quality Trends 2003 to 2006

Measured by route-miles, the ride quality was “acceptable” for 90.5% of *expressway* (Interstate and other expressway) route-miles in 2006, up from 88.4% in 2003. For *principal arterials*, the ride quality was “acceptable” for 61.9% of route-miles in 2006, down from 68.2% in 2003. Measured for vehicle-miles travelled (VMT), ride quality was “acceptable” for 92.4% of Interstate freeway VMT in 2006, and was “acceptable” for 61.3% of *principal arterial* VMT. See Exhibits 6 and 7; green shading in these exhibits shows that conditions improved or stayed the same from 2003 to 2006.

Exhibit 6: 2003-2006 Comparison: Acceptable Ride Quality
by Percent of Route-Miles

Acceptable Ride Quality % Route-miles Interstate/Expressway		Cook	DuPage	Kane	Kendall*	Lake	McHenry	Will	Chicago Region
Functional Class	(FC)	<=170	<=170	<=170	<=170	<=170	<=170	<=170	<=170
Interstate Freeway	10	88.6%	89.9%	87.3%	100.0%	87.5%	100.0%	97.7%	90.5%
IRIS 2006	20								
Interstate Freeway	1	82.6%	89.1%	86.6%	100.0%	94.5%	100.0%	100.0%	88.4%
HPMS 2003	11								
	12								
Acceptable Ride Quality % Route-miles Principal Arterials		Cook	DuPage	Kane	Kendall*	Lake	McHenry	Will	Chicago Region
Functional Class	(FC)	<=170	<=170	<=170	<=170	<=170	<=170	<=170	<=170
Principal Arterial	30	44.8%	75.9%	70.7%	72.2%	71.2%	75.3%	64.7%	61.9%
IRIS 2006									
Principal Arterial	2	53.6%	77.2%	82.8%	85.7%	79.3%	67.9%	72.2%	68.2%
HPMS 2003	14								

Exhibit 7: 2003-2006 Comparison: Acceptable Ride Quality
by Percent of Vehicle-Miles Travelled

Acceptable % VMT Interstate/Expressway		Cook	DuPage	Kane	Kendall*	Lake	McHenry	Will	Chicago Region
Functional Class	(FC)	<=170	<=170	<=170	<=170	<=170	<=170	<=170	<=170
Interstate Freeway	10	92.1%	89.7%	86.3%	100.0%	95.8%	100.0%	97.4%	92.4%
IRIS 2006	20								
Interstate Freeway	1	86.7%	89.1%	84.5%	100.0%	98.9%	100.0%	100.0%	89.0%
HPMS 2003	11								
	12								
Acceptable Ride Quality % VMT Principal Arterials		Cook	DuPage	Kane	Kendall + Grundy	Lake	McHenry	Will	Chicago Region
Functional Class	(FC)	<=170	<=170	<=170	<=170	<=170	<=170	<=170	<=170
Principal Arterial	30	46.8%	76.2%	71.4%	72.8%	76.4%	75.0%	68.6%	61.3%
IRIS 2006									
Principal Arterial	2	55.4%	77.3%	83.3%	81.0%	81.6%	63.7%	69.6%	66.6%
HPMS 2003	14								

6 2006 Ride Quality by Geography

This section describes ride quality by county geography, and also compares the Chicago region to state-wide and national bench marks. For a more detailed county by county breakdown, please refer to the series of maps in Appendix A.

6.1 Ride Quality on the Expressway System

Exhibits 8, 9, and 10 provide an overview of expressway ride quality by percent of route-miles and percent of VMT. 2006 *expressway* ride quality was “acceptable” for between 85 and 95% of VMT in Cook, DuPage, and Kane Counties, and was acceptable for more than 95% of VMT in remaining counties. *Expressway* ride quality by route-miles was above the regional average in three (3) counties: McHenry, Kendall, and Will. As noted in Exhibit 6, only Lake and Will counties showed a decline in “acceptable” *expressway* ride quality from 2003 to 2006. Very similar county-level trends were observed in term of *expressway* VMT.

Exhibit 8: 2006 Acceptable Ride Quality for Expressways by County
by Route-Miles and Vehicle-Miles Travelled

Geography	2006 Route-miles		2006 VMT		% Acceptable Ride	
	Acceptable IRI <=170	TOTAL Miles	Acceptable IRI <=170	TOTAL Miles		
					% Miles	% VMT
McHenry	9.0	9.0	419,866	419,866	100.0%	100.0%
Lake	30.0	34.2	2,374,570	2,478,560	87.5%	95.8%
Kane	34.8	39.8	1,722,867	1,995,317	87.3%	86.3%
DuPage	52.0	57.8	6,996,506	7,801,702	89.9%	89.7%
Kendall*	7.2	7.2	259,542	259,542	100.0%	100.0%
Will	75.2	76.9	5,192,723	5,333,543	97.7%	97.4%
Cook	204.4	230.8	30,035,644	32,603,802	88.6%	92.1%
REGION	412.5	455.8	47,001,718	50,892,332	90.5%	92.4%
Chicago	55.4	66.4	10,595,172	11,738,206	83.4%	90.3%
Sub Cook	149.1	164.4	19,440,472	20,865,596	90.7%	93.2%

Green shading indicates counties with conditions above the regional average.

For the regional expressway system as of 2006, 90.5% of route-miles provided acceptable ride quality. As shown in Exhibits 9 and 10, the Chicago region was 7.2% below the 97.7% acceptable ride quality route-miles for the Illinois *expressways* (FC 10 and FC 20), and 1.7% below the 92.2% route-miles for U.S. urban Interstate highways. In terms of VMT, acceptable ride quality was provided for 92.4% of *expressway* VMT in the Chicago region as of 2006, which was 3.0% below the 95.4% VMT for acceptable ride quality for Illinois *expressways*, and 2.5% higher than the 89.9% for U.S. urban Interstate highways.

Exhibit 9: 2006 Percent Acceptable Ride Quality for Expressways:
Route-Miles - Geographic Comparisons

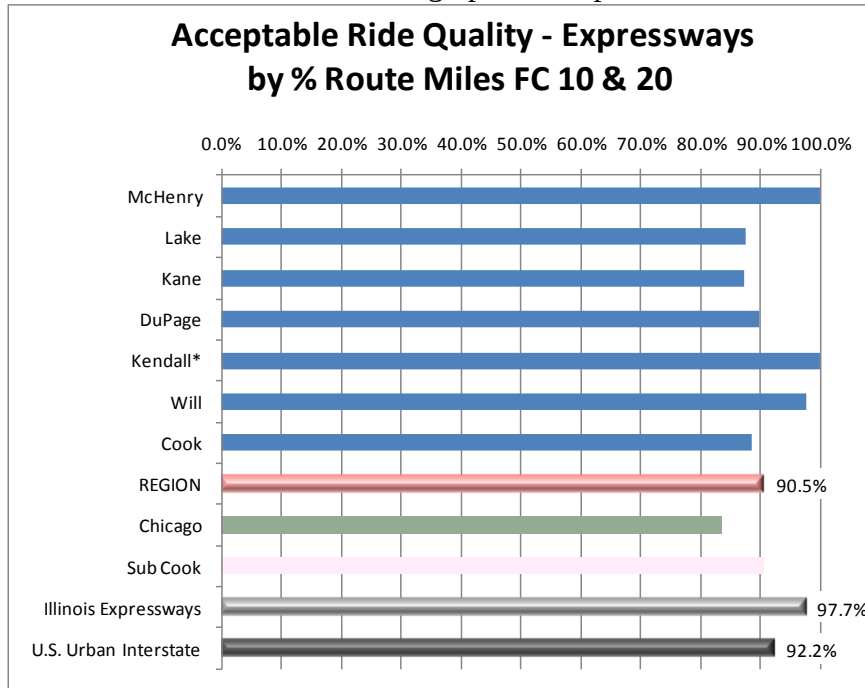
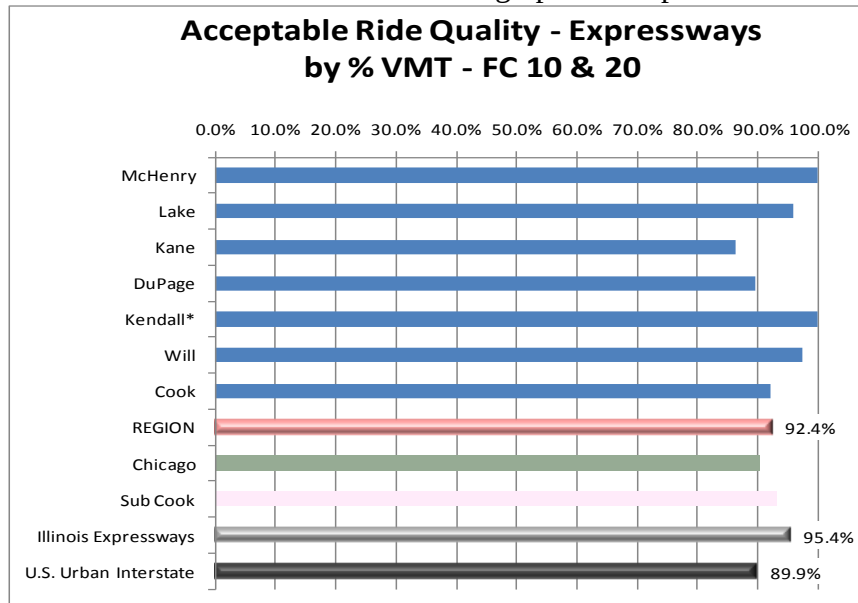


Exhibit 10: 2006 Percent Acceptable Ride Quality for Expressways:
Vehicle-Miles Travelled - Geographic Comparisons



Kendall* includes expressways (FC 10 and 20) in Kendall County and from Aux Sable Township in Grundy County.

6.2 Ride Quality on the Principal Arterial System

Exhibits 11, 12 and 13 provide an overview of principal arterial ride quality by county by route-miles and VMT. 2006 *principal arterial* “acceptable” ride quality was 32.9% of VMT in the City of Chicago and 54.3% in suburban Cook County. 2006 *principal arterial* “acceptable” ride quality by VMT was above 65% for all other counties in the region, and was at or above 75% in McHenry, DuPage, and Lake Counties. By county geography, *principal arterial* ride quality by route-miles was above the regional average for all counties, except for Cook County; with only McHenry County showing an increase in ride quality for *principal arterials* from 2003 to 2006. Very similar county-level trends were observed in terms of *principal arterial* VMT.

Exhibit 11: 2006 Acceptable Ride Quality for Principal Arterials
By County by Route-Miles and Vehicle-Miles Travelled

Geography	2006 Route-miles		2006 VMT		% Acceptable Ride	
	Acceptable	TOTAL	Acceptable	TOTAL	% Miles	% VMT
	IRI <=170	Miles	IRI <=170	Miles		
McHenry	153.2	203.5	1,963,472	2,616,502	75.3%	75.0%
Lake	171.1	240.3	4,218,205	5,520,093	71.2%	76.4%
Kane	122.7	173.5	2,366,022	3,315,803	70.7%	71.4%
DuPage	147.8	194.7	5,181,334	6,801,961	75.9%	76.2%
Kendall*	49.1	68.0	674,702	927,202	72.2%	72.8%
Will	158.2	244.4	2,380,967	3,468,842	64.7%	68.6%
Cook	278.7	622.3	9,335,763	19,930,970	44.8%	46.8%
REGION	1,080.7	1,746.7	26,120,465	42,581,374	61.9%	61.3%
Chicago	39.4	189.8	2,278,303	6,923,713	20.8%	32.9%
Sub Cook	239.3	432.5	7,057,460	13,007,257	55.3%	54.3%

Green shading indicates counties with conditions above the regional average.

For the principal arterial system in the Chicago region in 2006, 61.9% of route-miles provided acceptable ride quality. As shown in Exhibits 12 and 13, the Chicago region was a full 19.0% below the 80.9% of acceptable ride quality route-miles for Illinois principal arterials, and 7.4% below the 69.3% acceptable ride quality benchmark for U.S. urban arterials nationally. In terms of VMT, acceptable ride quality was provided for 61.3% of *principal arterial* VMT in the Chicago region, which was 10.2% below 71.5 % for Illinois principal arterials and 9.4% below the 70.7% for U.S. urban arterials.

7. A Look Ahead

A review of IRIS 2008 data is currently underway, but is not yet complete. However, preliminary analyses indicate that expressway system ride quality continued to improve, while arterial ride quality continued to deteriorate. An update of this report will take place in the next year, incorporating this new data.

It is hoped that performance measurement endeavors like this will give the public and officials an insight into current conditions, national comparisons, and historic trends. We also hope this information leads to support for system improvements.

Exhibit 12: 2006 Percent Acceptable Ride Quality for Principal Arterials:
Route-Miles – Geographic Comparisons

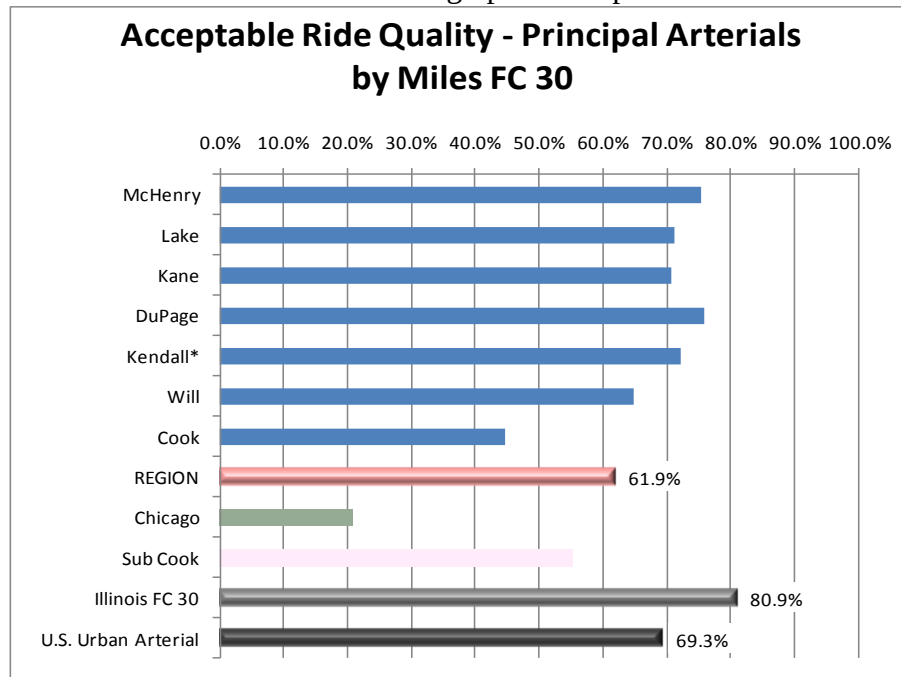
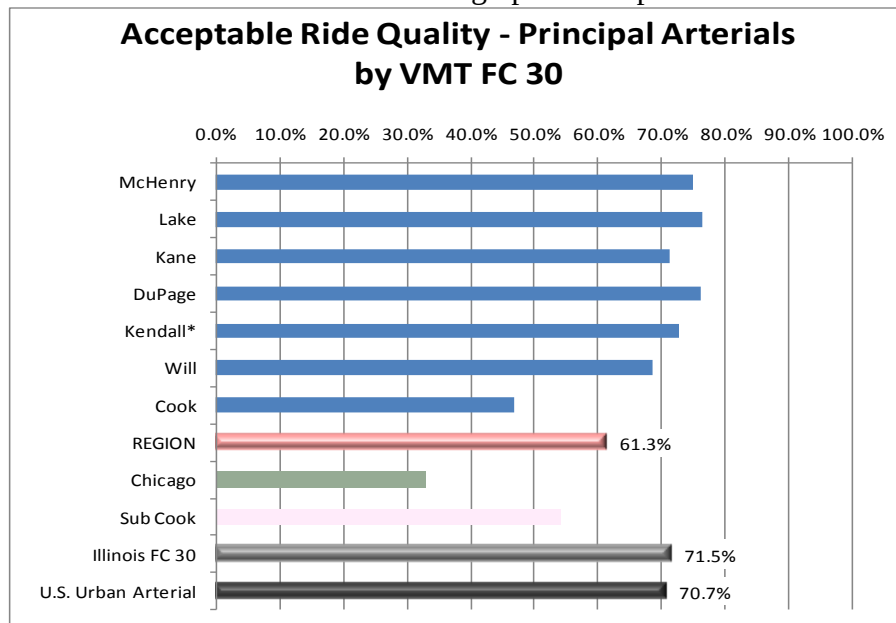


Exhibit 13: 2006 Percent Acceptable Ride Quality for Principal Arterials:
Vehicle-Miles Travelled – Geographic Comparisons



Kendall* includes principal arterials (FC 30) in Kendall County and from Aux Sable Township in Grundy County.