Recommended Roadway Plan

Section 3 – Existing Facilities & System Performance

Existing Facilities and System Performance

3.1 Introduction

An important prerequisite to transportation planning is an understanding of the components and performance of the existing transportation system. This section describes the existing transportation system in Kane County and presents a summary of 2009 travel demand, travel desire patterns, and system performance.

3.2 Existing Highway System

Major freeways serving Kane County include the Northwest Tollway (I-90) and the East-West Tollway (I-88), both radiating from Chicago. Three U.S. highways and 11 state highways also serve the county.

There are roughly 540 miles of highway (excluding local roads) in Kane County. Figure 3-1 is a map of the existing highway system by jurisdictional classification; Interstate (including Illinois State Tollways), U.S. Highway, Illinois State Highway, and Kane County Highway. Table 6-1 summarizes the mileage of existing highway in each jurisdictional classification. County highways make up 299 route miles, or 56 percent of the existing highway system.

TABLE 3-1
Mileage of all Highways in Kane County by Jurisdiction Classification

Jurisdiction	Route Miles	Lane Miles
Interstates	43	190
U.S. Highways	34	77
State Highways	160	418
County Highways	299	690
Total	**536**	**1,374**

Functional classifications of highways in Kane County were discussed earlier in Section 1 and 2. Functional classifications extend from freeways, expressways and principal arterials (primarily traffic service) to minor arterials, collectors and local streets (primarily service to abutting land uses). Figure 3-2 depicts the functional classification of highways in Kane County, and Table 3-2 shows the existing mileage of highways by functional classification. Functional class of just the Kane County highways is shown in Table 3-3.

TABLE 3-2
Mileage of Highways in Kane County by Functional Class—2009

Functional Class	Route Miles	Lane Miles
Freeways	56	241
Principal Arterials	272	792
Minor Arterials	266	577
Collectors	554	1,117
Total	**1,148**	**2,727**

Note: Excludes local streets.

TABLE 3-3
Mileage of Kane County Highways by Functional Class—2009

Functional Class	Route Miles	Lane Miles
Principal Arterials	50	191
Minor Arterials	185	370
Collector	74	148
Total	**309**	**709**

The SRA system has been developed to serve as a second tier to the freeway system with a focus on throughput capacity. The system is planned to be a comprehensive transportation network that can handle long distance regional traffic. There are more than 1,340 designated miles of SRA routes in the Chicago metropolitan area of which 91 miles are located in Kane County. Parts of the County highway system that are also designated as an SRA are as follows:

- Orchard Road/Randall Road
- Fabyan Parkway
- Kirk/Dunham Road
- Stearns Road East of IL 25 (Stearns Road west of IL 25 is a requested SRA)

3.3 Travel Demand Model

3.3.1 Background

The Chicago Area Transportation Study, now the Chicago Metropolitan Agency for Planning (CMAP), developed a transportation model of the Kane County transportation system in 1996. After the model was tested and calibrated by CMAP it was applied in the development of the *2020 Transportation Plan* and further utilized in 2003 and 2005 to develop the *Kane County 2030 Transportation Plan* and the *Kane County Impact Fee Plan,* respectively.

The model was updated again in 2009 for use in development of the *2040 Transportation Plan.* Base year population and employment estimates by traffic analysis zone for the most recent application were adjusted for growth between 2005 and 2009 based upon new building permits allocated to each zone. Forecasts of 2010 and 2040 households, population and employment in Kane County were obtained from data developed by CMAP for the GO TO 2040 Plan. The forecasts, furnished by CMAP for each quarter-section were aggregated into TAZ's, and slightly adjusted to reflect local existing conditions and future forecasts for the 2040 Transportation Plan. The forecasts developed for the 2040 Transportation Plan used the most current information available at the time. Many variables go into predicting future population, households and employment, and forecasts are only the best guess at the time of the assumptions. The assumptions do not provide exact locations, rather general areas of the land uses that will produce the vehicular trips that feed into the travel demand modeling efforts. The travel modeling efforts are performed to develop overall travel demand assessments for the 2040 planning horizon. Results–from the modeling efforts are further examined, post-processed and adjusted to better reflect projected system performance based on local knowledge. As the County moves forward with future planning efforts, development patterns and plans change and the forecasts will be adjusted using the most recent development information and controlled data sources (such as updated CMAP 2040 RTP information and US Census information).

3.3.2 Methodology

The travel demand forecasting process utilized in Kane County relies on a series of mathematical models incorporating three primary components; 1) trip generation; 2) trip distribution and 3) trip assignment.

CMAP developed a traffic analysis zone (TAZ) system as part of the *Kane County Sub-Area Study, July 1996*. The zone system consisted of 1,379 TAZs representing the Chicago metropolitan area. Of these, 780 TAZs were located within Kane County. See Figure 3-3. This is a finer breakdown than the CMAP regional zone structure. Figure 3-4 depicts the zone system utilized for the entire metropolitan area showing the larger external zones outside of Kane County and the external stations on the periphery of the area.

The trip generation model translates land use and demographic information into the number of trips created by an area. Four trip purpose categories were used to predict the number of daily vehicle trips: Home-Based Work (HBW); Home-Based Other (HBO); Non-Home Based (NHB): and truck (T). Estimated trips were calculated based upon TAZ land use information, including population and employment, by type.

The trip distribution model estimates where trips will be made within the study area. The primary objective is to distribute the total number of trips produced in each TAZ among all possible destination zones. The distribution model used for this study is commonly known as the gravity model. The gravity model assumes that trips between a zone of production and all other TAZ's is proportional to the number of attractions in all possible destination TAZ's and inversely proportional to some function of the impedance (expressed as travel time) between the TAZ's. The number of attractions in a TAZ is correlated with the number and type of employees in the TAZ.

Trip assignment models assign the distributed volumes of vehicle trips to individual network links representing roadway segments. An equilibrium trip assignment model was used in this study. This process is an optimization procedure that searches for the best combination of the current and previous assignment iterations. Equilibrium is said to be achieved when no trip can reduce travel time by changing paths.

The basic outputs of the travel demand modeling process are travel forecasts expressed as estimated traffic volumes on each segment of the road network. These volume estimates are used to indicate whether the transportation system can adequately serve future developments.

3.3.3 Existing Traffic Demand

The existing traffic model used in Kane County was originally developed and calibrated by the KCDOT in 2000 using the TRANPLAN suite of programs. The model development and calibration process is described in detail in *Development and Calibration of Kane County Transportation Systems Planning Model* prepared for the Division of Transportation in 2000. The work closely followed earlier CMAP model development reported in *Kane County Sub-Area Study, Ju1y, 1996*. Further calibration of the updated model was undertaken in 2003 as part of the 2030 Transportation Plan, in 2005 as part of the Impact Fee Plan and in 2009 as part of the development of the 2040 Transportation Plan. The travel demand model developed for this project was determined to meet or exceed the accepted criteria for validation/calibration of a tool of this type.

Figure 3-5 shows ranges of existing (modeled 2009) Average Daily Traffic (ADT) on highways in Kane County. The 2009 ADT values were based upon volumes produced by the traffic assignment model and generally correspond with the actual counts on maps published by the IDOT Office of Programming and Planning. Higher volume highways are located predominantly in the easternmost portion of the county. The heaviest traveled routes include the I-90 and I-88, Randall Rd., the Carpentersville/Dundee/North Elgin area and Tri-cities area.

Commercial vehicle (truck) traffic is also an important consideration in the analysis of current transportation facilities and in developing future plans. IDOT provided data regarding the daily volume of heavy commercial vehicle traffic on state and federal routes in Kane County. As would be expected, the Tollways carry a large percentage of commercial traffic, but truck traffic was also heavy on portions of IL 47 and IL 64.

3.4 Existing Travel Desires

Examination of travel desires is especially useful in planning transportation facilities. This analysis technique considers the travel desires of motorists regardless of the underlying traffic network. By assigning traffic to a network resembling a spiderweb that is unconstrained in terms of roadway availability and capacity, the trips follow a direct path from origin to destination. The travel desires are shown as bands with the width of the band proportional to the traffic volume on that link.

In order to portray travel desires, the 780 CMAP TAZs within Kane County were aggregated into 15 larger zones. The trip table also was compressed to conform to the modified zone structure. Connecting the centroids of adjacent zones created a “spiderweb” network. A graphic portrayal of travel desires was produced by assigning the base year (2009) daily vehicular trips to the spiderweb network (Figure 3-6).

The prominent travel desire is oriented in a north/south direction in the eastern part of the county through urbanized areas along the Fox River, which coincides with the largest concentration of development in the County. The north-south travel desires appear to be a combination of trips originating in and destined to locations in the urban corridor, as well as regional trips traveling through the County. In general, travel demand drops off considerably toward the western parts of the County. Another trend is the travel desire pattern between Kane and surrounding counties. The following list highlights some of these travel patterns:

- Northwest-southeast direction in the northern portion of the county between Kane County and McHenry and Cook Counties.
- East-west direction in the central portion of Kane County along the eastern border between Kane and DuPage Counties.
- Northeast and southwest direction in the southern portion of the county between Kane County and Kendall and DuPage Counties.

This set of travel desires indicates the importance of examining travel demand in relationship to the surrounding Counties. Notably, the existing travel desires in the northeast portion of the County appear to be heaviest. The roadway system that is in place accommodates these travel desires as follows:

- The Northwest Tollway and US 20 support northwest-southeast directional movement in the northern portion of the county.
- IL 64, IL 38, and Fabyan Parkway support the east-west directional movement in the central portion of the county.
- I-88/IL 56/US 30 and IL 59/US 34 support the northeast-southwest directional movement in the southern portions of the county.

3.5 Performance Measures

Performance measures were established to assess the ability of the transportation system and its components in meeting set performance goals. This type of technical evaluation was used to evaluate system conditions in the study base year and for the year 2040. Three categories of performance were used to analyze performance:

- Traffic service measures
- Congestion measures
- Traffic safety measures

The basic tool used in calculating the performance measurements for both the existing and future transportation networks was the travel demand model.

3.5.1 Traffic Service Measures

Traffic service measures match a calculated performance value such as speed or travel time to a corresponding level of congestion. Vehicle miles of travel (VMT) is a facility-based measure indicating system usage. It is the product of traffic volume over a specified length of highway. Vehicle hours of travel (VHT) is a user-based measure indicating the travel time spent from origin to destination. Summing the travel times of vehicles using a segment of highway produces VHT. Another traffic service measure is vehicle hours of delay (VHD). The delay function (VHD) can be calculated for each link by comparing the travel time produced at desirable speed for a particular roadway as defined by its functional classification to the congested time that results from the traffic assignment. VHD is a product of traffic volume multiplied by the change in travel time. The system-wide delay can be calculated by summing delays for all links. Separate summaries may be produced by functional class or by individual route.

Another measure used to evaluate traffic performance is travel speed. Travel speed is a measure that evaluates the operating characteristics of a facility. The travel speed measure can be determined by comparing the VMT and VHT by roadway segment.

3.5.2 Congestion Measures

Congestion is generally measured in terms of Level of Service (LOS) and the ratio of volume to capacity (v/c). Definitions of LOS for both roadway segments and intersections were presented earlier in Section 1. As explained, LOS on roadway segments is described by operating speed and delay experienced by motorists. For purposes of long-range planning, the ratio of v/c is often used as a surrogate measure to estimate the level of congestion on each facility segment in the travel model output. This measure of congestion is reflective of driver comfort and the degree of maneuverability within the traffic stream. The levels of v/c assumed to represent the approximate degree of congestion are presented below. Table 3-5 describes the v/c ratios used for the level of congestion categories.

TABLE 3-5
Level of Congestion Measures

Level of Congestion	Max v/c
Little or none	>0.66
Moderate	0.79
Severe	1.00
Extreme	>1.00

Source: Highway Capacity Manual, TRB Special Report 209, Table 7-1. Levels of congestion correspond generally with LOS C or better through LOS E

3.5.3 Traffic Safety Measures

Among transportation performance criteria, traffic safety is most universally accepted. A quantitative index or measure of safety performance is appropriate, therefore, as one of the basic performance measures for the Kane County transportation system.

Safety has often been discussed only in general or qualitative terms. To include safety as a more useful performance measure, it is desirable to quantify safety in readily understandable terms. Of course, any effort to quantify safety must be fully supportable. With the recent release of the first edition of FHWA’s Highway Safety Manual, there are now widely accepted tools for engineers to use to quantify the potential for reductions in crash frequency and severity when making transportation facility design and operations decisions. Highway safety can best be characterized by the number of highway crashes and the resulting injuries and fatalities that might occur or be expected to occur over a given time period. Developing a highway safety performance measure thus becomes an exercise in relating basic transportation system features and attributes to an expected number of highway crashes. There are a number of basic, well-established principles relating highway safety to elements of the highway. These include 1) the relationship of vehicular traffic volume to crash frequency and 2) differences in the safety performance of different highway types.

Recommended safety strategies that Kane County is in the process of pursuing include:

1 Adopt upcoming FHWA Safety Manual methodology for crash prediction for determining necessary safety elements/countermeasure for all maintenance and construction projects.

2 Apply new standards for design of all new and modernized traffic signal installations for increased conspicuity and target value of traffic signal faces - "one signal head per lane/center of lane" and backplates on all signal heads at high speed (45 mph or greater) locations.

3 Increased pavement marking line widths and exploration of the use of wet/night pavement marking products.

4 Use of rumble stripes and safety edges on rural highways (pavement resurfacing projects).

5 Use of protected and\or flashing yellow arrow left turn signalization at high speed (45 mph or greater) locations.

6 Use of zero and/or positive offset left turn lanes for permitted left turns.

7 Improved pedestrian accommodations including countdown pedestrian timers, refuge medians ADA accessible features.

3.6 Existing Traffic Performance Analysis

The traffic performance analysis of the existing Kane County highway system relied on data related to travel demand and existing facilities, as well as, measures of effectiveness derived from the county's travel demand model.

3.6.1 Existing Traffic Service Measures

The traffic service measures of VMT, VHT, and VHD on all highways stratified by functional classification, as well as county roads only, are summarized in Table 3-6. In examining the traffic performance of all highways, principal arterials, which account for 29 percent of the lane-miles within the county, were found to carry the bulk of traffic (approximately 50 percent of VMT) and experience approximately 24 percent of VHD. The same trend is further amplified when looking exclusively at the county roadway network. For county highways alone, principal arterials were only 27 percent of the system lane miles, but carried approximately 63 percent of traffic and experienced 51 percent of the VHD.

TABLE 3-6
Traffic Performance – 2009

	VMT		VHT		VHD	
Functional Class	**Miles**	**%**	**Hours**	**%**	**Hours**	**%**
2009 All Highways						
Freeways	1,416,971	12	28,088	4	3,763	1
Principal Arterials	6,122,152	50	271,197	34	98,813	24
Minor Arterials	2,262,589	18	342,625	44	265,763	64
Collectors	2,386,606	20	141,942	18	46,416	11
Totals	**12,188,318**	**100**	**783,852**	**100**	**414,755**	**100**
2009 County Highways						
Principal Arterials	1,826,607	63	91,212	55	38,877	51
Minor Arterials	948,084	33	69,823	42	36,411	48
.Collectors	122,920	4	5,570	3	652	1
Totals	**2,897,611**	**100**	**166,605**	**100**	**75,940**	**100**

3.6.2 Existing Congestion Measures

Congestion on all highways for 2009, based on daily traffic, is illustrated in Figure 3-7. Only roadway segments that were found to be operating at LOS D, E, or F are shown. The congestion level has been designated in three categories related to levels of service as follows:

- Moderate Congestion (LOS D)
- Severe Congestion (LOS E)
- Extreme Congestion (LOS F)

When considering all highways in Kane County, 41 percent of route miles and 45 percent of lane-miles were classified as congested. For just county roads, 28 percent of route miles and 36 percent of lane-miles were deemed to be congested. The concentration of these roadways was in the eastern part of the count in the vicinity of Carpentersville/Dundee/Elgin, St. Charles/Geneva, and Aurora.

Table 3-7 shows the length and percentage of route miles and lane-miles at each LOS for all highways and for county highways only.

TABLE 3-7
Congestion – 2009

	Route Miles		Lane Miles	
Level of Service	**Miles**	**%**	**Miles**	**%**
2009 All Highways				
A	427	37	861	32
B	142	12	300	11
C	116	10	316	12
D	113	10	269	10
E	162	14	418	15
F	189	17	539	20
Total	**1,149**	**100**	**2,703**	**100**
Total Congested*	**464**	**41**	**1,226**	**45**
2009 County Highways				
A	150	48	303	43
B	44	14	89	12
C	31	10	67	9
D	11	4	25	4
E	46	15	136	19
F	28	9	92	13
Total	**310**	**100**	**712**	**100**
Total Congested*	**85**	**28**	**253**	**36**

*LOS D, E and F

Section 3
Figures