CHAPTER 13
Transportation Systems Management & Operations

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Overview / Summary

Chapter 13 discusses strategies and actions targeted at improving the performance of the existing transportation network to relieve vehicular congestion and improve the safety and mobility of people and goods. The City of Rochester has been the primary agency leading the implementation of management strategies across the Rochester area network. MNDOT has invested in infrastructure including a regional Traffic Operations Center, variable message boards, traffic surveillance cameras and communication equipment as part of the ROC 52 project that is now utilized as part of the traffic management system in the Rochester area.

Among the key strategies that local roadway agencies utilize to operate the existing system more efficiently include periodic signal coordination and retiming projects, ongoing installation of advanced communications infrastructure to permit a higher level of control over traffic signal systems, signal pre-emption capabilities for both emergency service responders and transit vehicles, monitoring technologies including advanced vehicle detection sensors and closed circuit television to monitor traffic flow on major highways, and enhancements such as mobile data terminals for law enforcement officers.

Other key efforts to improve system performance include the adoption and application of access management policies and level of service policies to guide planning and project design efforts. The plan recommends three key initiatives, including an update to the 1998 Intelligent Transportation System (ITS) plan for the Rochester area, consideration of a Regional Concept of Operations Plan, and development of an ongoing planning process focused on the integrated assessment of Congestion & High Crash locations.
Introduction

Transportation Systems Management & Operations (TSM&O) refers to strategies and actions targeted at improving the performance of the existing transportation network to relieve vehicular congestion and maximize the safety and mobility of people and goods. The Long Range Plan supports system management goals, which focus on how the system operates rather than capital investment. Strategies to improve efficiency or effectiveness focus on low cost measures. Examples of system management and operations tools include:

- Metropolitan traffic management centers;
- Traffic signal coordination;
- Freeway/arterial corridor management;
- Incident management programs;
- Preferential treatment for transit
- Special event traffic management;
- Emergency management strategies;
- Customer information services;
- ITS applications for transit;
- Traveler information systems.

The City of Rochester has been the primary agency responsible for implementing management strategies across the Rochester area network. MNDOT, during the lead up to and construction of the ROC 52 project, did invest in infrastructure including a Traffic Operations Center, variable message boards, traffic surveillance cameras and communication equipment to aid in workzone management during construction of that project. The benefits of that investment are still being realized in ongoing ITS efforts.

System Management Strategies used in the ROCOG area

There are a range of TSM&O strategies being utilized in the Rochester area. Among the most widely implemented and important to improving the operation of the system include:

- Arterial Corridor Signal Optimization involving the timing and coordination of signals within a corridor or subarea to minimize the stop-and-go nature of traffic flow;
- Access management planning to reduce opportunities for conflict between through movements and vehicles turning off and onto roadways;
- Minor reconstruction and/or restriping projects on existing transportation facilities to address roadway safety and operations, which have included actions such as re-striping travel lane widths, realigning roadways to enhance sight distances and geometry at intersection approaches, and the channelization of turning movements through striping or roadway widening to provide left-turn bays, right-turn lanes and bus pullouts areas;
• Transit operation enhancements such as signal pre-emption have been deployed, with real-time transit arrival and departure monitors and AVL (vehicle location tracking technology) in the process of being deployed;

• Traffic calming projects to protect neighborhoods from intrusion of through-traffic seeking to avoid congested facilities during peak periods and high-speed traffic at all hours;

• Traveler information services including highway advisory radio; variable message signs and online road reports;

• Signal preemption to permit emergency vehicles to utilize communications technology to override intersection controls and facilitate response to incidents;

• Data management systems to improve management and response to incidents such as reported accidents, unsafe street conditions, and missing or damaged signage, sidewalks, street lights or traffic signals.

**Management Strategies**

Area transportation agencies have implemented a range of system management strategies which are well established and which will continue to be utilized over the 20 year horizon of the Long Range Plan. These efforts include:

**Signal Coordination and Timing**

The city of Rochester has 155 traffic signals on its system of which 118 are now interconnected and 144 of which feature emergency vehicle preemption capability. Through cooperative service agreements with MNDOT and Olmsted County the City of Rochester also manages traffic signals on state and county roadways within the city limits to provide for enhanced coordination of the system. The City budgets $100,000 per year to review and optimize signal timing. The goal is to review and retime signals in Rochester on an 8 year schedule. Priority is given to the major arterial corridors but differences in priorities between the road authorities (city / county / state) sometimes results in the inability to have the necessary funding in place where joint ownership is involved.

To insure the operational integrity of the traffic signal network, the City of Rochester has a signal maintenance programs established for 1) the replacement of signal hardware installations over 25 years in age, with a goal to replace one a year; 2) installation and upgrading of battery backup power systems for signal installations, with the goal to install 4 per year; 3) replacement of LED’s on a 10 year lifecycle; and 4) signal controller replacement, with the goal to replace one installation a year. Olmsted County contracts with the City to maintain signal installations in the Rochester area on the County road network at a cost of approximately $165,000 per year, while MNDOT funds an annual set-aside in their District Transportation Improvement Program for signal installation replacement at $450,000 per year within District 6 (an eleven county area).
Communications infrastructure

The City of Rochester has invested in communications infrastructure to support a number of TSM&O initiatives including the signal management system. Signal interconnection networks have been put in place to cover most of traffic signals infrastructure in place in the city using a variety of communication technologies. An Illustration of the scope of this system is shown in Figure 13-1. The city and state have a backbone fiber optic system in place along major corridors, and budget for the incremental expansion of the system as part of major reconstruction projects. For example, in 2014 MnDOT will be extending the system along TH 63 south from TH 52 to Interstate 90.

FIGURE 13-1: City of Rochester Signal Interconnection System

Pavement Markings and Signage

Pavement markings/restriping programs and sign maintenance provide low cost means to enhance the safety and operations of roadways. All three major roadway jurisdictions have established annual budget items to provide funding for the maintenance of pavement markings and traffic control signage at the levels indicated below.

<table>
<thead>
<tr>
<th></th>
<th>Rochester</th>
<th>Olmsted County</th>
<th>MnDOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restripping of Pavement Markings</td>
<td>$75,000-$150,000</td>
<td>$70,000</td>
<td>$850,000</td>
</tr>
<tr>
<td>Sign Replacement</td>
<td>2000 signs per year (12 year cycle)</td>
<td>$165,000</td>
<td>$220,000</td>
</tr>
</tbody>
</table>
ITS Implementation

ITS implementation in the Rochester area was initially completed as part of a “Quick Start” process under the MNDOT NOVA project in the late 1990’s, which focused on kick-starting the deployment of ITS initiatives in urban and rural areas of Greater Minnesota. As part of that effort, the Rochester Area Transportation Operations Center Scoping Study was completed in 1998. Table 13-1 lists the ITS components that were identified for deployment in that plan, reports on the current implementation status of projects, and, for those not yet implemented, whether they are programmed.

Table 13-1: ITS Implementation Status

<table>
<thead>
<tr>
<th>Proposed Rochester Area ITS Component</th>
<th>Deployed?</th>
<th>Program Status or Current Deployment Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FREEWAY MANAGEMENT</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transportation Operations Center established at State Patrol Communication Center ($0.4k)</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Vehicle Detection sensors installed on TH 52,14 and 63 to collect volume / speed data for identifying congestion ($0.4 k)</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Closed Circuit Television cameras installed at key locations to monitor freeway traffic condition / 4 in initial phase and 4 additional in second phase ($0.48k)</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Freeway Variable Message Signs at 8 locations on TH 52 and TH 14 ($1.6m)</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Portable Traffic Management System acquired for use in highway work zones; 1st deployment on 14/52 construction project</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td><strong>TRAVELER INFORMATION</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Automated Telephone System to provide real-time, route specific, on-demand information via telephone managed from Traffic Operations Communications Center (TOCC)</td>
<td>Yes</td>
<td>511</td>
</tr>
<tr>
<td>Pavement Condition Reporting system / Maintenance vehicles equipped with mobile data terminal to transmit information by maintenance personnel into Mobile Data Terminal (MDT)</td>
<td>No</td>
<td>Currently being field tested by MnDOT</td>
</tr>
<tr>
<td>Variable Message Signs operated by MNDOT on state highways used to alert motorists to construction diversion and travel conditions operated from Rochester Traffic Operations Center</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Real time travel condition information accessible through the Internet / managed by the Traffic Operations Communications Center</td>
<td>No</td>
<td>Under consideration by MnDOT</td>
</tr>
<tr>
<td>Cable Television Broadcast of traffic channel providing 24 hour information on congestion, travel speeds, accidents, construction and special events</td>
<td>No</td>
<td>Was targeted to assist in TH 52 reconstruction but not completed; low priority under typical network congestion conditions</td>
</tr>
<tr>
<td>Establish Highway Advisory Radio channel</td>
<td>No</td>
<td>Low Priority</td>
</tr>
</tbody>
</table>
## Proposed Rochester Area ITS Component

<table>
<thead>
<tr>
<th>Proposed Rochester Area ITS Component</th>
<th>Deployed?</th>
<th>Program Status or Current Deployment Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PUBLIC TRANSIT SERVICES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer aided scheduling and dispatch software system to provide dial-a-ride type service to general public during off-hours</td>
<td>No</td>
<td>Low Priority but may receive added impetus through transit / human service agency coordination efforts</td>
</tr>
<tr>
<td>Installation of information kiosks at key locations throughout Rochester to provide information on transit services (8 sites)</td>
<td>No</td>
<td>Low Priority / Kiosks deployed under FTA programs at main bus transfer centers</td>
</tr>
<tr>
<td><strong>RAILROAD INTERSECTION SAFETY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rail/Traffic Signal Coordination; system established to recognize trains and implement special signal timing plans to minimize disruption to traffic flow (7 crossings/13 signals)</td>
<td>No</td>
<td>Not a priority given uncertain status of DM&amp;E Powder River Basin Project</td>
</tr>
<tr>
<td>Variable Message Signs on secondary arterial roads under local control to alert motorists to approaching trains, construction diversion and congested travel conditions</td>
<td>No</td>
<td>Not programmed but Rochester has under consideration</td>
</tr>
<tr>
<td>Automatic Tracking of Trains using sensors with information transmitted to law enforcement/fire/ambulance dispatchers and RTOC to implement signal coordination</td>
<td>No</td>
<td>Not a priority given uncertain status of Powder River Basin Coal Train Project</td>
</tr>
<tr>
<td><strong>TRAFFIC SIGNAL CONTROL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency Vehicle Pre-emption</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Traffic Signal Interconnection, Control, Monitoring &amp; Timing for arterial street network in Rochester</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td><strong>PUBLIC SAFETY SERVICES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Automatic Vehicle Location – equipping State Patrol vehicles with AVL</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Mobile Data Terminal (MDT) system for State Patrol Rochester office</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

Consideration should be given to preparing an updated ITS Deployment Plan for the Rochester area. As shown on Figure 13-2 on the next page, the number and scope of ITS applications is significant, and there may be applications such as parking management systems, advanced safety systems or weather response management that would have value for the Rochester area. Some targeted work, such as the 2009 Olmsted County Pilot ITS Safety Study, have been completed since the 1998 Plan, but it may be prudent for recommendations from such studies to be incorporated into an overall master plan for the future of ITS in the ROCOG area. Also note that MnDOT is preparing to conduct some ITS planning work beginning in 2015.
Secondary TSM&O Strategies Employed

Improving the management and operations of a road system involves consideration of many different strategies. It is important that monitoring of conditions and adjustments to the system are considered on a regular basis to maintain a reasonable level of network efficiency. Table 13-2 provides a summary of strategies and actions used by the City of Rochester and MNDOT District 6 to manage the road network. Note that most references in this section are to MNDOT District 6 and the City of Rochester, as the city manages and maintains signals on county roads within the urbanized area under a joint agreement with Olmsted County.

Table 13-2 Management and Operations Strategies

<table>
<thead>
<tr>
<th>Strategy or Program</th>
<th>Description of Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Interagency Coordination</strong></td>
<td>To facilitate the efficient operation of the roadway system MNDOT, the City of Rochester and Olmsted County meet on a periodic basis to discuss operational issues of common concern. Among key coordination efforts are existing agreements between the state and the city regarding responsibility for signal system operations, and issues such as speed limits are coordinated across jurisdictions.</td>
</tr>
<tr>
<td><strong>Community Input</strong></td>
<td>Both the City of Rochester and the MNDOT accept comments regarding traffic operational issues via their websites as well as routinely taking input on issues via phone calls and letters. Issues are addressed as they are submitted, with no formal system in place to monitor or track trends in terms of the geographic location or types of requests. One of the most frequent requests the City of Rochester receives in terms of traffic issues is for speed control on neighborhood collector streets; The city currently programs $100,000 annually to provide for the implementation of traffic calming measures through jointly funded projects with neighborhood property owners. MNDOT also conducts an annual survey of area businesses to gather input about freight issues. Staff from ROCOG and the City of Rochester also participate in the Rochester Area Chamber of Commerce Transportation Forum and city staff meet with the Downtown Business Association as to help stay informed and respond to business concerns.</td>
</tr>
<tr>
<td><strong>Data Collection</strong></td>
<td>The primary source of crash data is the Department of Public Safety Accident Reporting system, which reflects incidents requiring the filing of accident reports under state law. Access to the information in this system is provided through the Minnesota Crash Mapping Analysis Tool (MnCMAT), an online database accessible through a GIS interface to allow easy on-line access to crash data. AADT (Annual Average Daily Traffic) count data is collected on a regular basis under the State Aid Assistance program, and the City of Rochester archives count data gathered as part of targeted studies in a local database. This data can be accessed electronically for analysis and evaluation purposes. The city also has the infrastructure in place to collect traffic volume data at signalized intersections through video cameras, though utilization at the current time is for gathering data needed for specific projects.</td>
</tr>
<tr>
<td><strong>Traffic</strong></td>
<td>The City of Rochester and Olmsted County review traffic accident data annually to identify locations with 5 or more crashes per year in order to monitor trends at these locations and...</td>
</tr>
</tbody>
</table>
### Monitoring & Performance Measurement

**Description of Strategy**

Assess the potential for safety projects to mitigate problems at these locations. MNDOT prepares its Statewide Green Sheets to assist in the reporting it must complete under the Federal Safety Program; this data provides district staff with information on crash experience at both the intersection and segment level and is monitored / evaluated to identify potential safety project locations.

The City of Rochester conducts travel time studies for the purpose of tracking performance on signalized corridors on a very limited basis. While the city and state do have staff that conduct and manage data collection activities, their level of resources is limited and devoted to other primary tasks such as state aid count updates and data collection for special studies or citizen complaints.

Level of Service standards are found in both the Long Range Plan and in the City’s Land Development Manual, which establish the guidelines that will be used in any study looking at traffic performance, including corridor studies and (with more frequency) Traffic Impact Studies. The MNDOT Highway Investment Plan 2014-2033 establishes performance measures for the state highway system focused primarily on designated Interregional Corridors. Travel time reliability and extent/duration of congestion on these corridors will be targeted as roadways become instrumented.

### Transit

**Transit Monitoring and Performance**

Management of the transit system relies heavily on monitoring to assess the cost effectiveness of various routes and for targeting of service improvements. Four key measures that are assessed routinely on both a system level and route level are 1) Farebox recovery ratio; 2) Load Factor; 3) Running Speed and 4) Passengers per vehicle hour, with reporting through the National Transit Database.

### Non-Motorized

**Pedestrian Accommodations**

The City of Rochester has incorporated pedestrian activation of signals at intersections in the downtown area and at other locations in the city where significant pedestrian crossing activity occurs on a regular basis and continues to expand the number of locations that have pedestrian activation installed. The city budgets for the installation of APS systems at 2-4 locations per year. To improve pedestrian understanding at particular high volume locations, countdown signals indicating the number of seconds of crossing time remaining for pedestrians has been installed, primarily in areas around the Mayo Medical Campus and at crossings of Broadway Avenue in downtown Rochester.

The City has a policy that requires the installation of sidewalks along all streets except for short cul-de-sacs as part of the required infrastructure improvements that must be provided in all developments.

**School Travel**

The City works closely with MNDOT, Olmsted County and the Rochester School District to assess school route travel options and identify the need for crosswalks and other safety devices on primary walking routes to primary school facilities.

### Traveler Information Services

**Traveler Information**

The key element that has been deployed in terms of traveler information systems in the Rochester area is a series of Variable Message Signs along TH 52, TH 14 and TH 63 to alert motorists to difficult travel conditions or incidents that may be impacting traffic operations. MNDOT also provides for distribution of regional traffic and road condition information via its website, including access to information from fifteen traffic cameras sited at various locations in the city, as part of its statewide 511 system.
### Work Zone and Temporary Operational Changes

The City of Rochester, Olmsted County and MNDOT work with contractors on all projects to implement work zone traffic operation plans in order to facilitate the safe flow of vehicular and non-motorized travelers during construction. All permit applications for construction within the right of way are reviewed to determine their impact on traffic, and if necessary measures such as limiting the hours of construction, instituting temporary signal retiming, adjusting transit routes and implementing detour routes are considered as mitigation measures. For major projects information about temporary changes and work zone areas is disseminated through the local newspaper, websites, and PSA’s sent to all TV and radio stations serving the area.

### Incident and Event Management

The State Patrol and MNDOT share a Dispatch / Operations Control Center located at the offices of MNDOT District 6 in northwest Rochester, which permits the sharing of critical data in real time on incidents and traffic operations on highways in the region. This system is currently not linked to the Rochester Traffic Operations Center located in downtown Rochester, though plans are to eventually link the centers to facilitate further sharing of information.

The City of Rochester routinely works with special event organizers and law enforcement agencies to coordinate roadway operations for major events, particularly those associated with the Mayo Civic Center in downtown Rochester. Most management efforts involve the deployment of personnel and traffic control to improve the efficiency and safety of traffic flow in and out of parking facilities located near the civic center. Currently the ability to adapt the traffic signal systems for short term event traffic is not available.

### Emergency Maintenance

Both MNDOT and the City of Rochester have processes in place to respond in a timely manner to reports of equipment failure from either law enforcement agencies or the general public. Both agencies maintain a sufficient inventory of spare parts and equipment to permit staff to respond to and correct most equipment breakdowns in a timely manner. The city has staff available on a 24/7 basis for responding, while MNDOT responds to equipment problems during normal working hours except in critical emergency.

### Parking Management

At this time fixed or dynamic message signing has been introduced on a limited basis to direct motorists to available parking in downtown Rochester. Limited use is made of parking restrictions by time of day or day of week to facilitate traffic operations.

### Freeways and Arterial Streets

In the ROCOG planning area management of existing freeway facilities (TH 52 / TH 63) is the responsibility of MNDOT. Periodically the agency will conduct operational analysis of critical "hot spots" identified through crash patterns, reports on congestion that have been received or field observation in an effort to maintain the operational efficiency of these corridors.

### Management & Operations in Long Range Plan

Figure 13-3 provides a snapshot of future needs related to traffic system operations in terms of corridors where the need for signal system coordination is anticipated or intersection locations where improvements are anticipated in order to manage traffic or improve safety. This analysis is based on projected 2040 daily traffic and does not imply a timing or priority of when specific improvements will be needed. Programming will depend on monitoring of conditions and analysis of those locations where screening or community input indicates issues are developing. Decisions and prioritization will generally be reflected in the preparation of annual Five Year Capital Improvements Programs.
Figure 13-3: Anticipated Locations of Future Operational Improvements

Signal Coordination
Existing and Future

Intersection Improvement Needs

LEGEND
- Standard Intersection Improvements
- Multiple Turn Lanes
Key Management Strategies / Access Management

The frequency and location of access connections along with traffic signal spacing are key elements for efficiently managing traffic flow and minimizing traffic conflict along highway corridors, and are most beneficial in the management of major urban and regional highways. The justification for control of access is based on several factors, including safety, capacity, economics, and aesthetics. Studies have demonstrated a range of potential benefits from implementation of programs to manage connection points and signal spacing along major highways, including:

- Reductions in traffic crashes and congestion, and decreases in travel delays. Studies have found that over 50% of crashes on arterials are access related.

- The economic potential of development corridors can be enhanced by a coordinated program of access management. Through corridor level access management, potential market areas are extended through reductions in travel time, and the economic viability of private investments can be enhanced by way of safe and easy access that is inviting and safer for shoppers and visitors.

- The functional life of roads can be extended through higher utilization of the roadway’s design capacity, thus permitting funds that might have been spent on road widening to be spent on road maintenance and operations. Studies have found that controlling left and right turns, the impact of unregulated driveways and the speed of access and egress can improve capacity by 25% over uncontrolled conditions.

- Motorists can benefit from reduced energy consumption. Estimated fuel usage reductions of 35-50% have been found in highly congested corridors where stops as well as deceleration and acceleration cycles were reduced due to coordinated access management planning. Similar reductions in air pollution emissions may be achieved as well.

- Research indicates that access management is just as valuable to pedestrians as to motorists. Every sidewalk or path that crosses a driveway represents multiple potential pedestrian/vehicle conflict points. Reducing the number of driveways per block reduces the number of conflict points proportionally, which makes it easier for both pedestrians and drivers since they have fewer conflicts to concentrate on while passing through a corridor.

The rationale for managing access in rural areas differs from that in urban areas. Roadways in rural areas almost always serve low-density land uses and usually have volumes below capacity thresholds, thus disruptions to through traffic are less significant. However, managing rural access increases safety (by insuring adequate sight distance, reducing the number of conflict areas, and reducing the severity of crashes when vehicles run off the road) and minimizes ongoing operational/maintenance costs related to snow removal, resurfacing and drainage repairs.

Establishing rules in advance of development also aids developers by reducing the cost and delay that may occur as a result of needing to negotiate and redesign access. Adopted guidelines also assure consistent and equitable treatment of all property owners and business interests.
Minnesota State Statutes direct public road authorities to provide “reasonable, convenient, and suitable” access to property unless these access rights have been purchased. Courts have interpreted this to allow:

- Restrictions of access to right-in/right-out
- Redirection of access to another public roadway if that roadway provides access that is reasonable, convenient and suitable

Land use authorities may exercise additional authority in managing access through development rules and regulations. Any number of means may be used to manage access, including zoning and subdivision authority, whereas road authorities are typically limited to issuing driveway permits after development may have been approved. Since county or city land use authorities are usually involved at the earliest planning stages of a development, the application of connection spacing guidelines should be focused at this level, supported by coordination with the applicable road authority.

**Implementation Directions / Strategies – Access Management**

**Strategy 1:** Preserve the integrity of the major street system with an effective program for managing the frequency of connections and signals along major street corridors to maximize the capacity of the existing street system and improve safety. Plan new higher volume connections to existing arterials at locations where the spacing of traffic signals will preserve two-way traffic progression.

**Strategy 2:** ROCOG should work with local jurisdictions to adopt Access Management guidelines for major street corridors to manage the number and location of driveways and local street connections to major roadways. Promote the integration of Access Management guidelines into municipal subdivision and zoning processes at the local level to support roadway management goals, and apply connection and signal spacing guidelines when reviewing development plans.

**Strategy 3:** Include connection and spacing recommendations as part of all Corridor Management or Congestion Mitigation Plans. Median treatments, road connection priorities and use of signalization should always be a consideration in these plans.

**Strategy 4:** In rural areas, connection and spacing guidelines should balance land use objectives with the primary function of major roads as important regional travel corridors

**Strategy 5:** When purchasing right of way for future major street construction, roadway authorities should acquire access control rights consistent with the connection and spacing guidelines of this plan.

**Implementing Connection and Signal Spacing Guidelines at the Local Level**

Connection spacing guidelines should be adopted at the county, municipal or township level since these units of government have authority to review and approve development proposals and typically are involved at the early planning stages of development when adjustments and changes to access are more easily accommodated.

Actions that local land use authorities should consider include:
1. **Adopt an access policy for major roads:** Jurisdictions should adopt access policies in order to have a consistent set of location, spacing and design guidelines for use in review of access requests.

2. **Establish a consistent process for applying and enforcing access policy.**

3. **Encourage coordination during the zoning and platting process:** Agencies should encourage coordination between planning/zoning and highway departments early in the building and development permitting process relative to future access needs.

4. **Access permits should be given for specific use:** It is recommended that agencies adopt a policy that grants access for a specific use. If this use should change, a new access permit would be required.

5. **Mechanism for variances:** A variance process for addressing hardship situations where reasonably convenient and suitable access meeting spacing guidelines is not available should be provided, since policies that are too inflexible risk the loss of public support.

Counties and municipalities have the authority to incorporate access management policy into their zoning and subdivision regulations and to adopt driveway-related ordinances. The guidelines presented in this plan provide a starting point for the formulation of an access management program. However, requirements related to permit application, review processes, variances, permit issuance and enforcement need to be considered.

**CONNECTION AND SIGNAL SPACING CONSIDERATIONS**

Spacing provisions should apply to all highway connections including private driveways, private streets, and public streets. All should be located and designed to ensure safe and efficient highway operations. Factors to consider concerning the number and spacing of driveways and streets include:

1. **Spacing should be keyed to roadway classification, operating speed, and development density.** Spacing generally will need to be more restrictive along higher-type roads, such as interregional corridors or strategic arterials, because of higher speeds and traffic volumes.

2. **Spacing guidelines should apply to new developments and to significant changes in existing development.**

3. **Spacing guidelines do not have to be consistent with past access practices.** Problems with past access practices are often one reason to develop new, clearer, and more explicit guidelines.

4. **Guidelines should address (1) interchanges, (2) signalized streets and driveways, (3) unsignalized streets and driveways, (4) median openings, and (5) corner clearances.**

5. **High volume connections for major activity centers should be treated similar to an intersecting public road rather than as a private driveway.**

6. **Traffic signal spacing should be related to the desired operating speed for the corridor.**

7. **Signal spacing criteria should take precedence over unsignalized spacing standards in situations where future signalization is likely.**

8. **In general, traffic signals should not be installed on high-speed corridors in rural locations.** Isolated signals in rural locations are inconsistent with the function and expected performance of the highway. Rural traffic signals are unexpected by the motorist who is unfamiliar with the location, requiring longer than normal time for drivers to react.
From a site layout perspective, guidelines concerning the spacing and number of driveways should reflect the following general principles:

1. **Provide access from more than one roadway if available for any traffic generator that will create more than limited levels of access traffic.**
2. **On sites with multiple frontages plan primary access to roadways of lower function.**
3. **Base the number of site driveways on need.** For small developments where access to a lower function street is not available, limit site access to one driveway. For large developments, it may be better to disperse driveway traffic to a major road across multiple access points than through a single driveway.
4. **On-site circulation should be designed with sufficient storage space to preclude spillback of traffic from site driveways onto the roadway system.**
5. **Low volume private access onto a major roadway may be permitted when the property in question has no other reasonable alternative access available.** However, access should be relocated if other reasonable access to a lower function category street becomes available.

### STREET CONNECTION & SIGNAL SPACING GUIDELINES

The following tables provide a set of guidelines that serve to establish benchmarks for the interconnection of roads and driveways in terms of the spacing of connections. The guidelines address both the connections of public streets and of driveways to the major street network.

The guidelines will have relevance to many of the traffic management decisions that jurisdictions will make, from whether to permit certain types of connections to occur, to the location of traffic signals, to the appropriate spacing between adjacent driveways and streets. The guidelines are intended as a planning tool that will be most relevant 1) in the early stages of development review, 2) the design of roadway improvement projects, and 3) as the policy basis for a more specific access management regulation. Additional considerations related to permitting processes, variance procedures, review procedures and inspection/enforcement are needed at the jurisdictional level in order to establish a full-fledged access management program. It is important to note that while these guidelines are comprehensive, final spacing of medians and driveways will need to be resolved on an individual basis using accepted engineering and planning principles.

The basis on which the guidelines have been established is by roadway classification. The key factors which have been addressed in the guidelines are connection limitations, the spacing of medians, local streets and driveways, traffic signal spacing, corner clearance guidelines and interchange area spacing guidelines. The guidelines do not address the specifics of access or street design such as grades, sight distance, driveway or roadway widths or vehicle storage needs, which are driven by engineering principles and are best left to be addressed in a design guide or handbook. The specific guidelines recommended in this plan include:

1. **Table 13-3** below identifies **PERMITTED CONNECTIONS and CONNECTION LIMITATIONS**. An important principle of connection management is to avoid if possible the connection of roadways or driveways that have significantly different functions and operating characteristics. For example, the connection of private driveways to high mobility arterials or expressways should be discouraged by regulations. Table 13-3 groups the roadway network into four classes (down the side of the table) and addresses
connection policy for each of five different classes of connection types (across the top of the table) ranging from major roadways to low volume or minimum use driveways.

2. **Table 13-4** includes **Spacing Guidelines for INTERCHANGES, MEDIAN OPENINGS, STREET CONNECTIONS AND DRIVEWAYS**. Spacing guidelines identify minimum separation standards for different types of connections, which will improve safety and traffic flow by reducing the number of conflict points through separation of areas where drivers are entering, existing, weaving or crossing opposing traffic streams. Spacing standards also should provide adequate sight distance and reaction time for motorists in general.

3. **Table 13-5** includes guidelines for **TRAFFIC SIGNAL SPACING** on different classes of roadways. Spacing between traffic signals is a strategy employed to increase the level of service (LOS) of the roadway segment. Optimum signal spacing will provide for greater signal progression and higher arterial speeds. Long and uniform spacing can more efficiently accommodate varying traffic conditions during peak and off peak and are essential to an effective traffic management program.

4. **Table 13-6** includes guidelines for **CORNER CLEARANCE**, which is the distance from an intersection of a public or private road to the nearest access connection, measured from the edge of the pavement of the road to the closest edge of the pavement of the connection. Inadequate corner clearance can result in traffic operation, safety and capacity problems by creating confusing and conflicting turns at intersections, insufficient weaving distance and backups from downstream driveways into upstream street intersections.

5. **Table 13-7** establishes guidelines for the specialized issue of **INTERCHANGE MANAGEMENT AREAS**. New highway interchanges have the ability to create substantial impacts on land development patterns around the interchange area. A variety of problems can occur if interchange areas are allowed to develop without connection management measures. Signalized intersections too close to interchange ramps can cause heavy volumes of weaving traffic, complex traffic signal operations and the backing of traffic down ramps onto the freeway mainline. Curb cuts and median openings in close proximity to the ramps only further complicate these problems. The IMA guidelines assist in improving the operation of the road system through incorporation of minimum spacing recommendations that permits the complex mix of traffic movements at an interchange to flow more smoothly.

The Access Spacing Guidelines tables begin on the next page.
## TABLE 13-3: PERMITTED CONNECTIONS AND CONNECTION LIMITATIONS

<table>
<thead>
<tr>
<th>Intersecting Connection Type</th>
<th>Roadway Classification</th>
<th>Major Highways (InT/InR/SA/MA)</th>
<th>Secondary Roads (ScA / PC)</th>
<th>Local Roads (Urban/Developing)</th>
<th>Local Roads (Rural / UIA)</th>
<th>Land Use Overlay Zone</th>
<th>Private Access - High (HV) &amp; Medium Volume (MV)</th>
<th>Low Volume (LV) &amp; Minimum Use (MU)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Limited Access Roadways / Median Controlled</strong></td>
<td>Freeway</td>
<td>Connections Permitted; Interchange Preferred; See recommended spacing in Table 13-4-a</td>
<td>Direct Connection Not permitted; Overpass Preferred; See Recommending Spacing in Table 13-4-a</td>
<td>Connection Not Permitted</td>
<td>All</td>
<td>Connection Not Permitted</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planned Freeway</td>
<td>Connection Permitted; Full Median Opening; See table 13-4-b for recommended spacing; Interim Signals if future interchange location</td>
<td>Interim Connection permitted; Full Median Opening with reversion to Directional median if safety / congestion problems develop; See Table 13-4-b for recommended spacing</td>
<td>No new connections permitted; Existing connections permitted to remain on Interim basis with planning for closure</td>
<td>Reversion of Full Median Opening to Directional median or RI/RO if safety or congestion problems develop</td>
<td>All</td>
<td>Connection not permitted except on interim basis where no feasible alternative access exists</td>
<td>Interim access approval must include planning for closure to occur at time alternate access becomes available or when freeway is built</td>
<td></td>
</tr>
<tr>
<td>Expressway</td>
<td>Connection permitted via Full or Directional Median Opening; Spacing of median openings consistent with Divided Roadway Median Opening Guidelines (Table 13-4-b); Signal spacing consistent with guidelines of Table 13-5; Signalization only when warranted</td>
<td>Connection permitted with Local Street Spacing (Table 13-4-c); subject to finding that higher order road is not needed; Unsignalized with reversion to Directional Median unless location meets signal spacing guidelines (Table 13-5)</td>
<td>Permitted if consistent with Local Street Spacing (Table 13-4-c) subject to finding that higher order road is not needed; Signalization must be warranted</td>
<td>Permitted if consistent with Local Street Spacing (Table 13-4-c) subject to finding that higher order road is not needed; Signalization must be warranted</td>
<td>All</td>
<td>Generally Not Permitted; HV may be permitted in lieu of local road connection if consistent with Local Street Spacing (Table 13-4-c) on one leg of intersection subject to finding public street not needed; Unsignalized with reversion to Directional Median unless location meets signal spacing guidelines</td>
<td>Connections not permitted except on interim basis where no feasible alternative access exists; approval of interim access on planned expressway must include agreement for removal of access when local street system is completed or alternate access becomes available</td>
<td></td>
</tr>
<tr>
<td>Roadway Classification</td>
<td>Intersecting Connection Type</td>
<td>Land Use Overlay Zone</td>
<td>Private Access - High (HV) &amp; Medium Volume (MV) (1)</td>
<td>Private Access - Low Volume (LV) &amp; Minimum Use (MU) (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------</td>
<td>-----------------------------</td>
<td>-----------------------</td>
<td>--------------------------------------------------</td>
<td>--------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Limited Access Roadways / Median Controlled (Continued)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Regional Major Arterial</td>
<td>Connection permitted via Full or Directional Median opening consistent with guidelines of Table 13-4-b</td>
<td>Not</td>
<td>Connection permitted subject to Divided Road Median Opening guidelines of Table 13-4-b and subject to Land Use Overlay Zone</td>
<td>Connection not permitted if alternative access available;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Urban Major Arterial</td>
<td>13-4-b; Signalization permitted if consistent with guidelines in Table 13-5 for signal spacing, otherwise reversion to Directional median if safety/congestion problems develop</td>
<td>Applicable</td>
<td>Finding that major road not needed at location; Signalization permitted if consistent with Signal Spacing Guidelines (Table 13-5); Reversion to Directional Median if signal not permitted</td>
<td>If no feasible alternative exists consider joint/shared access; Directional median if consistent with Median Opening spacing guidelines of 13-4-b, otherwise Ri/RO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Limited Access Roadways / Undivided</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expressway</td>
<td>...</td>
<td>...</td>
<td>Rural/UIA</td>
<td>Require access to lower level road if available; otherwise, one access per parcel subject to corner clearance (13-6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Super Two</td>
<td>Spacing of connections should be consistent with</td>
<td>Spacing of connections should be consistent with</td>
<td>Rural/UIA and driveway separation (13-4-c) req.; Traffic Signal if warranted</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main Street</td>
<td>Guidelines of Table 6-1 on page 4-25</td>
<td>Guidelines of Table 6-1 on page 4-25</td>
<td>CBD</td>
<td>New connection not permitted; require access to lower class street or alley</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Regional Major Arterial</td>
<td>Signalization should be consistent with signal</td>
<td>Signalization should be consistent with signal</td>
<td>Urban Zones</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Urban Major Arterial</td>
<td>spacing guidelines (Table 13-5)</td>
<td>spacing guidelines (Table 13-5)</td>
<td>Urban Zones</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TABLE 13-3 (CONT)

<table>
<thead>
<tr>
<th>Roadway Classification</th>
<th>Intersecting Connection Type</th>
<th>Land Use Overlay Zone</th>
<th>Private Access - High (HV) &amp; Medium Volume (MV)</th>
<th>Private Access - Low Volume (LV) &amp; Minimum Use (MU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Highways (InT/InR/SA/MA)</td>
<td>Connection permitted</td>
<td>All Urban</td>
<td>Connection permitted</td>
<td>Connection permitted to lower level road if available, otherwise</td>
</tr>
<tr>
<td>Secondary Roads (ScA / PC)</td>
<td>Connection permitted</td>
<td>Subject to Local Road / Driveway Separation guidelines</td>
<td>Connection permitted</td>
<td>one access per parcel subject to corner clearance guidelines</td>
</tr>
<tr>
<td>Local Roads (Urban/Developing)</td>
<td>Connection permitted</td>
<td>Subject to Local Road / Driveway Separation guidelines</td>
<td>Guidelines (Table 13-4-c) and Corner Clearance</td>
<td>One access per parcel subject to corner clearance guidelines</td>
</tr>
<tr>
<td>Local Roads (Rural / UIA)</td>
<td>Guidelines (Table 13-6) Signals discouraged</td>
<td>Guidelines (Table 13-6) Signals discouraged</td>
<td>Guidelines (Table 13-6)</td>
<td>local property clearance requirements</td>
</tr>
</tbody>
</table>

**Other Urban Roadways**

**Regional Secondary Arterials**
- Connection permitted
- Subject to consistency with System
- Signalization controlled

**Urban Secondary Arterials**
- Connection permitted
- Subject to meeting
- Development Guidelines (Table 6-1)

**Regional Primary Collectors**
- Signalization only if warranted
- Guidelines (Table 13-6) Signals discouraged

**Urban Primary Collectors**
- Signalization only if warranted
- Guidelines (Table 13-6) Signals discouraged

**Other Rural Area Roadways**

**Regional Major Arterials**
- Connection permitted
- Connection permitted Subject to meeting
- Connection permitted - Subject to Local Road / Driveway Separation Guidelines (Table 13-4-c) and Corner Clearance Guidelines (table 13-6)

**Regional Secondary Arterials**
- Signalization only when warranted and only on a Major Arterial
- System Development Guidelines (Table 6-1)
- Driveway Separation Guidelines (Table 13-4-c)

**Regional Primary Collectors**
- Signalization Discouraged

**Footnotes**

(1) Volume Ranges for Private Access Connections: High (HV) > 1500 ADT; Medium (MV) 500-1500 ADT; Low (LV) 50-500 ADT; Minimum Use <50ADT
(2) If Driveway Separation requirements cannot be met use of joint or shared access to obtain spacing should first be investigated to determine feasibility
Table 13-4: Connection Spacing Guidelines

Table 13-4-a: Interchange and Overpass Spacing

<table>
<thead>
<tr>
<th>Road Classification</th>
<th>Rural UIA</th>
<th>Rochester Developing</th>
<th>Rochester Urban / Core</th>
<th>Small City Developing</th>
<th>Small City Urban Core</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freeway Interchange</td>
<td>4-6 mi</td>
<td>1-2 mi</td>
<td>1 mi</td>
<td>2-3 mi</td>
<td>1-2 mi</td>
</tr>
<tr>
<td>Freeway Overpass</td>
<td>2-3 mi</td>
<td>1 mi</td>
<td>1 mi</td>
<td>1-2 mi</td>
<td>1 mi</td>
</tr>
</tbody>
</table>

Also see Table 4-15 for Interchange Management Area Guidelines for spacing requirements on crossing highway.

Table 13-4-b: Divided Roadway Median Spacing

<table>
<thead>
<tr>
<th>Roadway Classification</th>
<th>Full Median Opening</th>
<th>Directional Median Opening</th>
<th>Right-In / Right-Out**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planned Freeway</td>
<td>Rural UIA</td>
<td>Developing / Urban</td>
<td>Urban Core</td>
</tr>
<tr>
<td>NA</td>
<td>1/2 mi</td>
<td>1/4 mi</td>
<td>NA</td>
</tr>
<tr>
<td>Expressway</td>
<td>1/2 mi</td>
<td>1/4 mi</td>
<td>1/8 mi</td>
</tr>
<tr>
<td>Other Regional Arterial</td>
<td>NA</td>
<td>1/8 mi</td>
<td>330 ft</td>
</tr>
<tr>
<td>Other Urban Arterial</td>
<td>NA</td>
<td>1/8 mi</td>
<td>330 ft</td>
</tr>
</tbody>
</table>

See Driveway Spacing.

Table 13-4-c: Local Street and Driveway Spacing

<table>
<thead>
<tr>
<th>Posted Speed Limit</th>
<th>&lt; 35 Mph</th>
<th>35 - 45 Mph</th>
<th>&gt; 45 Mph</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desirable Offset: Local or HV</td>
<td>300 ft</td>
<td>425 ft</td>
<td>525 ft</td>
</tr>
<tr>
<td>Desirable Offset: LV or MV</td>
<td>150 ft</td>
<td>200 ft</td>
<td>250 ft</td>
</tr>
</tbody>
</table>

NOTES
(1) Driveway Spacing may be reduced by up to 33% if driveway restricted to Right-In / Right-Out operation only.
(2) Adequate Stopping Sight Distance and Intersection Sight Distance should be provided at all local street and private driveway connections points.
(3) Distances between adjacent one-way driveways with inbound drive upstream from outbound drive can be 1/2 distance shown in table.
(4) Where parcel lacks sufficient frontage to meet above requirements, owner may 1) seek a variance, but in no case shall variance permit spacing less than the next lower class, or 2) agree to establish common driveway with adjacent owner.
(5) Local Streets and Low to High Volume driveways should be aligned with connection points on the opposite side of the roadway or offset a minimum distance as defined in the following table.

SPACING OF INTERCHANGES, MEDIANS, STREETS AND DRIVEWAYS

Table 13-4 contains three subsections which establish guidelines for the spacing of different types of connections to the major roadway network.

- Table 13-4-a provides guidelines for interchange and overpass spacing along freeways and planned freeways.
- Table 13-4-b provides guidelines for the spacing of full and restricted median openings along the various types of divided highways that are constructed in Olmsted County.
- Table 13-4-c provides guidelines for the minimum spacing of local streets and private driveway spacing along major roadways, linked to the posted speed limit of the roadway.

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REAFFIRMATION OF ROCOG 2040 LONG RANGE PLAN
### TABLE 13-5: Minimum Spacing - Signalized Intersections

**NOTE:** In practice, signals must also meet warrants for signalization.

<table>
<thead>
<tr>
<th>Roadway Classification</th>
<th>Rural</th>
<th>Urban Influence Area</th>
<th>Developing Urban Area</th>
<th>Urban / Urban Core Areas</th>
<th>CBD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Limited Access Roadways / Median Controlled</strong>&lt;sup&gt;⑴&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freeway</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planned Freeway</td>
<td>Interim only: only if warranted / 2 mi</td>
<td>Interim only / 1 mi</td>
<td>Not applicable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expressway</td>
<td>Only if warranted and all other options exhausted / 1 mi</td>
<td>1 mile</td>
<td>1/2 mi - Urban Area</td>
<td>1/4 mi - Urban Core Area</td>
<td>1/8 mi</td>
</tr>
<tr>
<td>Other Regional Major Arterial</td>
<td>Not</td>
<td></td>
<td>1/2 mi</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Urban Major Arterial</td>
<td>Applicable</td>
<td></td>
<td>1/4 mi</td>
<td></td>
<td>1/8 mi</td>
</tr>
<tr>
<td><strong>Limited Access Roadways / Undivided</strong>&lt;sup&gt;⑴&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expressway</td>
<td>Only if warranted and all other options exhausted / 2 mi</td>
<td>1 mile</td>
<td>1/2 mi</td>
<td>1/8 mi</td>
<td></td>
</tr>
<tr>
<td>Super Two</td>
<td>1 mile</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main Street</td>
<td>Not Applicable</td>
<td></td>
<td>Min 2 blocks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Regional Major Arterial</td>
<td>1 mile</td>
<td></td>
<td>1/2 mi</td>
<td>1/4 mi</td>
<td>1/8 mi</td>
</tr>
<tr>
<td>Other Urban Major Arterial</td>
<td>1 mile</td>
<td></td>
<td>1/2 mi</td>
<td>1/4 mi</td>
<td>1/8 mi</td>
</tr>
<tr>
<td><strong>Other Urban Roadways</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regional Secondary Arterials</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban Secondary Arterials</td>
<td></td>
<td>Signals Spacing at Intersections with major roads controlled by major</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regional Primary Collectors</td>
<td></td>
<td>Spacing; other locations only where warranted</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban Primary Collectors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other Rural Area Roadways</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regional Major Arterials</td>
<td></td>
<td>Signals only considered when other options ineffective and signal must be warranted</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regional Secondary Arterials</td>
<td></td>
<td>Use of traffic signals highly discouraged on regional secondary arterials or primary collectors in rural areas; evaluate other options first</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regional Primary Collectors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTES**

⑴ A signalized intersection location may deviate from the ideal location without detailed analysis, if within a distance from the preferred location as specified in the table below. Where a proposed distance is offset by a greater distance, an analysis should be conducted demonstrating that minimum bandwidth criteria can be met.

<table>
<thead>
<tr>
<th>Road Classification</th>
<th>Permissible offset from Desired location</th>
<th>Minimum Bandwidth Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Peak Period</td>
<td>Off-peak Period</td>
</tr>
<tr>
<td>Interregional</td>
<td>100 ft</td>
<td>50%</td>
</tr>
<tr>
<td>Strategic Arterial</td>
<td>150 ft</td>
<td>45%</td>
</tr>
<tr>
<td>Major Arterial</td>
<td>200 ft</td>
<td>40%</td>
</tr>
</tbody>
</table>

---

Chapter 13

Transportation Systems Management & Operations

**TRAFFIC SIGNAL SPACING**

Table 13-5 describes recommended signal spacing for different classifications of roadways and land use environments. Roadway classifications are listed down the left column and land use overlay zone designations across the top of the table.

Spacing should be measured from center of intersection to center of intersection, though distances may vary by up to 200 feet without having a significant effect on the ability to establish traffic flow progression, which is the key goal of this guideline.
CORNER CLEARANCE GUIDELINES

Table 13-6 contains recommended guidelines for upstream and downstream corner clearance, defining the spacing that should be observed between an intersection on a major roadway and the first adjacent driveway or local street upstream and downstream of the intersection. The columns in Table 13-6 for “A” and “B” distances refer to the dimensions labeled in Figure 13-4. The upstream clearance “C” dimensioned in Figure 13-4 is normally influenced by the stacking distance needed for vehicles approaching the major street intersection. In the absence of a traffic study identifying expected stacking distance, minimum distances for dimension “C” should be:

- 35 ft if ADT < 3000
- 75 ft if ADT 3000-6,000
- 150 ft if ADT 6000-15,000
- 300’ if ADT > 15,000

The distance recommended for dimension “D” is 120 ft. This reflects the time needed for a driver to complete a turning maneuver off the major street before needing to react to conditions at the first access point.

![Anatomy of Intersection Corner Clearances](image)

**FIGURE 13-4**

**TABLE 13-6: CORNER CLEARANCE GUIDELINES (1)**

<table>
<thead>
<tr>
<th>Road Classification</th>
<th>Median Area</th>
<th>&lt; 35 MPH</th>
<th>35-45 MPH</th>
<th>&gt; 45 MPH</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Type Street Design</td>
<td></td>
<td>A B A B</td>
<td>A B A B</td>
<td>A B A B</td>
</tr>
<tr>
<td>Planned Freeway or Expressway</td>
<td>Divided</td>
<td>N/A N/A</td>
<td>400 275</td>
<td>500 375</td>
</tr>
<tr>
<td>Expressway or Super Two</td>
<td>Undivided</td>
<td>350 250</td>
<td>450 315</td>
<td>625 435</td>
</tr>
<tr>
<td>Main Street</td>
<td>100 75</td>
<td>125 100</td>
<td>125 125</td>
<td></td>
</tr>
<tr>
<td>Urban Street Classes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major Arterial</td>
<td>Divided</td>
<td>135 100</td>
<td>150 115</td>
<td>175 125</td>
</tr>
<tr>
<td>Major Arterial</td>
<td>Undivided</td>
<td>225 175</td>
<td>300 235</td>
<td>375 300</td>
</tr>
<tr>
<td>Secondary Arterial</td>
<td>Undivided</td>
<td>175 125</td>
<td>235 175</td>
<td>275 225</td>
</tr>
<tr>
<td>Primary Collector</td>
<td>Undivided</td>
<td>100 75</td>
<td>125 100</td>
<td>175 125</td>
</tr>
<tr>
<td>Local Collector</td>
<td>Undivided</td>
<td>50 25</td>
<td>N/A N/A</td>
<td>N/A N/A</td>
</tr>
<tr>
<td>Rural Street Classes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regional Major Arterial</td>
<td>Undivided</td>
<td>300 225</td>
<td>400 275</td>
<td>500 375</td>
</tr>
<tr>
<td>Regional Secondary Arterial</td>
<td>Undivided</td>
<td>275 175</td>
<td>350 235</td>
<td>425 315</td>
</tr>
<tr>
<td>Regional Primary Collector</td>
<td>Undivided</td>
<td>250 125</td>
<td>275 200</td>
<td>300 275</td>
</tr>
</tbody>
</table>

**NOTES**

(1) Where required Corner Clearance cannot be provided first driveway should be located at far side of property away from intersection setback 10 feet from adjacent property.
INTERCHANGE MANAGEMENT AREAS

Interchange Management area requirements include spacing between a ramp intersection with the crossroad and

1. the first access point along the crossroad departing from the ramp (X);
2. the first median opening along the crossroad departing from the intersection (M)
3. the first signalized intersection adjacent to the ramp intersection (Y)
4. the spacing of the nearest access point in the approach direction to the ramp (Z)

Figures 13-5 and 13-6 illustrate the four dimensions of concern, with Figure 13-5 related to conditions where the crossroad is undivided with Figure 13-6 related to the condition where the crossroad has a raised median. Minimum recommended distances for dimensions X, Y, Z and M are listed in Table 13-7

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**TABLE 13-7: SPACING REQUIREMENTS IN INTERCHANGE MANAGEMENT AREAS**

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Ramp</th>
<th>Spacing Dimension X</th>
<th>Spacing Dimension Y</th>
<th>Spacing Dimension Z</th>
<th>Spacing Dimension M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overlay Zone Type</td>
<td>4/6 Lane Divided</td>
<td>2/4 Lane Undivided</td>
<td>4/6 Lane Divided</td>
<td>2/4 Lane Undivided</td>
<td>4/6 Lane Divided</td>
</tr>
<tr>
<td>Rural/Urban Influence Area</td>
<td>990</td>
<td>990</td>
<td>1760</td>
<td>1320</td>
<td>990</td>
</tr>
<tr>
<td>Developing Area</td>
<td>660</td>
<td>660</td>
<td>1320</td>
<td>990</td>
<td>880</td>
</tr>
<tr>
<td>Urban or CBD</td>
<td>Free Flow</td>
<td>660</td>
<td>660</td>
<td>1320</td>
<td>990</td>
</tr>
<tr>
<td></td>
<td>Signalized</td>
<td>380</td>
<td>380</td>
<td>660</td>
<td>660</td>
</tr>
</tbody>
</table>

---

FIGURE 13-5

FIGURE 13-6

13-23 | Page | REAFFIRMATION OF ROCOG 2040 LONG RANGE PLAN
Connection Spacing in Fully Developed Urban Corridors

Applying access management in a fully developed arterial corridor is one of major challenges in traffic engineering. An opportunity-based strategy that focuses on prevention and remediation when the opportunity arises is probably the most feasible approach to addressing traffic management needs in these corridors. The process of improving access management along an already developed corridor can take twenty years or more. It is often best to start slowly by evaluating the full range of techniques available and identifying what will work best in a corridor.

Elements of a REMEDIATION approach that should be considered for a developed urban corridor include:

1. Correct unsafe access situations as individual parcels are expanded or redeveloped. Work with affected owners to consolidate driveways and provide cross access between parcels. Use the standards for new development as a guide to improve access in “change of use” situations.

2. For the most critical corridors, prepare corridor-level access management plans and include broad property owner participation on projects involving major physical changes. In addition to addressing direct access onto major roadways, the plan should look at opportunities for filling in the supporting roadway network with local access roads as part of future redevelopment efforts.

3. Consider combining major access management remediation programs into a larger set of corridor enhancement or revitalization initiatives (such as economic redevelopment or adaptive reuse projects, community beautification, improved sign or landscaping controls, etc.).

Desirable Land Development Best Practices

The best time to consider access management is at the time of site development planning when plans can more easily be adjusted to accommodate spacing considerations. Among the best practices in terms of land development that support connection and signal spacing priorities include:

*Development of good parallel street systems for carrying local traffic:* Make sure that important arterial routes have good parallel street systems to provide for the local access function and to handle short distance local trips.

*Providing or preserving the opportunity for future frontage roads through adequate setbacks (Fig 13-7)*: Make sure that proper building and parking lot set-backs are established so that future frontage roads or internal private drives connecting to local streets can be installed with minimal impacts.
Develop proper secondary street spacing: When reviewing new development proposals, be sure that they provide proper intersection spacing for future signals. As a guideline, signalized intersections should be limited to use on through streets, with spacing of ¼ to ½ mile on secondary arterials and collectors and ½ mile or more on major arterials and expressways in developing areas. This spacing is important in order to provide the ability to effectively manage traffic on the major corridors. The secondary street system also needs to provide continuity and connectivity between the major arterials and local street system to minimize the need for local street connections to major highways.

Encourage proper lot layout to minimize access points (Fig 13-8vii) Plans should promote residential access onto local streets, not arterials or major collectors. Direct residential access to arterial or collector routes will result in complaints when traffic levels increase. Even in rural areas, where
development is less dense and traffic levels are lower, access should be encouraged off local roads, not high-speed, higher volume state or county roads.

**Coordinate Commercial and Industrial Development in Nodes and Centers (Fig 13-9viii)**

Limit or prevent commercial and industrial strip development. Promote planned centers or nodes that extend back from the road and will permit the use of joint access connections between individual developments or local roads for travel in the area. Where existing parcels are to be subdivided, encourage developers and/or landowners to provide access by utilizing existing access or by relocating an unused access point so that the net number of access points remains constant.

**Encourage connectivity between developments (Fig 13-10ix)**

Align local streets in adjacent developments to provide access or reserve right-of-way to provide for future connections to adjacent developments. This reduces the need for short trips on the arterial system and promotes neighborhood connectivity, good emergency services, and more efficient travel for mail, garbage and bus services as well as street maintenance activities.

**Avoid offset or “dogleg” intersections and entrances (Fig 13-11x)**
Agencies should encourage alignment of access points directly across from other roads or entrances and avoid minimal offsets to minimize driver errors and impacts to mainline flow. In areas where offsetting access points cannot be avoided, adequate spacing is needed to avoid the conflict created by overlapping turning movement and acceleration and deceleration maneuvers.

*Restrict turning movements to reduce conflicts*

If access points cannot be eliminated, consider turning movement restrictions (e.g., left-in only, or right-in/right-out only) through installation of raised median or other channelization. Eliminating a single turning movement can significantly reduce vehicle conflicts and potential accidents.
Key Management Strategies: Level of Service Guidelines

Level of Service (LOS) is a measure of the quality of service provided by a roadway facility. Quality of service refers to a user’s perception of how well a transportation service or facility operates. LOS measurement is tied to a rating scale ranging from A (very high level of satisfaction with freely moving traffic) to F (very poor quality with near gridlock conditions). Figure 13-12 illustrates typical roadway conditions under different levels of service.

Implementation Directions/Strategies for Level of Service:

Strategy 1: A primary traffic management goal for roadway authorities in the ROCOG planning area should be to manage the major road system to maintain an acceptable level of service during peak and off-peak periods of demand.

Strategy 2: When reviewing land use amendments, zone changes, master plans, conditional uses and other significant development requests, jurisdictions should take into consideration the impact of the project on roadway Level of Service. Jurisdictional land use policy with regards to the traffic impact of proposed development should support the level of service standards in this plan and the policies to achieve these standards.

Strategy 3: Level of Service impacts should be considered and improvements to maintain or improve level of service should be considered in all planning and project development studies involving the preparation of corridor or traffic management plans or road improvement plans.

Guidelines for Level of Service described in Table 13-8 define the minimum operating conditions that should be maintained for the 100th highest hourly volume of the year in the predominant peak or off-peak direction of traffic flow. LOS analysis should consider short term (5 years out) and long term (20 years out) needs. In Table 13-8, use of the terminology “Maintain” means operating conditions are preserved at or above the existing level of service through immediate or future improvements in areas where existing service levels are already below the standards in the table.

While numerous methods have been developed to assess Level of Service, ROCOG recommends use of the methods found in the Highway Capacity Manual as the primary methodology for assessing LOS.
**Understandings for applying Level of Service guidelines**

- Where a roadway creates the border between adjacent land use zones (for example, where a roadway is the border between an Urban and a Developing land use zone) the less restrictive guideline from Table 13-8 should be used.

- Level of Service is quantitatively measured using numeric performance measures where each LOS grade (A through F) represents a range of performance on a continuum; guidelines such as “B/C” in the table above represent the breakpoint between LOS B and LOS C, and guidelines such as “Mid-C” represent the midpoint of the range for Level of Service C conditions.

### Table 13-8: Level of Service Guidelines

<table>
<thead>
<tr>
<th>Subarea</th>
<th>Land Use Zone</th>
<th>Land Use Area</th>
<th>Functional Designation</th>
<th>Peak Period</th>
<th>Mid-Day</th>
<th>Existing Substandard</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBD</td>
<td>Small City</td>
<td>All roadways</td>
<td>C/D</td>
<td>Mid-C</td>
<td>N.A.</td>
<td></td>
</tr>
<tr>
<td>Rochester</td>
<td>InT/InR/SA</td>
<td>Mid-D</td>
<td>C/D</td>
<td>Maintain</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MA/ScA</td>
<td>Mid-D</td>
<td>C/D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PC/LC</td>
<td>D/E</td>
<td>Mid-D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban Core</td>
<td>Rochester</td>
<td>All roadways</td>
<td>Mid-D</td>
<td>C/D</td>
<td>Maintain</td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>Small City</td>
<td>All roadways</td>
<td>C/D</td>
<td>B/C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rochester</td>
<td>All roadways</td>
<td>C/D</td>
<td>Mid-C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Developing</td>
<td>Small City</td>
<td>All roadways</td>
<td>Mid-C</td>
<td>B/C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rochester</td>
<td>All roadways</td>
<td>C/D</td>
<td>Mid-C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban Influence</td>
<td>Rochester</td>
<td>All roadways/2020</td>
<td>B/C</td>
<td>Mid-B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area</td>
<td>All roadways/2035</td>
<td>Mid-C</td>
<td>B/C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>All</td>
<td>All roadways</td>
<td>B/C</td>
<td>Mid-B</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) Functional Designation Abbreviations are as follows:
- All roadways - guideline refers to all classes of roadways
- InT/InR/SA - guideline refers to Interstate, Interregional, Strategic Arterials
- MA/ScA - guideline refers to Major Arterials, Secondary Arterials
- PC/LC - guidelines refers to Primary Collectors, Local Collectors
Key Management Strategies: Capacity Preservation through Safety and Operations

ROCOG and its partner agencies should conduct traffic engineering studies on roadway segments or at key intersections where there are identified congestion or capacity problems, giving priority to locations where elevated congestion levels are combined with a high incidence of accidents. In the development of mitigation plans, priority should be given to low cost methods for improving traffic flow such as:

- Traffic signal system optimization achieved through interconnection of signal systems and coordination of signal timing patterns
- Isolated geometric improvements in critical bottleneck areas
- Enhanced traveler information systems to disseminate information on incident locations affecting daily system operation
- Better roadway access control to reduce level of conflict along corridors

In areas where multiple jurisdictions are involved in the management of land adjacent to the corridor, efforts should be made to develop and implement corridor management Intergovernmental Agreements: Efforts should be made to develop corridor management agreements in cooperation with land use agencies along selected corridors where extensive future land use change is expected. A good corridor management agreement will include detailed discussions of matters such as traffic signal spacing, development of turning lanes and medians, acceptable driveway locations and alternative access such as frontage and backage roads.

Make access rights purchases where feasible: Agencies should undertake a targeted program to purchase access rights from private landowners along selected arterial highways in situations where there is considerable land development pressure expected in the near future. This sort of situation—where access purchases could still be made and there is a considerable risk of future access management, safety and operational problems—is where access rights purchase may be most effective. These areas are likely be found on major radial and beltway corridors that carry or are projected to carry the heaviest volumes of high mobility traffic.

Other Recommended Management Strategies

REGIONAL CONCEPT FOR TRANSPORTATION OPERATIONS (RCTO)

ROCOG and its partners should consider development of an RCTO, which is a formal agreement that would be developed collaboratively to guide regional operations through establishment of a shared regional framework or vision for transportation operations. Implementation of the RCTO would involve deliberate, continuous, and sustained activity by the transportation agency managers and officials responsible for day-to-day operations working together at a regional level to solve
Developing an RCTO helps partnering agencies think through and reach consensus on what they want to achieve in the next 3 to 5 years and how they are going to get there. The scope of an RCTO is defined in terms of three major dimensions: functional, institutional, and geographic.

The functional dimension defines the operations areas addressed within the RCTO, the institutional dimension defines the partnering entities engaged in developing and carrying out the RCTO, and the geographic dimension defines the region (i.e., political boundaries) for which the RCTO is developed. Each dimension is shaped by the collaborative activity among transportation operators from multiple jurisdictions.

A concept of operations document will attempt to answer the following specific questions:

- What? Identify the elements and high level capabilities of existing transportation management and operations systems?
- Where? Define the geographic and physical extent of the current and future system
- When? Define expectations in terms of timing when activities will be performed or actions taken
- How? Identify resources that will be needed for design, construction or operations
- Who? Identify the stakeholders involved and their respective responsibilities
- Why? Establish the justification for system modifications and what improvements will provide that the system currently lacks
- Measures? Identify performance measures to be used in determining how well the system is achieving desired or expected outcomes.

The RCTO concept has been pioneered in many of larger urban areas across the United States and is now moving into use in smaller areas. Recently the Fargo-Moorhead completed an RCTO framework document as part of ongoing management of their traffic operations center.

**Congestion & Crash Monitoring /Mitigation Program**

Consideration should be given to establishing a coordinated Congestion and Crash Monitoring and Mitigation program to provide for a region-wide, inter-jurisdictional assessment of needs related to safety and traffic mobility. Congestion and safety problems often have roots in similar causes, and a partnership program considering both safety and mobility offers the prospect of addressing problems in a more efficient and systematic manner. The monitoring element of the program would involve the establishment of a periodic review of data that would be collected according to a predefined data
collection program, which would be screened for identification of potential congestion “hot spots” or safety “black spots”. The mitigation element of the program would consist of undertaking studies to evaluate strategies in high risk locations to identify low cost measures that could be deployed in a relatively short period of time. Issues requiring major study and investment should be addressed through a corridor study and appropriate funding programmed when available.

The partners should define a “right-sized” process that would balance the level of effort and timeliness of response to the resources available. Consideration of the following elements should be considered in the basic program framework:

a) Identification of a set of basic performance measures that will be used for monitoring and evaluation;
b) Review the current data collection efforts and potential data gaps that need to be filled;
c) Prioritize key policy goals related to congestion and safety in order to provide direction to evaluation efforts;
d) Establish a process, preferably on an annual basis, for reviewing traffic management priorities;
e) Establish a reporting process to provide monitoring results to decision-makers and the general public.

Prepare an update to the 1998 ITS Scoping Study

Deployment of the ITS infrastructure in the Rochester area has been guided by the 1998 Rochester Area Transportation Operations Center Scoping Study. Given the status of this document, and the fact that a number of the ITS infrastructure elements have been deployed though are not fully utilized, it may be appropriate to consider an update to the 1998 study report that would address the following items:

- Preparation of an inventory of deployed ITS infrastructure in the Rochester area and active ITS-based services that are being provided which utilize the infrastructure in place.
- Identification of any refinement or expansion of existing services or new services that could be deployed based on using the current ITS infrastructure in place.
- Identification of new ITS services that should be considered for deployment along with the infrastructure, operational framework and level of resources that would be needed to deploy.
- Review of current ITS architecture for consistency with regional and national standards.
- Identification of a Regional ITS program identifying a future sequence of projects to be implemented.

Continue funding for the following TSM&O Services

- Intersection Signal Timing and Signal Optimization

The timing and coordination of signalized intersections should be reviewed periodically, especially in areas of rapid development or increased commercial activity. The city, county and
state should develop, as part of an RCTO or through a separate agreement, a framework for resourcing this effort in a timely manner.

- Traffic Calming

The City of Rochester and as needed other ROCOG partners should continue to fund a traffic calming program to address issues of driver behavior that is inconsistent with the function and environment of specific road corridors. Areas of particular concern include residential collector streets and other local streets in the vicinity of major traffic generators.

- Access Management

ROCOG should continue to work with local jurisdictions on development, adoption and administration of access management ordinances.

- Roundabouts

When issues related to intersection configuration are involved, give strong consideration to the use of a modern roundabout design where appropriate.

- Travel Demand Management

The traffic management toolbox should emphasize consideration of demand management strategies to encourage the use of alternative modes or changes in timing or routing of traffic as a means to address system management or operations problems.

- Non-recurrent Traffic Delay

Continue to respond on a case by case basis but monitor need for more systematic approach to issues such as Incident management, work zone management and event management to identify where benefits could be gained from improved coordination of planning, response or deployment.

- Effective Signage and Markings

Emphasize the effective use of and provide for timely maintenance of signage and pavement markings to improve the safety and efficiency of the roadway network as well as the travel opportunities of pedestrians, bicyclists, the elderly, disabled or school age children.
ENDNOTES

i Figure 13-1 courtesy of City of Rochester Public Works Department, Traffic Division
ii Figure 13-2 from USDOT Research and Innovative Technology Administration, Intelligent Transportation Systems website, http://www.itsoverview.its.dot.gov/
iii Access Management Manual, Transportation Research Board, p. 155
v Access Management Manual, Transportation Research Board, p. 161
vi Figure 13-7
vii Figure 13-8 courtesy of Center for Transportation Research and Education, Iowa State University, Access Management Toolkit, Frequently Asked Question #2: Driveway Spacing, available online at http://www.ctre.iastate.edu/research/access/toolkit/2.pdf
viii Access Management Manual, Transportation Research Board, p.57
ix Figure 13-10 courtesy of Mn/DOT, in Mn/DOT Needs You! As Partners in Corridor Access Management brochure, available online at http://www.dot.state.mn.us/accessmanagement/pdfs/bookletpartners.pdf
x Access Management Manual, Transportation Research Board, p.137
xi Figure 13-12 courtesy of Florida Department of Transportation, 2002 Quality/Level of Service Handbook, p.7