Fine Particulate Matter ($PM_{2.5}$) Project Level Hot-Spot Analysis

Prairie Parkway Study

Grundy, Kendall, and Kane Counties, Illinois

January 4, 2008

Illinois Department of Transportation

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1.0 Executive Summary

The Northeastern Illinois and Northwestern Indiana regions have been designated as nonattainment of the national ambient air quality standard (NAAQS or "standard") for fine particulate matter ($PM_{2.5}$). Based on the Transportation Conformity regulations found in 40 CFR 93.123(b)(1) (as amended March 10, 2006) federally funded non-exempt transportation projects in the Northeastern Illinois/Northwestern Indiana region are required to address project level or "hot-spot" considerations for $PM_{2.5}$.

According to 40 CFR 93.123(b)(2) and (4), a quantitative analysis for applicable projects is not required until EPA releases modeling guidance in the Federal Register. However, a qualitative hot-spot analysis is required for projects that are found to be "projects of air quality concern" in order to assess whether the project will cause or contribute to any new localized $PM_{2.5}$ violations, increase the frequency or severity of any existing violations, or delay timely attainment of the $PM_{2.5}$ NAAQS. This document addresses those requirements for the Prairie Parkway project.

This analysis used a surrogate methodology for complying with the qualitative hot-spot requirements. A "surrogate" (or substitute) site is a site for which the current levels of Average Daily Traffic (ADT) and truck traffic are comparable to or greater than those of the future worst-case build scenario. If, additionally, the surrogate site has a monitor in the vicinity with current $PM_{2.5}$ monitored values less than the standards, then one can logically conclude that the worst-case build scenario will not cause or add to an existing $PM_{2.5}$ violation.

Four surrogate sites with $PM_{2.5}$ monitors in proximity to existing freeways were chosen for this analysis: Elgin/I-90, Aurora/I-88, Joliet I-80 & I-55 and Braidwood/I-55. At these locations current freeway mainline daily traffic ranges from 30,000 to over 100,000; nearest arterial road interchange daily traffic ranges from 8,000 to over 33,000 and heavy commercial vehicle traffic is between 10% and 24% of total daily traffic. The Prairie Parkway Preferred Alternative forecast traffic ranges from 13,400 to 28,600 (near-term) and 25,000 to 50,000 (design year) vehicles per day with approximately 20% estimated to be diesel powered vehicles. Current traffic conditions at these four surrogate sites equal or exceed those forecast for the Prairie Parkway Preferred Alternative. The most recent (2004 to 2006) $PM_{2.5}$ monitor data at these four locations show them to be below both the 24-hour and annual $PM_{2.5}$ NAAQS.

In summary, current monitor data from four locations with (1) traffic levels equal or higher than those estimated for the Prairie Parkway Preferred Alternative; (2) current development levels comparable to those forecast for the study area; and (3) proximate enough that metrological conditions are equivalent all meet the current $PM_{2.5}$ 24-hour and annual mean NAAQS. Thus, it is determined that the Prairie Parkway Preferred Alternative meets the $PM_{2.5}$ project-level conformity requirements, and will not cause or contribute to a new violation of the $PM_{2.5}$ NAAQS, or increase the frequency or severity of a violation.

2.0 Purpose of this Document

The Clean Air Act section 176(c) requires that federally supported highway and transit project activities be consistent with state air quality goals, found in the State Implementation Plan (SIP). The process to ensure this consistency is called Transportation Conformity. Conformity to the SIP means that transportation activities will not cause new violations of the national ambient air quality standards (NAAQS or "standards"), worsen existing violations of the standard, or delay timely attainment of the relevant standard.

Transportation conformity is required for federal supported transportation projects in areas that have been designated by the U.S. Environmental Protection Agency (EPA) as not meeting a NAAQS. These areas are called nonattainment areas if they currently do not meet air quality standards or maintenance areas if they have previously violated air quality standards, but currently meet them and have an approved Clean Air Act section 175A maintenance plan.

EPA amended the Transportation Conformity rule on March 10, 2006[1] requiring a hot-spot analysis to determine project-level conformity in $PM_{2.5}$ and PM_{10} nonattainment and maintenance areas. A hot-spot analysis is an assessment of localized emissions impacts from a proposed transportation project and is only required for "projects of air quality concern." The March 10, 2006 rule provides examples of projects of air quality concern. The $PM_{2.5}$ and PM_{10} hot-spot requirements in the final rule became effective April 5, 2006. Project level hot-spot analyses are required pursuant to 40 CFR Part 93.

The Prairie Parkway project is partially located within the Metropolitan Chicago Interstate Air Quality Control Region (AQCR #67). The portion of the project from I-88 south to the Kane/Kendall border (approximately 10 miles) and where preferred alternative connects to I-80 near Minooka in Aux Sable Township of Grundy County are within AQCR #67. This region is currently designated as a non-attainment area for the ozone and $PM_{2.5}$ NAAQS[2]. Early interagency coordination on the project involving IDOT, FHWA, USEPA, IEPA and CMAP resulted in the determination that the Prairie Parkway project is a project of air quality concern, and thus a qualitative hot-spot analysis has been completed for the project. This hot-spot analysis of the Prairie Parkway Preferred Alternative follows the joint EPA/FHWA guidance for qualitative PM hot-spot analysis[3].

3.0 Prairie Parkway Project Description

The proposed improvement is located approximately 50 miles west of the City of Chicago in southern Kane, Kendall and northern Grundy counties. This portion of the Chicago metropolitan region is undergoing major transformation, changing from a

[1] EPA posted the final rule on its website on March 1, 2006 and the final rule was published in the Federal Register on March 10, 2006.

[2] EPA: Last updated on Wednesday, March 15, 2006; URL: http://www.epa.gov/oar/oaqps/greenbk/

3 EPA/FHWA, "Transportation Conformity Guidance for Qualitative Hot-spot Analyses in PM2.5 and PM10 Nonattainment and Maintenance Areas", March 2006.

generally rural area to a more suburban environment with the coming of new residential, commercial, and industrial development. Between 1990 and 2000, there was 28 percent overall population growth for the six counties included in the Prairie Parkway study area. Will, Kendall, and Kane counties exhibited the largest increases in population at 40 percent, 38 percent, and 27 percent, respectively. These three Illinois counties were on the US Census Bureau's list of the 100 fastest growing counties in the United States between 2000 and 2005. Based on the absolute increase in population between April 2000 and July 2005, Will County is ranked 4th, Kane is 13th, and Kendall is 48th in the nation.

Population and employment in the six county Prairie Parkway study area are projected to approximately double from 2000 to 2030. Table 1 shows the forecast growth in population and employment for three counties traversed by the proposed facility.

Table 1 – County Population and Employment Forecasts

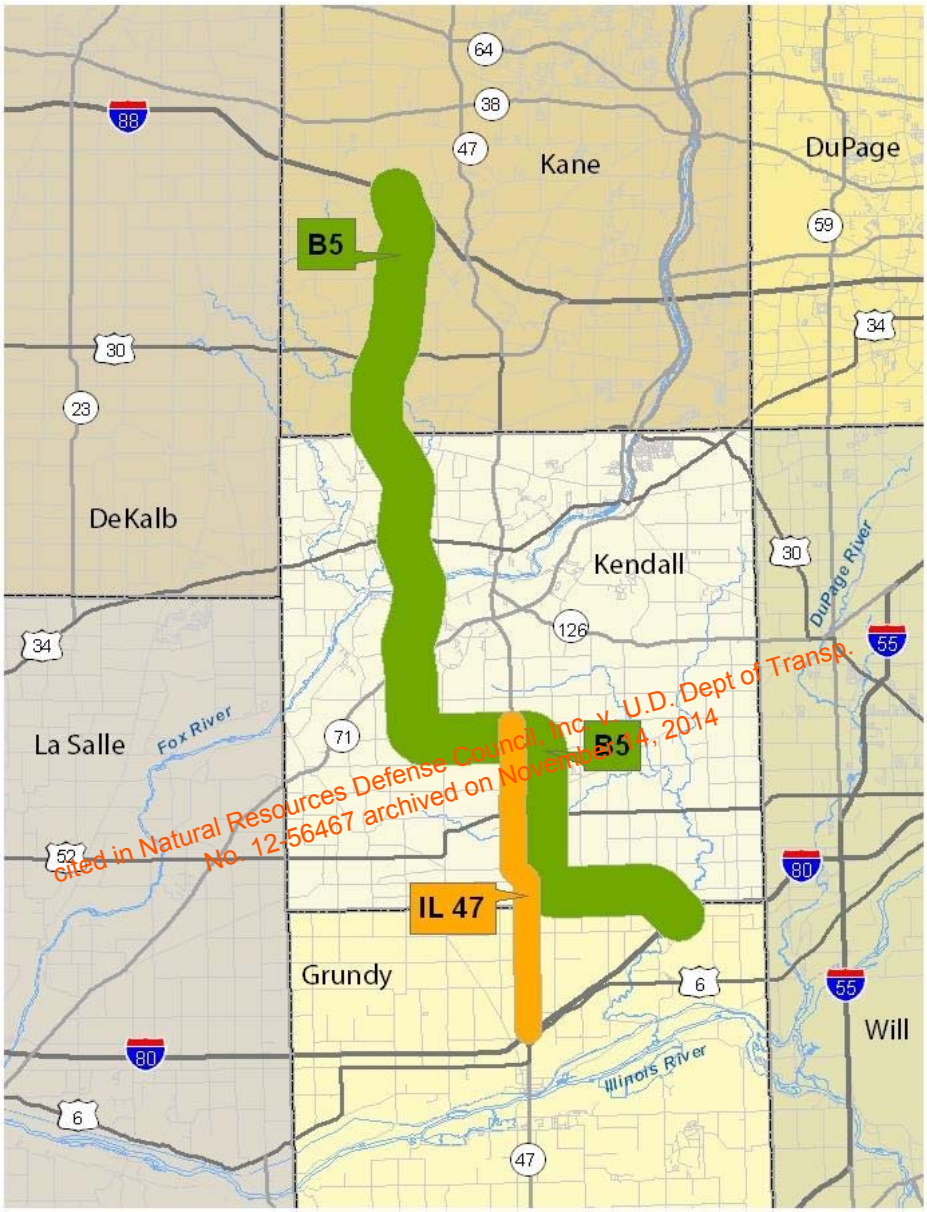
	2000 Population	2030 Population	2000 Employment	2030 Employment
Kane County	404,119	697,321 (+72.6%)	242,351	423,422 (+74.7%)
Kendall County	54,544	176,607 (+223.8%)	21,604	70,003 (+224.0%)
Grundy County	37,535	65,006 (+73.2%)	20,122	35,000 (+73.9%)

Source: "Draft Environmental Impact Statement – Prairie Parkway Study Grundy, Kendall and Kane Counties, Illinois", tables 2-1 and 2-2

The Draft Environmental Impact Statement (DEIS) evaluated a No Action Alternative together with two detailed build alternatives (B2 and B5). Alternative B5 with IL-47 widening shown in Figure 1 is the Preferred Alternative. The Preferred Alternative includes provisions for the inclusion of congestion management system improvements; freeway component between Interstate 80 (I-80) and Interstate 88 (I-88); and IL-47 widening component between I-80 and Caton Farm Road.

The Preferred Alternative freeway component (Alternative B5 with IL-47 Widening) will be 37 miles long. It will begin on its south end with a freeway-to-freeway interchange with I-80 west of Minooka. It will end on the north with a freeway-to-freeway interchange with I-88 near Kaneville. It will include five additional interchanges with US-52, IL-47, IL-71, US-34, and US-30 (on a new connector road) to provide access to the study area's road system. The freeway component of the Preferred Alternative will be four lanes (two lanes in each direction of travel) with a 63-foot-wide median that could accommodate transit or added highway lanes if needed in the future. The freeway component of the Preferred Alternative will cross 33 other roadways, 20 will be grade-

Figure 1 – Prairie Parkway Preferred Alternative



separated (with the existing road passing over the Prairie Parkway at all grade-separations except for IL-71, US-34 and US-30) and 13 roads will be closed. At two of the road closures, frontage roads will be built to maintain local access.

The Preferred Alternative freeway will pass under seven ComEd electric power lines. It will pass over three railroads. The freeway will include new drainage structures at 30 major and 14 minor stream crossings, including seven with bridges. The Preferred Alternative freeway also will include 15 major and 14 minor stream crossings on existing and new roads that cross or intersect with the freeway, including five with bridges.

The IL-47 widening component of the Preferred Alternative will be 12 miles long. It will begin on its south end at I-80 and end on its north end at Caton Farm Road where it will connect to other planned or programmed IL-47 widening projects. IL-47 will be a four-lane highway (two lanes in each direction) with a 32-foot-wide raised curb median and paved shoulders. Median openings and exclusive left-turn lanes will be provided at existing intersections.

Full control of access to adjoining properties is not planned on any section of the IL-47 improvement except for limited control of access at signalized intersections. The widening will replace existing drainage structures at nine major and one minor stream crossings, including two with bridges.

4.0 Background of $PM_{2.5}$ Requirements

Airborne particulate matter (PM) consists of many different substances suspended in air in the form of particles (solids or liquid droplets) that vary widely in size. The particle mix in most U.S. cities is dominated by fine particles (less than 2.5 micrometers in diameter) generated by combustion sources, with smaller amounts of coarse dust (between 2.5 and 10 micrometers in diameter). Particles less than 10 micrometers in diameter include both fine and coarse dust particles. These particles pose the greatest health concern because they can pass through the nose and throat and get into the lungs. Particles larger than 10 micrometers in diameter that suspend in the air are referred to as total suspended particulates (TSP). These larger particles can cause irritation to the eyes, nose and throat in some people, but they are not likely to cause more serious problems since they do not get down into the lungs.

Motor vehicles (*i.e.*, cars, trucks, and buses) emit direct PM from their tailpipes, as well as from normal brake and tire wear. In addition, vehicles cause dust from paved and unpaved roads to be re-entrained, or re-suspended, in the atmosphere; and highway and transit project construction may cause dust. Finally, gases in vehicle exhaust may react in the atmosphere to form PM. Particles come in a wide variety of sizes and have been historically assessed based on size, typically measured by the diameter of the particle in micrometers. $PM_{2.5}$, or fine particulate matter, refers to particles that are 2.5 micrometers in diameter or less. (*Note*: A human hair is about 70 micrometers in diameter and a grain of sand is about 90 micrometers in diameter). The National Ambient Air Quality Standards (NAAQS) for fine particulate matter, as revised by EPA in 2006, include an annual standard (15.0 micrograms per cubic meter ($\mu g/m^3$)) and a 24-hour standard (35 $\mu g/m^3$). However, for conformity purposes, only the 1997 $PM_{2.5}$ NAAQS (15.0 $\mu g/m^3$ for the annual standard and 65 $\mu g/m^3$ for the 24-hour standard) applies at this time based on EPA's April 2007 guidance[4]. The annual standard is based on a 3-year average of annual mean $PM_{2.5}$ concentrations; the 24-hour standard is based on a 3-year average of the 98th percentile of 24-hour concentrations.

[4] EPA, "Transportation Conformity and the Revised 24-hour PM2.5 Standard", April 16, 2007.

4.1 Statutory and Regulatory Requirements

On March 10, 2006, EPA issued amendments to the Transportation Conformity Rule to address localized impacts of particulate matter: "$PM_{2.5}$ and PM_{10} Hot-Spot Analyses in Project-level Transportation Conformity Determinations for the New $PM_{2.5}$ and Existing PM_{10} National Ambient Air Quality Standards" (*71 FR 12468*). This rule amendment requires the assessment of localized air quality impacts of Federally-funded or approved transportation projects in PM_{10} and $PM_{2.5}$ nonattainment and maintenance areas deemed to be *projects of air quality concern*[5]. This assessment of localized impacts (*i.e.*, "analysis") examines potential air quality impacts on a scale smaller than an entire nonattainment or maintenance area. Such an analysis is a means of demonstrating that a transportation project meets Clean Air Act conformity requirements to support State and local air quality goals.

Qualitative hot-spot analysis is required for these projects before EPA releases its future quantitative modeling guidance and announces that quantitative $PM_{2.5}$ hot-spot analyses are required under *40 CFR §93.123(b)(4)*. EPA requires hot-spot findings to be based on directly emitted $PM_{2.5}$, since secondary particles take several hours to form in the atmosphere giving emissions time to disperse beyond the immediate area of concern. The Conformity Rule requires $PM_{2.5}$ hot-spot analyses to include road dust emissions only if such emissions have been found significant by EPA or the state air agency prior to the $PM_{2.5}$ SIP or as part of an adequate $PM_{2.5}$ SIP motor vehicle emissions budget (*40 CFR §93.102(b)(3)*). Emissions resulting from construction of the project are not required to be considered in the hot-spot analysis if such emissions are considered temporary according to *40 CFR §93.123(c)(5)*.

The $PM_{2.5}$ and PM_{10} hot-spot requirements in the final rule became effective April 5, 2006. A qualitative $PM_{2.5}$ hot-spot analysis that meets the final rule's requirements must be completed for project-level determinations for projects of air quality concern completed on or after April 5, 2006.

4.2 $PM_{2.5}$ Regional Conformity Determination

Section 176(c) of the Clean Air Act and the federal conformity rule require that transportation plans and programs conform to applicable state air quality implementation plans (SIPs) and Section 174 and 176(c) and (d) of the Clean Air Act (42 U.S.C. 7504, 7506(c) and (d)). The Prairie Parkway project was included in the 2030 Regional Transportation Plan (RTP) and FY 2007 – 2012 Transportation Improvement Program (TIP), endorsed by the Policy Committee of the Chicago Area Transportation Study (CATS), the Metropolitan Planning Organization (MPO) for the region in which the project is located. On October 16, 2006, the FHWA and the FTA determined that the RTP and TIP conformed to the State Implementation Plan (SIP) and made a $PM_{2.5}$ conformity determination. These findings were in accordance with 40 CFR Part 93, "Criteria and Procedures for Determining Conformity to State or Federal

[5] Criteria for identifying projects of air quality concern is described in 40 CFR 93.123(b)(1), as amended.

Implementation Plans, Programs, and Projects Funded or Approved under Title 23 USC or the Federal Transit Act."

The Prairie Parkway Preferred Alternative design concept and scope is consistent with the project information used for the RTP and TIP conformity analysis. The northeastern Illinois 2030 RTP and FY 2007-2012 TIP comply with the interim $PM_{2.5}$ emissions tests required by the conformity rule and the project complies with the project-level $PM_{2.5}$ hot-spot analysis requirements of the conformity rule. This project's TIP number is #09-02-9033. The Prairie Parkway project was included in the regional emissions analysis and there have been no significant changes in the project's design concept or scope, as used in the conformity analyses. Therefore, the project comes from a conforming plan and program in accordance with 40 CFR §93.115.

5.0 $PM_{2.5}$ Hot-spot Analysis

The Prairie Parkway project meets the criteria set forth in 40 CFR 93. 123(b)(1) for projects of air quality concern primarily because it is a new highway facility with a significant level of diesel vehicles; thereby requiring a hot-spot analysis. The Prairie Parkway maximum 2030 ADT and total daily diesel vehicle traffic are forecasted to be approximately 50,000 and 10,000 (20 percent), respectively. Comparing these values to those cited in the preamble to the conformity rule by EPA as examples of projects of air quality concern – AADT greater than 125,000 AADT and 10,000 trucks per day – indicate this project should be so categorized.

According to *40 CFR §93.123(b)(2) and (4)*, a quantitative analysis for applicable projects is not required until EPA releases modeling guidance in the Federal Register. However, a qualitative hot-spot analysis is still required. Therefore, a qualitative project-level hot-spot assessment was conducted for the Prairie Parkway Preferred Alternative in order to assess whether the project will cause or contribute to any new localized $PM_{2.5}$ violations, or increase the frequency or severity of any existing violations, or delay timely attainment of the $PM_{2.5}$ NAAQS.

5.1 Construction Emissions and Re-Entrained Road Dust

40 CFR 93.123(c)(5) states "CO, PM_{10}, and $PM_{2.5}$ hot-spot analyses are not required to consider construction-related activities which cause temporary increases in emissions. Each site which is affected by construction-related activities shall be considered separately, using established "Guideline" methods. Temporary increases are defined as those which occur only during the construction phase and last five years or less at any individual site."

At this point in time, no project construction schedule for the Prairie Parkway Freeway and associated IL-47 widening exists. It is, however, probable that the freeway facility will be constructed in at least two phases and that IL-47 south of Caton Farm Road will be built at a later date. As such, localized construction emissions can be considered separately and temporary as construction-related emissions at each individual construction site is anticipated to be less than 5 years. Per 40 CFR 93.123(c)(5),

temporary construction-related emissions are not required to be included in the hot-spot analysis.

The Conformity Rule requires $PM_{2.5}$ hot-spot analyses to include road dust emissions only if such emissions have been found significant by EPA or the state air agency prior to the $PM_{2.5}$ SIP or as part of an adequate $PM_{2.5}$ SIP motor vehicle emissions budget (40 CFR §93.102(b)(3)). EPA has not approved a $PM_{2.5}$ SIP for the Metropolitan Chicago Interstate Air Quality Control Region $PM_{2.5}$ nonattainment area, nor has EPA or the state air agency made any significance findings related to re-entrained road dust for the $PM_{2.5}$ nonattainment area. Therefore re-entrained road dust is not considered in the analysis, per the Conformity Rule. In addition, as there is not an applicable $PM_{2.5}$ SIP for this area, there are no $PM_{2.5}$ control measures and the project is in compliance with 40 CFR 93.117.

5.2 Existing Conditions

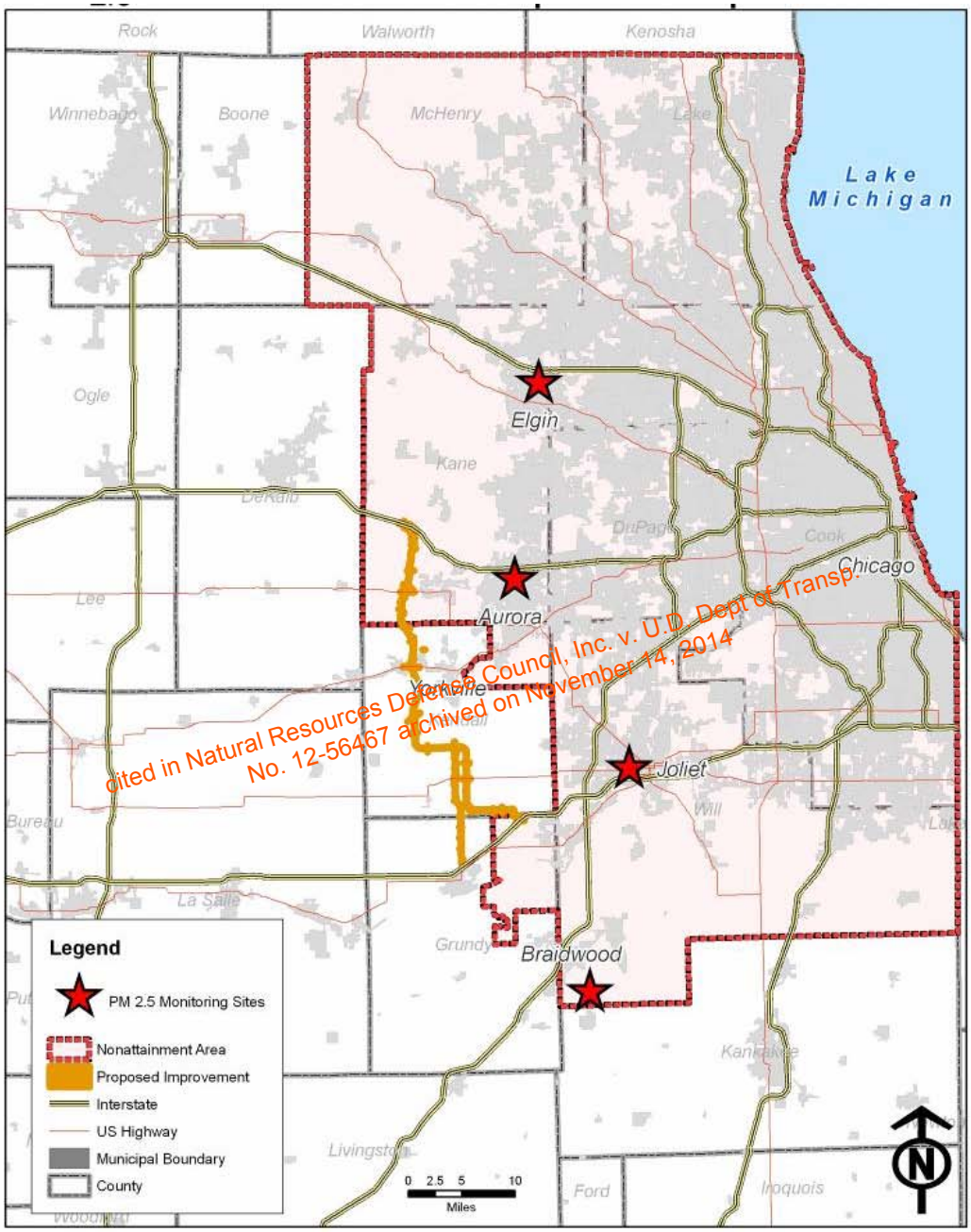
The affected area for the purposes of this analysis is a new freeway corridor (37 miles) between I-88 in southern Kane County traversing Kendall County to I-80 in northern Grundy County and approximately 12 miles along existing IL-47 between Caton Farm Road in southern Kendall County and I-80 in northern Grundy County. Additional details are in the "Draft Environmental Impact Statement Prairie Parkway Study Grundy, Kendall and Kane Counties, Illinois" and associated documentation. This section includes a discussion of currently available information on existing conditions related to air quality and traffic conditions within and near the Prairie Parkway project study area.

5.2.1 Air Quality Monitors

There are no $PM_{2.5}$ monitors in Kendall County. Figure 2 shows the four $PM_{2.5}$ monitors closest to the proposed improvement. Available monitoring data for 2002 through 2005 at the Aurora, Elgin, Joliet and Braidwood sites have been published in the "Illinois Annual Air Quality Report 2005"[6]; and while not yet published, 2006 $PM_{2.5}$ monitor data have been prepared and provided by the Illinois Environmental Protection Agency for these same sites. These sites are located in Kane and Will counties: the Aurora monitor is generally south of I-88 and west of IL-31; the Elgin monitor is south of I-90 and east of IL-31; the Joliet monitor is north of I-80 and east of IL-7; the Braidwood monitor is south of the I-55/IL-129 interchange. Tables 2 and 3 show 2002 through 2006 monitor data for the $PM_{2.5}$ 24-hour and annual standards at the four monitoring sites listed.

[6] Information extracted from the "Illinois Annual Air Quality Report 2005", Illinois Environmental Protection Agency, Bureau of Air 1021 North Grand Avenue, East, P.O. Box 19276, Springfield, Illinois, 62794-9276; December 2006

Figure 2 – PM2.5 Monitors Near Proposed Improvement



It is recognized that in 2005, Illinois, as well as other Midwestern and Northeastern states experienced a most unusual air quality episode. This was the first time Illinois had any Air Pollution Action Days outside the ozone season (May through September). February 2 through 4 were so classified due to elevated levels of fine particulate matter ($PM_{2.5}$). The "Illinois Annual Air Quality Report 2005" directly addresses the unusual 2005 air quality episode stating "Scientists determined that a combination of a stagnating regional air mass and region wide winter fuel combustion was the main cause of this incident".

The Illinois and NAAQS consist of a primary and secondary standard for each pollutant. The primary standard represents the level of air quality which is necessary to protect the public health. The secondary standard defines the level of air quality which is necessary to protect the public welfare. This includes, among other things, effects on crops, vegetation, wildlife, visibility and climate, as well as effects on materials, economic values and on personal comfort and well-being. For $PM_{2.5}$ the primary and secondary standards have the same value. Two averaging times are used for the $PM_{2.5}$ standard: 24-hour and the annual arithmetic mean. The specific standards for these two averaging times are 65μg/m^3 and 15 μg/m^3 for 24-hour and annual arithmetic mean respectively.

Data from 2002 through 2006 for the $PM_{2.5}$ 24-hour standard at the four monitoring sites in Table 2 make apparent the uniqueness of the 2005 data. The 2005 anomaly clearly affected the three year averages, but all values still were well below the 65 μg/m^3 standard. It should be noted that EPA lowered the applicable standard from 65 μg/m^3 to 35 μg/m^3 on December 17, 2006; but the 2006 standards are not subject to conformity until one year after the non-attainment designations based on the 2006 standards become effective. Such a designation has not yet been made so the 1997 standard of 65 μg/m^3 is applicable for this hot-spot analysis (although at some future time the lower 2006 standard will be applicable).

Table 2 – $PM_{2.5}$ 24-hour Standard Assessment

Violation is a 3-Year Average > 65.0 μg/m^3

Site	2002	2003	2004	2005	2006	Average 2002 - 2004	Average 2003 - 2005	Average 2004 - 2006
Aurora				43.6	25.4			34.5
Elgin	35.3	34.5	25.8	41.2	29.8	31.9	33.8	32.3
Joliet	33.7	30.8	29.1	45.3	25.9	31.2	35.1	33.4
Braidwood	32.0	27.9	23.6	43.8	21.6	27.8	31.8	29.7

Monitor data for 2002 through 2005 can be found in Appendix B of "Illinois Annual Air Quality Report" for those same years. Monitor data for 2006 provided by IEPA. Note - Aurora average based only on two years data.

Table 3 shows the annual arithmetic average standard values at the four selected monitor sites for the years 2002 through 2006. Again the unusual results for 2005 stand out, but it is also clear that 2006 values have returned to those for 2004; and that even when the 2005 values are included in the three year averages the results are well below the 15 μg/m3 standard.

Table 3 – $PM_{2.5}$ Annual Standard Assessment

Violation is a 3-Year Average > 15.0 μg/m³

`						Average	Average	Average
Site	**2002**	**2003**	**2004**	**2005**	**2006**	**2002 - 2004**	**2003 - 2005**	**2004 - 2006**
Aurora				**15.9**	**12.7**			**14.3**
Elgin	**14.3**	**13.3**	**11.5**	**15.7**	**11.8**	**13.0**	**13.5**	**13.0**
Joliet	**14.4**	**13.8**	**11.9**	**15.4**	**12.2**	**13.3**	**13.7**	**13.2**
Braidwood	**13.5**	**11.9**	**10.3**	**13.2**	**9.8**	**11.9**	**11.8**	**11.1**

Monitor data for 2002 through 2005 can be found in Appendix B of "Illinois Annual Air Quality Report" for those same years. Monitor data for 2006 provided by IEPA. Note - Aurora average based only on two years data.

5.2.2 Transportation and Traffic Conditions

As noted previously, there are no $PM_{2.5}$ monitors located in Kendall County, which is where the majority of the project is proposed to be constructed. Furthermore, there is no facility like the proposed improvement in the area. The principal north-south roadway in the area is IL-47, which is primarily a two-lane rural/exurban road. Current traffic levels on IL-47 are for the most part in the 8,000 to 16,000 ADT range with volumes reaching 20,000 in Yorkville and near I-88. The four most proximate $PM_{2.5}$ monitor locations were the logical starting point to search for traffic conditions similar to that forecast for the Prairie Parkway.

Traffic data at points nearest the four monitor sites were taken from IDOT published Average Daily Total Traffic and Average Daily Heavy Commercial Vehicle (HCV) Traffic maps for 2005. Monitor locations relative to freeway sections and major road interchanges, 2005 ADT and HCV for these road sections, and the combined ADT and HCV at the monitor locations are shown in Table 4. HCV traffic is taken as the best indicator of how much of total traffic is diesel powered vehicles, with the percent share shown below the combined HCV volume. At the four monitor sites combined ADT ranges from slightly more that 40,000 to just over 140,000 and the HCV share between 9% and 20%. Traffic levels for the Prairie Parkway Preferred Alternative are estimated to be between 13,400 and 28,600 near-term, and 23,400 and 50,000 in 2030 the design year. The share of diesel powered vehicles is estimated to be 20%.

Total traffic at three of the four monitor locations is higher than the maximum forecast for the Prairie Parkway, with the Braidwood location traffic level approximating that of the Prairie Parkway Preferred Alternative at its terminal point near I-88 and I-80. Two of the traffic locations have lower HCV shares than the estimated Prairie Parkway diesel share; while HCV shares at the other two traffic locations are slightly higher than the 20% diesel share estimated for the Prairie Parkway.

Table 4 – 2005 Traffic at Selected $PM_{2.5}$ Monitor Sites

$PM_{2.5}$ monitor location	Roadway	2005 ADT	2005 HCV	Combined 2005 ADT	Combined 2005 HCV
Aurora (0890007) ~0.5 mile south of I-88 and west of IL-31	I-88	57,300	7,300	80,200	9,000 11%
	IL-31	22,900	1,700		
Elgin (0890003) ~1.2 miles south of I-90 and east of IL-31	I-90	108,900	10,700	141,700	12,850 9%
	IL-31	32,800	2,150		
Joliet (1971002) ~1.1 miles north of I-80 and west of IL-7.	I-80	76,000	17,400	109,400	19,550 18%
	IL-7	33,400	2,150		
Joliet (1971002) ~3.6 miles east of I-55 and south of US-52	I-55	62,800	14,800	90,400	16,500 18%
	US-52	27,600	1,700		
Braidwood (1971011) ~1.8 miles south of I-55 at IL129	I-55	31,200	7,200	39,700	7,800 20%
	IL-129	8,500	600		

5.2.3 Built and Natural Environment

The study area is southwest of the Chicago metropolitan area. Development is radiating out from Chicago. Existing land use in the vicinity of the proposed facility is shown in Figure 3. The greatest concentrations of development currently within the study area are in eastern Kane County, in northern Kendall County along US-34, and in the Morris and Minooka areas along I-80 in Grundy County. Much of this area is agricultural. This is expected to change significantly by 2030 when the area will become primarily suburban in character with residential, commercial and industrial uses dominating. The extent of this change is reflected in the land use plans of municipalities near the proposed improvement as shown in Figure 4. In comparison to agriculture as the dominant existing land use, residential, industrial and commercial uses will predominate in the future. The figures depict this land use transformation in the greatly expanded yellow areas representing residential land and reduced green areas representing agricultural uses. In Kendall County, for example, residential land use was 17% of the total county land area in 2000 and is expected to grow to 67% of total county land area by 2030. Conversely, agricultural land is expected to fall from 80% of total county land area in 2000 to 26% by 2030. It should be noted that while the character of this part of the region will change markedly, the affected counties either have already

Figure 3 – Study Area Existing Land Use

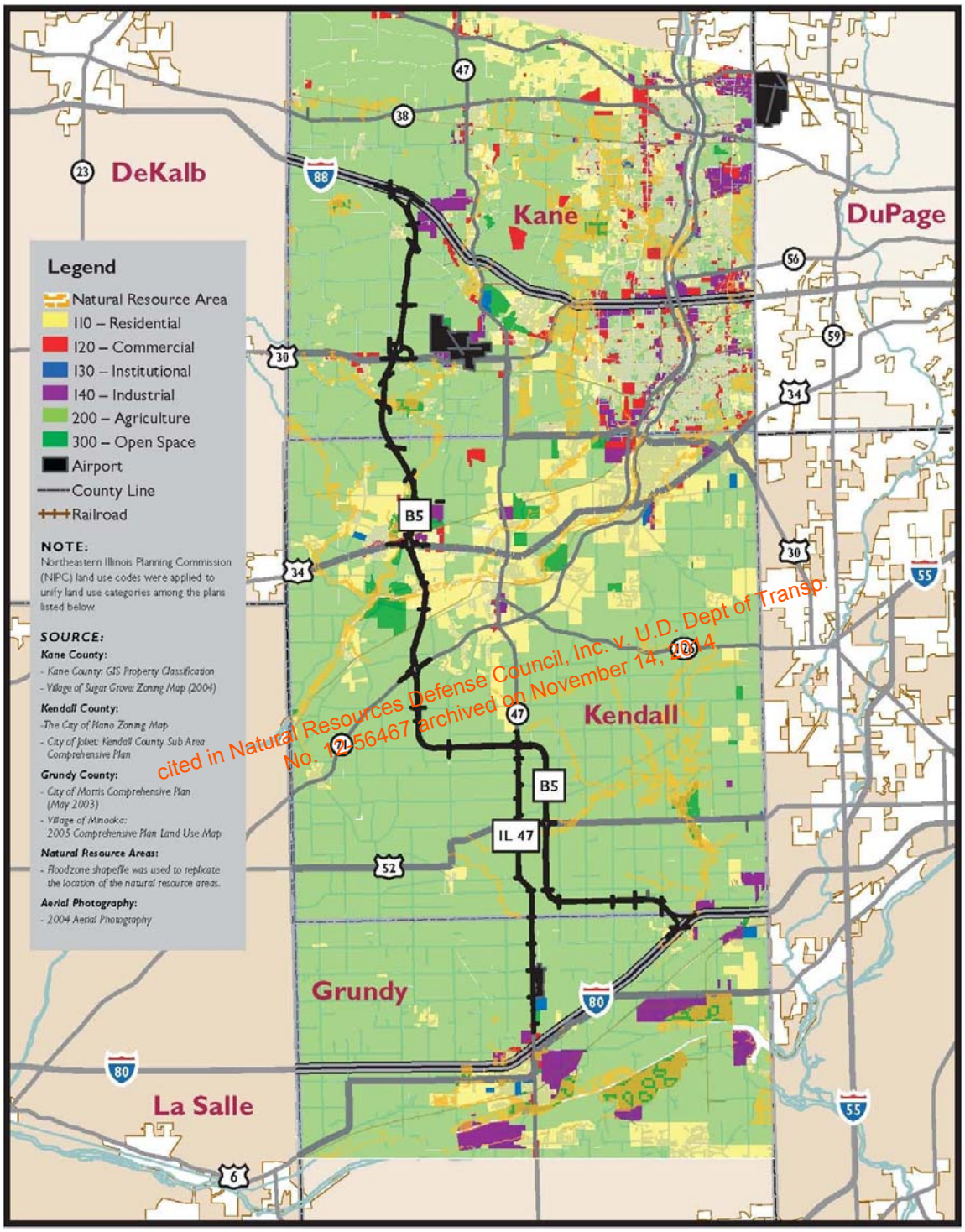
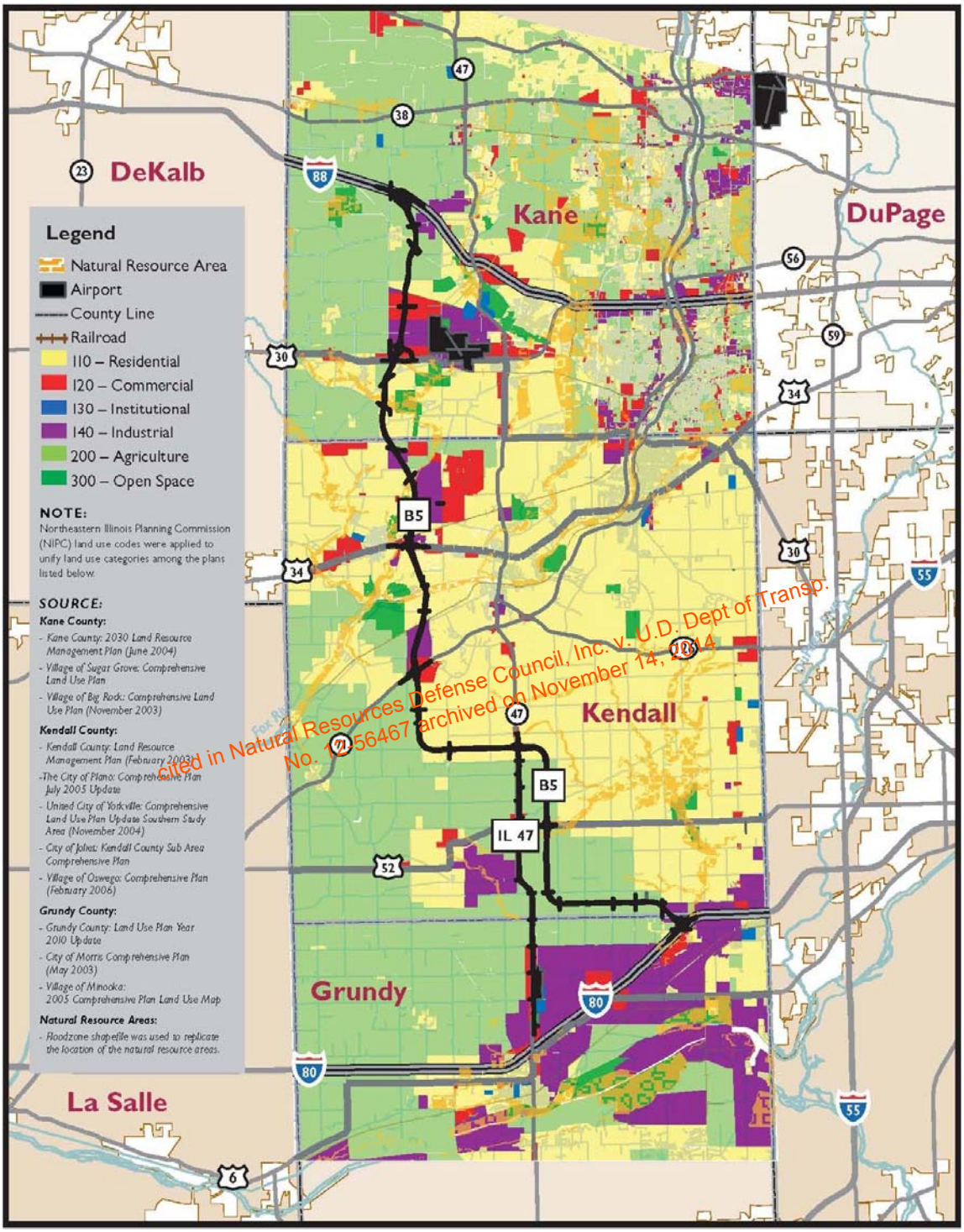


Figure 4 – Study Area Planned Land Use



established or are actively working toward programs to protect significant tracts of agricultural lands using agricultural conservation and protection areas, the conservation reserve program and designating centennial farms.

5.3 Emission Trends and Information

This section presents information about recent trends in $PM_{2.5}$ emissions from the national to the project level; and future $PM_{2.5}$ pollutant burden estimates for the northeastern Illinois region.

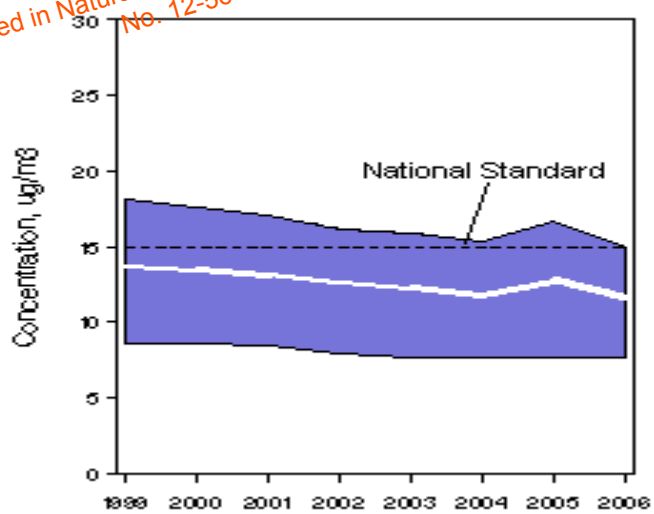
5.3.1 National Emission Trends

EPA's December 2004 "Particle Pollution Report: Current Understanding of Air Quality and Emissions through 2003" states that $PM_{2.5}$ emissions have dropped nationwide by 10% from 1999-2003. During that time, in the Industrial Midwest states, including Illinois, $PM_{2.5}$ emissions have dropped by 9%. The most current national $PM_{2.5}$ trend data from EPA, shown in Figure 5, indicates that as of 2006 levels have decreased by 15% from 1999. Note that national 2005 $PM_{2.5}$ monitor data exhibits the same anomalous spike as does Illinois 2005 $PM_{2.5}$ monitor data.

Figure 5 – $PM_{2.5}$ Air Quality 1999 – 2006

(Based on seasonally-weighted annual average)

1999 – 2006: 15% decrease in national average



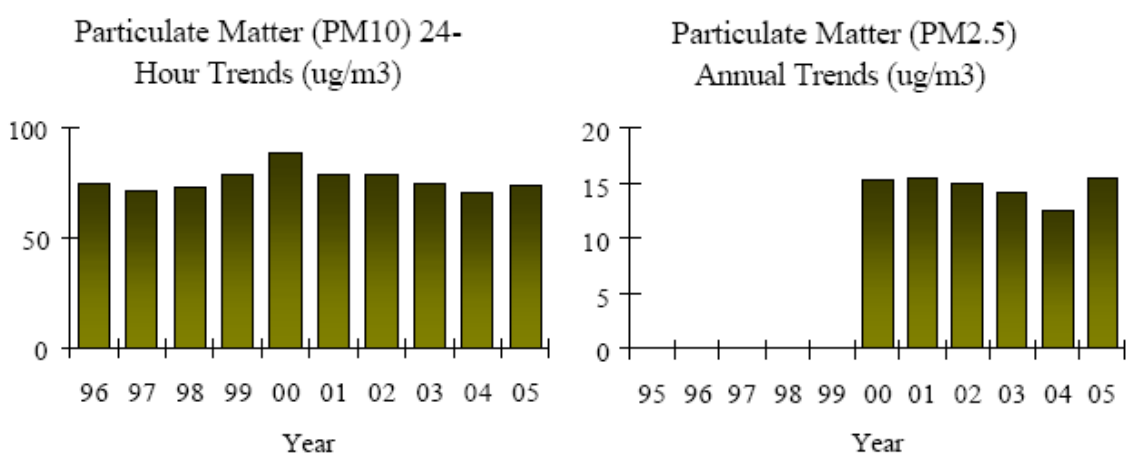
According to EPA, the 2007 heavy-duty engine standards will result in the introduction of new, highly effective control technologies for heavy-duty engines, beginning in 2007. Heavy-Duty trucks and buses currently account for approximately one-quarter of mobile source PM emissions. These new standards will result in PM emission levels 95% below today's levels. By addressing diesel fuel and engines together as a single

system, this program will provide annual emission reductions equivalent to removing the pollution from more than 90% of today's trucks and buses, or about 13 million trucks and buses, when the current heavy-duty vehicle fleet has been completely replaced by 2030. By 2030, this program is expected to reduce annual emissions of PM by 110,000 tons.

5.3.2 Illinois Statewide Emission Trends

Recent trends in $PM_{2.5}$ levels throughout the State of Illinois including Kane, Kendall and Will, counties were available in the "Illinois Annual Air Quality Report, 2005". For the State, in terms of the Air Quality Index (AQI) during 2005, there were 32 days (13 for $PM_{2.5}$) when air quality in some part of Illinois was considered "Unhealthy for Sensitive Groups". This compares to seven days (all $PM_{2.5}$) in 2004 and 19 days (8 for $PM_{2.5}$) in 2003. Throughout the state monitoring was conducted at 38 stations for $PM_{2.5}$. Valid annual averages (meeting minimum statistical selection criteria) were obtained for 36 of the 38 sites. Twenty-two stations recorded averages above 15.0 $\mu g/m^3$, the level of the annual standard, compared with 6 stations in 2004 and 9 stations in 2003. The Statewide average of annual averages was 15.5 $\mu g/m^3$ in 2005 compared with 12.5 $\mu g/m^3$ in 2004 and 14.1 µg/m3 in 2003. The trend of the statewide annual averages for $PM_{2.5}$ for the period 2000-2005 is shown in Figure 6. There were no exceedances of the 24-hour standard of 65 $\mu g/m^3$ in 2005. The Statewide peak in 2005 of 62.6 $\mu g/m^3$ was recorded at the Chicago - Mayfair station located on the north side of Chicago. The Statewide average of the 98th percentile of 24-hour averages was 42.1 $\mu g/m^3$ in 2005 compared with 30.9 $\mu g/m^3$ in 2004 and 34.1 $\mu g/m^3$ in 2003.

Figure 6 – Illinois Statewide $PM_{2.5}$ Trends



5.3.3 Northeastern Illinois Region Future Emission Trends

The CATS October 2006, $PM_{2.5}$ conformity assessment, using EPA's MOBILE6.2 mobile source emission factor model, estimated that direct on-road mobile source $PM_{2.5}$ annual emissions for the northeastern Illinois $PM_{2.5}$ nonattainment area would decrease by 37%

between 2010 and 2030, the period when this project could reasonably be anticipated to be open to traffic. Over this same time period, annual vehicle miles of travel are expected to increase by 15%. These data are summarized in Table 5.

Table 5 – Northeastern Illinois $PM_{2.5}$ Conformity Trend

Year	Annual Direct $PM_{2.5}$ (tons/year)	Annual NOx (tons/year)	Annual Vehicle Miles of Travel
2002	3,070.78	167,630.81	58,696,684,998
2010	1,634.99	78,495.92	65,019,086.507
2020	1,042.49	26,035.81	70,374,739,843
2030	1,029.25	18,853.12	75,009,620,983

Source: Table 8, "Transportation Conformity Analysis for the $PM_{2.5}$ and 8-hour Ozone National Ambient Air Quality Standards", CATS, October 12, 2006.

5.3.4 Dan Ryan Reconstruction Project Level $PM_{2.5}$ Emission Monitoring

The Dan Ryan is the most heavily traveled expressway in the Chicago region. In 2005, at the start of reconstruction, average daily traffic levels were between 230,000 and 300,000 and the number of daily heavy commercial vehicles ranged from 22,000 to 29,000. In conjunction with the Dan Ryan Expressway reconstruction project, IDOT monitored air quality prior to and during the entire reconstruction period. Baseline $PM_{2.5}$ monitor data were collected from September 2004 through the end of the year. Monitoring of the construction phase began in January 2005 and ended October 31, 2007. $PM_{2.5}$ monitoring locations were established in the area bounded by Cottage Grove Avenue on the east, Halsted Street on the west, 23rd Street on the north and 103rd Street on the south. In 2005 there was one elevated reading. This occurred on June 28, 2005, which was an Air Pollution Action day. On this day the entire Chicago region was experiencing poor air quality and thus the elevated $PM_{2.5}$ levels were attributed to a regional air quality issue and not a project level issue caused by the Dan Ryan. In 2006, one monitor recorded an elevated reading on October 21. No other monitors registered elevated readings on this day and no particular event or condition could be identified as the cause. These readings are not individually relatable to the $PM_{2.5}$ NAAQS. The readings are individual data points. The $PM_{2.5}$ standard is based on a 3-year average of the 98th percentile of 24-hour concentrations.

5.4 $PM_{2.5}$ Hot-spot Analysis Approach

The Prairie Parkway project proposes a new roadway improvement where there is currently no comparable transportation facility. There is no logical initial condition to use in comparing localized $PM_{2.5}$ concentrations for build conditions because there is neither a comparable facility nor $PM_{2.5}$ monitor data at the project location. Relying on the March 2006 joint EPA and FHWA guidance for conducting $PM_{2.5}$ hot-spot analyses, this analysis follows the "Comparison to another location with similar characteristics" or surrogate approach described in Chapter 4 of the March 2006 joint EPA and FHWA qualitative hot-spot analysis guidance. The preamble to the July 1, 2004, revision to the transportation conformity rule (69 Federal Register 40004) requires that project-level analyses consider the year (or years) of expected peak mobile source emissions from the project. For $PM_{2.5}$ this is expected to be a near term year, such as the first year of operation of the project, because emission rates from vehicles are predicted to decline significantly between the project's opening year and its design year due to lower tailpipe emissions from fleet turnover and national vehicle emissions control programs. A particular opening year for this project has not been established; so for consistency with the analysis years used in the DEIS and FEIS, 2016 and 2030 represent near-term, expected peak emissions and design years respectively.

For the reason stated in section 5.1 above, this analysis does not consider $PM_{2.5}$ precursors, re-entrained road dust or construction emissions. The project's major design features are consistent with those used in the last regional $PM_{2.5}$ conformity determination. No $PM_{2.5}$ mitigation or control measures are anticipated as part of this project's implementation.

5.4.1 Surrogate Site Selection

Existing $PM_{2.5}$ monitor locations in Illinois were reviewed to identify sites that could serve as surrogates for this analysis. Acceptable surrogate sites should have similar, or greater, ADT and diesel vehicle traffic levels compared to the values forecast for the Prairie Parkway Preferred Alternative; development levels like those forecast for the project study area; and comparable average meteorological conditions. Information about the four $PM_{2.5}$ monitor sites chosen as surrogates was presented previously in Table 4. These sites all have comparable or higher total traffic levels; HCV shares near the regional average or above the project's estimated diesel share; are all east of the project area in more developed parts of the region; but are physically close enough that metrological conditions such as temperature, humidity, etc. are similar.

5.4.2 Proposed Improvement Forecast Traffic

Table 6 shows the maximum mainline traffic level estimate for the Preferred Alternative and arterial cross road for the near-term, worst case year (2016) and design year (2030). The maximum freeway mainline traffic level is on the section between the US-34 and IL-71 interchanges, with US-34 having higher traffic levels at its interchange with the Prairie Parkway than IL-71. Forecast 2030 traffic is from regional travel simulations that were done as part of the project's Phase 1 Engineering Study, while those for the near-

term, worst case year 2016 were interpolated using 2000 base and 2030 design year forecasts.

Table 6 – Preferred Alternative – Mainline Traffic

Roadway	Year	ADT (2-Way)	HCV (2-Way)	Combined ADT	Combined HCV
Prairie Parkway	2016	28,600	5,700	50,500	7,100
US-34	2016	21,900	1,400		14%
Prairie Parkway	2030	50,000	8,900	80,300	12,100
US-34	2030	30,300	2,100		15%

In addition to maximum freeway traffic level, another worst case $PM_{2.5}$ condition can occur at freeway/freeway junctions. The Prairie Parkway Preferred Alternative maximum combined freeway/freeway terminal volume will be at its southern terminus with I-80. Table 7 shows the near-term (2016) and design year (2030) traffic estimates for the Preferred Alternative at this point.

Table 7 – Preferred Alternative – Terminal Point Traffic

Roadway	Year	ADT (2-Way)	HCV (2-Way)	Combined ADT	Combined HCV
Prairie Parkway	2016	13,400	2,700	53,800	16,200
I-80	2016	40,400	13,500		30%
Prairie Parkway	2030	23,400	4,700	70,000	20,100
I-80	2030	46,600	15,400		29%

5.4.3 Surrogate Site Comparisons

This $PM_{2.5}$ hot-spot analysis is for a project extending more than 30 miles. Conditions will obviously vary over the project length in terms of volume of traffic, flow along the mainline or near interchanges, at connections to other expressways, level of development, type of area etc. The use of multiple surrogates is the best means of matching such a range of conditions and so ensuring a robust analysis. Consistent with the $PM_{2.5}$ hot-spot guidance, traffic comparisons are made using the expected peak mobile source emission year 2016 and design year 2030 project traffic estimates. Table 8 summarizes the comparison data for 2016 and Table 9 summarizes the data for 2030. Overall conditions at each of the four surrogate $PM_{2.5}$ monitor sites are discussed below.

Table 8 – Surrogate to Preferred Alternative to 2016 Comparison

Comparison Monitor	Comparison roadways	Comparison traffic		Project traffic		Monitor data		Project traffic condition
		Combined 2005 ADT	Combined 2005 HCV	Combined 2016 ADT	Combined 2016 HCV	2004-2006 μg/m³ 24-hour	2004-2006 μg/m³ annual	
Aurora	I-88 & IL-31	80,200	9,000	50,500	7,100	34.5	13.0	Max volume between US-34 & IL-71
Elgin	I-90 & IL-31	141,700	12,850	50,500	7,100	32.3	14.3	Max volume between US-34 & IL-71
Joliet	I-80 & IL-7	109,400	19,550	50,500	7,100	33.4	13.2	Max volume between US-34 & IL-71
Joliet	I-55 & US-52	90,400	16,500	50,500	7,100	33.4	13.2	Max volume between US-34 & IL-71
Braidwood	I-55 & IL-129	39,700	7,800	50,500	7,100	29.7	11.1	Max volume between US-34 & IL-71
Joliet	I-80 & I-55	152,000	19,800	53,800	16,200	33.4	13.2	Max terminal volume at I-80

Table 9 – Surrogate to Preferred Alternative to 2030 Comparison

Comparison Monitor	Comparison roadways	Comparison traffic		Project traffic		Monitor data		Project traffic condition
		Combined 2005 ADT	Combined 2005 HCV	Combined 2030 ADT	Combined 2030 HCV	2004-2006 μg/m³ 24-hour	2004-2006 μg/m³ annual	
Aurora	I-88 & IL-31	80,200	9,000	80,300	12,100	34.5	13.0	Max volume between US-34 & IL-71
Elgin	I-90 & IL-31	141,700	12,850	80,300	12,100	32.3	14.3	Max volume between US-34 & IL-71
Joliet	I-80 & IL-7	109,400	19,550	80,300	12,100	33.4	13.2	Max volume between US-34 & IL-71
Joliet	I-55 & US-52	90,400	16,500	80,300	12,100	33.4	13.2	Max volume between US-34 & IL-71
Braidwood	I-55 & IL-129	39,700	7,800	80,300	12,100	29.7	11.1	Max volume between US-34 & IL-71
Joliet	I-80 & I-55	152,000	19,800	70,000	20,100	33.4	13.2	Max terminal volume at I-80

5.4.3.1 Aurora

The Aurora monitor (0890007) is located approximately one-half mile south of I-88 just west of the IL-31 interchange. This is a relatively new monitoring site and so data are available only for 2005 and 2006. The level of development in the area surrounding the monitor is as high as or higher than anticipated for any location along the Prairie Parkway corridor – the City of Aurora 2000 population was 142,990 while 2030 estimated population for all of Kendall County is 176,607. The combined 2005 ADT at this monitor site is almost 60% higher than the project's 2016 traffic estimate and equal to the project's 2030 traffic forecast. The combined 2005 HCV traffic at this monitor site is approximately 25% higher than the project's 2016 truck traffic estimate, but almost 35% below the project's 2030 truck traffic forecast. Both the 24-hour and annual monitor values are below their respective standards at this location. Note that because this is a new monitor site, data are averaged for only two years not three.

5.4.3.2 Elgin

The Elgin monitor (0890003) is located approximately 1.2 miles south of I-90 just east of the IL-31 interchange. This monitor is located in a mature, built out section of the City of Elgin that is developed to a higher level than anticipated for the Prairie Parkway corridor – the City of Elgin 2000 population was 94,487 while 2030 estimated population for all of Kendall County is 176,607. The combined 2005 ADT at this monitor site is more than double the project's 2016 traffic estimate and approximately 75% higher than the project's 2030 traffic forecast. The combined 2005 HCV traffic at this monitor site is 80% higher than the project's 2016 truck traffic estimate and still 6% above the project's 2030 truck traffic forecast. Both the 24-hour and annual monitor values are below their respective standards at this location.

5.4.3.3 Joliet

The Joliet monitor (1971002) is located in the vicinity of the junction of I-80 and I-55 on the near west side of the City of Joliet. It is approximately one mile north of I-80 east of the IL-7 interchange, and approximately 3.6 miles east of I-55 just north of the US52 interchange. This monitor is located in a mature, built out section of the City of Joliet that is developed to a higher level than anticipated for the Prairie Parkway corridor – the City of Joliet 2000 population was 106,221 while 2030 estimated population for all of Kendall County is 176,607. Because this monitor is near the junction of two existing freeways, it is reasonable for comparisons to be made to both maximum project section traffic level and maximum traffic level at the project's junction with existing freeways.

The 2005 combined traffic at I-80 and IL-7 is slightly more than twice the project's 2016 traffic estimate and still 36% higher that the project's forecast 2030 traffic. The combined 2005 HCV at I-80 & IL-7 is 175% of the project's estimated 2016 HCV traffic and 60% higher than the project's forecast 2030 traffic.

The 2005 combined traffic at I-55 and US-52 is 80% higher than the project's 2016 estimated traffic and 12% higher than the project's forecast 2030 traffic. The combined 2005 HCV traffic at I-55 and US-52 is 130% higher than the project's 2016 estimated HCV traffic and 36% higher than the project's forecast 2030 HCV traffic.

The 2005 combined traffic at the junction of I-80 and I-55 is approximately three times that of the Preferred Alternative's 2016 traffic level at its terminus with I-80 and somewhat more than double the project's 2030 traffic at this same point. The combined HCV traffic at the junction of I-80 and I-55 is 22% higher than the project's 2016 HCV estimate and just slightly less than the project's forecast 2030 HCV traffic level. Both the 24-hour and annual monitor values are below their respective standards at this location.

5.4.3.4 Braidwood

The Braidwood monitor (1971001) is located approximately 1.8 miles south of I-55 just west of the IL-129 interchange. This monitor is located in an exurban town that is currently developed to a level comparable to the lower to moderate levels anticipated for the Prairie Parkway corridor. The 2005 combined ADT at this monitor site is 27% lower than the project's 2016 traffic estimate and only about half of the project's estimated 2030 traffic level. The combined HCV traffic at this monitor site is 10% higher than the project's 2016 estimate HCV traffic, but 55% lower than the project's 2030 forecast HCV traffic. Both the 24-hour and annual monitor values are significantly below their respective standards at this location.

6.0 Conclusions

In summary, based on the analysis and surrogate site monitoring data, it is determined that Prairie Parkway Preferred Alternative meets all the project level $PM_{2.5}$ conformity requirements, and that the Prairie Parkway project will not cause or contribute to a new violation of the $PM_{2.5}$ NAAQS, or increase the frequency or severity of a violation for the reasons listed below. Therefore, the Prairie Parkway Preferred Alternative meets the conformity hot-spot requirements in 40 CFR 93.116 and 93.123 for $PM_{2.5}$.

- $PM_{2.5}$ monitor sites with current traffic characteristics comparable to those estimated for the Preferred Alternative have current values below the 24-hour and annual $PM_{2.5}$ NAAQS. This is true for the project's overall maximum traffic level and freeway junction maximum traffic level at both the near-term worst case year 2016 and design year 2030.
- The development level at three of the four comparison $PM_{2.5}$ monitor locations are equal to or greater than those anticipated for the Prairie Parkway corridor by 2030. Monitor data for these locations therefore most likely reflects higher non-mobile source particulate matter emissions than would the development level anticipated in the Prairie Parkway corridor.
- The comparison $PM_{2.5}$ monitor locations are proximate enough to the corridor that there should be no difference in metrological conditions in comparison to the Prairie Parkway corridor.
- National and state data show a consistent downward trend in $PM_{2.5}$ emissions that is anticipated to decline even more due to technological improvements on new diesel vehicles from the 2007 heavy-duty engine standards and new clean fuels program. Regional $PM_{2.5}$ conformity analyses show reductions in $PM_{2.5}$ of 36% from 2010 to 2020 and a continued, slight, further decline between 2020 and 2030.
- Detailed, project level $PM_{2.5}$ monitoring data from the Dan Ryan Expressway reconstruction area has consistently been below the 24-hour $PM_{2.5}$ NAAQS. Current Dan Ryan traffic levels are many times higher than both the near-term and design year volumes estimated for the Prairie Parkway Preferred Alternative, and the Dan Ryan Expressway is located in an area far more densely developed than envisioned for any portion of the Prairie Parkway study area.