Section 5

Transportation System Planning

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5.1 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 were discussed generally in the preceding section.

5.2 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 5-1. 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 5-1
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 5-2. 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.

5.3 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.

TABLE 5-2
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

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 TSM and 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 regulation also contribute to an overall program to manage traffic congestion. Other supply-side actions may include expansion/channelization of critical intersections, access control, traffic control/surveillance systems, and traffic calming.

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 signalization are a few of the relatively low price/impact solutions to intersection congestion problems.

5.4 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 4 of this document.

5.5 Travel 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 strategies, that encourage use of these modes.[2]

TDM alternatives include familiar travel options such as:

- Carpools and vanpools
- 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.

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.

5.6 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

- Traffic control and surveillance systems

- Preferential or exclusive lanes for transit and/or high occupancy vehicles (HOVs)

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[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

- Provisions for parking and loading
- Pedestrian and bicycle facilities

5.7 Traffic Calming

Traffic calming is another important element in transportation planning. As defined by the Institute of Transportation Engineers (ITE), traffic calming is;

The combination of many physical measures that reduce the negative effects of motor vehicle use, alter driver behavior and improve conditions for non-motorized street users.[3]

More broadly defined, traffic calming applies to a number of transportation techniques developed to reduce motorist speed, decrease traffic volumes, increase safety for pedestrians and cyclists, and to educate and increase awareness of the traveling public. Some of the "tools" applied in traffic calming are:

- Speed humps and bumps
- Roundabouts
- Turn restrictions and one-way operation
- Forced-turn channelization
- Median barriers and diverters
- Cul-de-sacs
- Landscaping / tree-lined streets
- On-street parking

As reported by ITE, traffic calming can involve changes in street alignment, installation of barriers and other physical measures to reduce traffic speeds and cut-through volumes in the interest of street safety, livability, and other purposes. Traffic calming assists in making streets an attractive place to slow down. Reductions in traffic speed and volume, however, are just means to other ends such as traffic safety and active street life.

5.8 Effect of Land Use Policies on Transportation

It has been proposed that land use policies be utilized to mold transportation demand in Kane County. Worthy transportation objectives for shaping land use patterns and site design features in the interests of transportation efficacy and impact mitigation include (Transit Cooperative Research Program [TCRP] Report 95, 2003):

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

In general, research confirms association between (land use) density and vehicle travel. At higher densities, use of alternative modes – particularly transit and pedestrian travel – is higher. Per capita passenger vehicle trips and VMT are lower.

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[3] I.M. Lockwood, *ITE Traffic Calming Definition*, ITE Journal, Vol. 67, July 1997, pp 22-24

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. There is wide disparity, however, as to the potential effect that could be achieved. One study reported that doubling population density would result in localized travel reduction of from 5 percent to 10 percent. (Transportation Research Board (TRB), Record 1780, Ewing and Cervero, 2001). Yet another study concluded that doubling suburban density might produce 25-30 percent less VMT (per household or per capita) if urban transportation alternatives are provided. (Holtzclaw, 1990 and 1994) Regardless of the magnitude of effect, however, there is general consensus regarding the positive relationship between land use density and transportation.

Higher densities are associated with lower proportions of travel by SOV, and most strongly linked with higher use of bus and walking modes.

The Conceptual Land Use Strategy adopted by the Kane County Board is the framework for the 2030 Land Resource Management Plan. The land use strategies are given for three areas within the county – the 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/Rural Area in the westernmost portion of the county.

Priority Places have been designated within the Critical Growth Area. These areas of 5,000 to 10,000 residents, which can combine a mix of uses, compact design, a sense of place, pedestrian, bicycle and other transportation alternatives and important links to the countywide greenway system.

Two of the *Smart Growth Principles* on which the plan for Priority Places is based 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 redundancy, resiliency and connectivity within the transportation networks; and ensuring connectivity between pedestrian, bike, transit and road facilities.

The CATS 2030 Regional Transportation Plan (RTP) recommends that special emphasis be placed on the land principles of TOD. TOD is the design and development of land around transit stations and bus stops that encourage people to use public transportation.

The purpose of TOD is to build active and convenient communities that link people to jobs as well as to commercial, retail and entertainment centers. The RTP encourages communities to embrace TOD principles to support existing transit service and to encourage transit investment.