Recommended Roadway Plan

Section 1 – Transportation System Planning

Transportation System Planning

1.1 Introduction

The 2040 Recommended Roadway Plan is the highway element of the County's long range Transportation Plan. Mandated by State law, the plan represents the long term vision for the highway system and addresses the safety, capacity and personal mobility needs to accommodate forecasted growth. The plan provides a list of highway improvement projects and alternative strategies aimed at improving the system efficiency and an estimate of revenues to the year 2040. The improvements are evaluated for their effectiveness, and recommendations are made for on-going implementation and long term maintenance.

1.2 Overview of the Planning Process

The principal steps involved in formulating the 2040 Recommended Roadway plan included:

1. Obtain and review recent studies (subsequent to the completion of the 2030 Kane County Transportation Plan), ongoing studies and available basic data (i.e. AADT, Crash data, etc.).
2. Extension of the planning horizon from 2030 to 2040 and forecast socioeconomic data required to establish future travel demand.
3. Evaluate current and future transportation system and identify deficiencies in the transportation network.
4. Evaluation of alternative transportation improvements and selection of a set of proposals comprising a recommended plan.
5. Conduct financial analysis by comparing revenues to plan costs.

The plan can be implemented, with proposals staged in a logical sequence, and methods of financing are identified. Finally, the plan was developed in a manner that facilitates future updating or modification as development continues and conditions change.

1.3 The Role of Functional Classification

Creation of a system whereby different roadways are engineered to handle varying types of demand is essential in circulation planning. The purpose of having a functionally classified highway system is not only to recognize existing travel patterns, but to reinforce and control them so that there is some established order in the county's traffic flow. If a smoothly functioning system cannot be established, then drivers seeking short cuts on less congested routes will constantly be diverting on neighborhoods streets that are not designed to handle heavy traffic. Principles of functional classification in Kane County are discussed generally in the preceding section (Section 2 - Land Development and Roadway Access).

1.4 Level of Service

Traffic service is usually measured in terms of LOS. For roadway segments, average delay and speed enter into the LOS determination along with other factors. LOS measures the quality of traffic service, and may be determined for each roadway segment on the basis of delay, congested speed, volume to capacity (v/c) ratio, or vehicle density by functional class. The various levels of service for roadway segments are defined as follows:

> **LOS A** describes primarily free flow operation at average travel speeds, usually about 90 percent of the free-flow speed for the arterial classification.
>
> **LOS B** represents reasonably unimpeded operations at average travel speeds, usually about 70 percent of the free-flow speed for the arterial classification.
>
> **LOS C** represents stable operations; however, ability to maneuver and change lanes in mid-block locations may be more restricted than at LOS B, and longer queues, adverse signal coordination, or both, may contribute to lower average travel speeds of about 50 percent of the average free-flow speed for the arterial classification.
>
> **LOS D** borders on a range in which small increases in flow may cause substantial increases in delay, and hence decreases in arterial speed. Average travel speeds are about 40 percent of free-flow speeds. LOS D is often used as a limiting criterion for design purposes.
>
> **LOS E** is characterized by significant delays and average travel speeds of one-third of the free-flow speed or less. LOS E is sometimes accepted as a limiting for design criterion when restricted conditions make it impractical to consider a higher LOS.
>
> **LOS F** characterizes arterial flow at extremely low speeds, below one-third to one-fourth of the free-flow speed. Intersection congestion is likely at critical signalized locations with high delays and extensive queuing. LOS F is never used as a design standard. It represents a condition that is intolerable to most motorists.

For segments the LOS is based on the v/c ratio. Extreme congestion is considered to be LOS F with a v/c greater than 1.0. Severe congestion corresponds with LOS E, which has a v/c greater than 0.79 but less than one. Moderate congestion corresponding with LOS D has a v/c greater than 0.66 but less than or equal to 0.79.

For signalized intersections, both LOS and v/c ratio are indicative of an intersection's operation. LOS is defined in terms of control delay per vehicle. Control delay includes a vehicle's initial deceleration delay at a signal, queue move-up time, stopped delay, and final acceleration delay. Overall intersection LOS range from A (less than 10 seconds of control delay per vehicle) to F (greater than 80 seconds of control delay per vehicle), see Table 1-1. LOS C or D for the entire intersection and for individual movements is generally considered desirable for peak hour operation in urban/suburban areas. The v/c ratio compares the demand flow rate of traffic approaching an intersection to its practical capacity. This is also a measure of the operating characteristic of a signalized intersection. Intersections with critical v/c ratios approaching or slightly exceeding 1.0 represent locations where queues develop and vehicles wait through more than one cycle to clear the intersection. For planning level analysis, the target v/c is less than 0.90.

TABLE 1-1
LOS Criteria for Signalized Intersections

LOS	Control Delay per Vehicle (seconds/vehicle)
A	≤10
B	>10-20
C	>20-35
D	>35-55
E	>55-80
F	>80

Source: *Highway Capacity Manual HCM2000*, Transportation Research Board (TRB), Exhibit 16-2

For unsignalized intersections, LOS is also used to measure intersection operations. However, LOS thresholds for unsignalized intersections are different than those for signalized intersections. Overall intersection LOS for unsignalized intersections range from A (less than 10 seconds of control delay per vehicle) to F (greater than 50 seconds of control delay per vehicle), see Table 1-2. The LOS for a two-way stopped controlled intersection is based on the minor leg or stopped approach. For a planning level study, intersections with a LOS D or better are considered acceptable.

TABLE 1-2
LOS Criteria for Unsignalized Intersections

LOS	Control Delay per Vehicle (seconds/vehicle)
A	0 – 10
B	> 10 – 15
C	> 15 – 25
D	> 25 – 35
E	>35 – 50
F	> 50

Source: *Highway Capacity Manual HCM2000*, TRB, Exhibit 17-22

1.5 Congestion Management

Traffic congestion and travel delay are among the most visible manifestations of an area’s transportation problems. Drivers experience congestion for the most part as a personal annoyance although traffic congestion is a problem that wastes time, consumes energy resources, and contributes to deficient air quality. Businesses are adversely affected by congestion if it discourages potential clients or customers.

Traffic congestion is typically confined to the morning and evening peak hours of travel, but a large proportion of daily travel normally occurs during these peak periods.

Expanding the capacity of roadways is not the sole solution to congestion. Congestion may be alleviated by actions taken to improve both the supply side and demand side of the transportation equation—referred to as Transportation System Management (TSM) and Transportation Demand Management (TDM).

New roadways, bridges, and highways built to relieve congestion satisfy deficient supply (capacity) of the roadway system and also provide for latent and diverted travel demand. The use of alternate modes and land use regulations also contribute to an overall program to manage traffic congestion. Other supply-side actions may include expansion/channelization of critical intersections, access control, advanced traffic control/surveillance systems, traffic incident management and user information distribution.

Congestion is most prevalent during weekday morning and evening peak hours and is most evident at intersections, which are the constricting points in the roadway system.

Intersection modifications such as provision of turn lanes, channelization to separate conflicting traffic movements, or improved signing, marking and modification to existing signalization (i.e. signal heads, re-timing, re-phasing, introduction of adaptive traffic signal control, etc.) are a few of the relatively low price/impact solutions to intersection congestion problems. Also, in recent years, non-traditional intersection/interchange concepts such as Modern Roundabouts, Continuous Flow Intersections (CFI) and Diverging Diamond Interchanges (DDI) have been promoted by the FHWA and are being brought into wider use across the country. Through promoting yield and free flow operations for left turning movements these treatments provide a substantial reduction in delay over more traditional intersection improvements.

However, congestion can also occur at less frequent times such as during special events (i.e. Kane Cougar baseball games, large Kane County Fair Ground events, large church events) unanticipated emergency incidents such as major crashes, road/bridge closures and major evacuations as well as traffic impacts related to construction/maintenance activities (i.e. lane/road closures, signal outages, etc.). Certain TSM (advance traffic control and surveillance) improvements and strategies such as notification through Computer Aided Dispatch (CAD), special event signal timing, video monitoring adaptive traffic signal control, deployment and control of Dynamic Message Signs (DMS), etc. coordinated through an Arterial Operations Center would provide a substantial reduction in delay as compare to current traditional traffic management approaches.

1.6 Access Management

Management of access to area roadways is yet another method of improving the ability of the system to satisfy mobility requirements. Properly implemented access management will result in improvements to traffic operations, increase highway safety and minimize adverse environmental impacts.

Each new driveway that is located on an arterial reduces the arterial's traffic carrying capacity. After several new driveways have been installed, it often becomes clear that turning traffic has a negative impact on traffic speeds on the arterial. Studies indicate that average travel speeds during peak hours are considerably higher on well managed roads than on roads that are less well managed, even though the two types of roads carry approximately the same number of vehicles.[1]

Specific techniques applied in access management are addressed in Section 2 (Land Development and Roadway Access) of this document.

1.7 Transportation System Management (TSM)

TSM is the concept of more efficiently using existing transportation systems by means other than large-scale construction. Just as TDM strategies are aimed at managing transportation *demand,* TSM strategies are directed at managing the transportation *system*. Some categories of actions that comprise TSM are:

- Physical improvements to roadways, intersections and interchanges such as lane or shoulder widening, channelization, grade separations, and removal of restrictive segments that prevent full utilization of capacity
- Advance traffic control and surveillance systems
- Traffic Incident Management
- Preferential or exclusive lanes for transit and/or high occupancy vehicles (HOVs)
- Provisions for parking and loading
- Pedestrian and bicycle facilities

1.8 Transportation Demand Management (TDM)

TDM is not one action, but rather a set of actions or strategies, the goal of which is to encourage travelers to use alternatives to driving alone, especially at the most congested times of the day. The term TDM encompasses both alternative modes to driving alone and the techniques, or the strategies that encourage use of these modes.[2] The primary goal of most TDM programs is to reduce commute trips in a particular area and/or at a particular time of day. Program effectiveness varies widely by program type, by site, and by the TDM strategies chosen. In general, the success of a TDM program depends heavily on the extent to which individual employers support the program.

TDM alternatives include familiar travel options such as:

- Carpools and vanpools

[1] *Access Management Handbook*, prepared for the Iowa DOT, the Safety Management System (SMS) Coordination Committee, and the Access Management Task Force, by the Center for Transportation Research and Education (CTRE), Iowa State University, Ames Iowa, October, 2000.

[2] *A Guidance Manual for Implementing Effective Employer-Based Travel Demand Management Programs*, prepared for FHWA by Comsis Corporation and ITE is association with Georgia Institute of Technology, K.T. Analytics, Inc. R.H. Pratt, Consultant, Inc. Final Report, November 1993

- Public and private transit (including buspools and shuttles)
- Bicycling, walking, and other non-motorized travel

TDM alternatives also can include "alternative work hours," program options that reduce the number of days commuters need to travel to the worksite, or that shift commuting travel to non-peak period times of the day. Some such programs are flexible work schedules, compressed workweek, and telecommuting.

As indicated above, the success of any of these TDM strategies in reducing peak period traffic congestion will depend to a great extent on the level of employer participation or encouragement. Experience elsewhere has indicated that rideshare programs, for example, may reasonably be expected to reduce vehicle trips from approximately 2 percent to 5 percent for a particular traffic generator given a moderate degree of outside support.

The Transit Plan and Bicycle/Pedestrian Plan provide additional information about TDM strategies for Kane County.

1.9 Effect of Land Use Policies on Transportation

Effect of Land Use Policies on Transportation

Reducing the Growth in Congestion through Land Use Decisions

The shape and design of developments play an important role in how much people travel by car. When neighborhoods are compact and many of a person's daily needs can be accommodated by transit, bicycle, or within a few minutes' walk, vehicle trips per household decline rapidly. Supportive land use patterns and site design can result in:

- Reductions in the growth of VMT, pollutant emissions, and energy consumption;
- Increased transit use and productivity; and
- Pedestrianization of activity centers;

(Transit Cooperative Research Program [TCRP] Report 95, 2003).

At higher densities use of alternative modes of transportation, particularly transit and pedestrian travel, is higher, and per capita passenger vehicle trips and Vehicle Miles Travelled (VMT) are lower.

There is general consensus regarding the positive relationship between land use density and transportation, and a number of studies have shown a relationship between population density and per-capita auto travel, with less per-capita vehicle travel at higher densities. Higher densities are associated with lower proportions of travel by single occupancy vehicle, lower vehicle miles travelled, and most strongly linked with higher use of transit and walking modes. However, the success of density in reducing vehicle trips is *also* dependent on the following factors:

1. **Distance to transit –** the location of a development relative to transit can result in a mode shift and therefore reduce VMT. Typically, Transit Oriented Developments

(TODs) include residential and commercial centers designed around a rail or bus station and should consider the following design features to optimize vehicle trip reduction:

a. A transit station/stop located within a 5-10 minute walk (approximately ¼ mile); or

b. A rail station located within a 20 minute walk (approximately ½ mile)

Effects of TOD on Housing, Parking, and Travel (TCRP Report 128, 2008) reports that Transit Oriented Developments (TODs) have 47% lower vehicle trip rates and have 2 to 5 times higher transit mode share.

2. **Location –** the location of a development relative to urban/suburban contexts influences the amount of VMT. Density has a negligible impact on VMT reduction in a rural environment (or Greenfield site, unless it's a master planned community) because jobs and amenities may not be accessible without the use of a vehicle. *Growing Cooler* (Ewing, et al, 2008) reviewed 10 studies that consider the affect of location on VMT and found that infill locations generate substantially lower VMT per capita than do Greenfield locations, ranging from 13-72% lower VMT.

3. **Mix of uses** – typically residential and commercial development and the degree to which they are balanced in an area (jobs-housing balance). A mixture of land uses reduces the number of vehicle trips by reducing travel distances and allowing more trips by alternative modes (i.e. cycling, walking and transit). Trip reduction is further reduced when affordable housing is located in job-rich areas (Modarres1993; Kuzmyak and Pratt 2003; Ewing, et al. 2010; Spears, Boarnet and Handy 2010).

4. **Design and Walkability** – Neighborhood layout and street characteristics, particularly connectivity, block size, presence of sidewalks and other design features (e.g. shade, scenery, presence of attractive homes and stores) that enhance the pedestrian and bicycle friendliness of an area.

The 2040 Conceptual Land Use Strategy adopted by the Kane County Board is the framework for the 2040 Land Resource Management Plan (LRMP). The land use strategies are given for three areas within the county – the Sustainable Urban Corridor Area located in the easternmost portion of the county along the Fox River; the Critical Growth Area located west of the Urban Corridor generally in the center of the county; and the Agricultural/Food, Farm and Small Town Area in the westernmost portion of the county. Two of the *Smart Growth Principles* from the 2040 Conceptual Land Use Strategy are to create walkable neighborhoods and provide a variety of transportation choices. It is acknowledged that communities are beginning to implement new approaches to transportation planning, such as better coordinating land use and transportation; increasing the availability of high quality transit service; creating connectivity within the transportation networks and between pedestrian, bike, transit and road facilities.

The County's 2040 LRMP recognizes the role of all of the 10 smart growth principles as well as the new Livability Principles recommended by the Partnership for Sustainable Communities, in providing more transportation choices, and creating active and convenient communities that link people to jobs as well as to commercial, retail and entertainment centers. The County encourages communities to embrace the Smart Growth and Livability Principles to support and create more livable communities, and to reduce the growth in congestion through smart land use decisions.