GUIDELINE

Transportation and Traffic Engineering

1994

Published by
Association of Professional Engineers of Ontario

CONTENTS

INTRODUCTION

This guideline was prepared by the Professional Practice Committee of the Association of Professional Engineers of Ontario. It deals with transportation and traffic engineering, primarily within the urban context, and will be useful to engineers who plan, design and operate urban transportation facilities, predominantly roadways and transit systems.

To obtain more information, contact:

The Ontario Traffic Conference

Ontario Urban Transit Association

Transportation Research Board

Transportation Association of Canada

Canadian Urban Transit Association

National Cooperative Highway Research Program

American Public Transit Association

Highway Users Federation for Safety and Mobility

Urban Mass Transit Association

ENO Foundation

Federal Highway Administration

1.0 TRANSPORTATION PLANNING

1.1 OBJECTIVE

Transportation planning, in the urban context, comprises road and transit requirements of existing and future developments. This continuous process is interactive with land use planning, since it evaluates spatial and quantitative aspects of population and employment growth.

1.2 STUDY CONSIDERATIONS

1.2.1 Official Plan

Transportation planning is an integral part of the official plan process whereby lands are designated for future growth or changes in use. Long-term planning is normally carried out for a 15-20-year planning horizon. Forecasts of travel demand are made based on projected land use. For large urban areas, a modelling approach is normally used. For smaller areas, future forecasts are determined by a growth factoring technique. Testing of alternative land use scenarios is undertaken and a selection is made, based not only on transportation requirements, but also on all factors considered part of the overall planning process.

Road facilities are identified by classification, function and number of lanes and rights-of-way. Possible transit needs include bus routes, bus and high-occupancy vehicle lanes and higher-order transit corridors.

Official plan changes are sometimes made on an individual area or site basis. The same rigorous testing should be carried out to ensure the workability of future transportation infrastructure and service.

1.2.2 Secondary Plans and Zoning

Transportation planning for these activities requires a more detailed examination of a sub-area of the city or town, or a site within that area. Road requirements would identify intersection treatments and other elements of the street system. Transit needs for a specific area should be determined, as well as transit facility requirements and/or priority treatment.

1.2.3 Site Plan

At the site planning stage, site impact studies are often conducted, which cover such on-site issues as circulation and parking.

1.2.4 Functional Planning

Functional plans for urban transportation should consider:

- the integration of transportation services and networks to achieve a balance among such various modes as road, rail, air and public transit (bus, subway, street car and transit for the disabled), and
- plans for the most effective expenditure of resources to maximize the overall provision of transportation services (e.g., shifts in mode choice from private automobile to public transit).

1.3 REFERENCES

1. Institute of Transportation Engineers, Publications Catalogue, selected references on transportation planning.
2. Transit Supportive Land Use Planning guidelines, Ministry of Municipal Affairs, 1992.

2.0 ENVIRONMENTAL ASSESSMENTS

2.1 OBJECTIVE

Environmental assessment ensures that social, economic and natural environmental effects are considered in planning development projects. The environmental assessment document shows that the environmental impacts of various alternative courses of action were identified and evaluated before one was selected as the preferred undertaking.

In accordance with the *Environmental Assessment Act* (EA Act), 1975, assessments must be completed for all public undertakings (unless exempted by the environment minister), and for private undertakings specifically defined and designated by regulation.

Section 50(3) of the EA Act sets out the required general content of an environmental assessment. The proponent (the jurisdiction responsible for the project) must provide the following information:

- the purpose of the proposed undertaking;
- evaluation of the environmental effects caused by both the undertaking and alternatives, and
- a statement of the rationale for the undertaking, which is the proponent's summary of the environmental assessment.

2.1.1 Class Environmental Assessments

The class EA procedure is used for the majority of municipal projects, which are relatively small in scale. They also recur frequently, and have a generally predictable range of effects which, though significant enough to require environmental assessment, are likely to cause relatively minor effects in most cases. Examples are electric transformer stations and substations highway widening, moderate-sized extensions to sewage treatment plants and communication towers.

Under the class EA, the project is given EA Act approval subject to certain conditions. The proponent of a proposed project does not have to apply for formal approval under the act, provided it is planned in accordance with the approved class EA procedure. The class EA provides some measure of relief from the individual application of the EA Act, while still achieving its purpose by incorporating environmental considerations into a municipality's ongoing project planning.

Projects covered by a class EA will fall within one of three activity schedules. Schedule A applies to the simplest of projects that meet all the requirements of a class EA. These projects are considered approved, and no further approval is required under the EA Act. Schedule B applies to slightly more complex projects that require screening, involving notification of those government agencies whose

programs may be affected by the proposed project, as well as adjacent property owners. Schedule C projects are more elaborate undertakings that require the submission of an Environmental Study Report (ESR). There is no formal review of an ESR. The only requirement is that it be made available for viewing by the public at the office of the Clerk of the Municipality for 30 days. Proceeding under the class EA places the responsibility for environmental planning in the hands of the municipality. ESRs are not routinely brought before the environment minister. An ESR will only be submitted to the minister if someone requests a "bump-up" to an individual EA. If a bump-up request is received, the minister will review the ESR to ascertain whether the potential effects of the project warrant a more detailed investigation.

2.1.2 Individual Environmental Assessments

All individual EAs are subject to the same requirements as outlined in section 5(3) of the EA Act. EAs must be submitted to the environment minister, after which they must undergo a formal review process by government staff. The review and approval process for an individual EA is centralized, and provides extensive provincial input. Individual or full EAs are usually completed for large or complex projects where an agency recognizes that the undertaking is not defined within the class EA process. Alternatively, an individual EA must be compiled if a request for a bump-up of a class EA is made after obtaining the environment minister's approval. A full EA must have a sound rationale and a clearly defined need or justification to support the undertaking. It also must include extensive consultation to ensure that the decision-making process includes the public.

2.2 STUDY CONSIDERATIONS

All documentation compiled throughout the environmental assessment process should contain a clear explanation of the methodology which has been followed. Certain assumptions and subjective judgments are an inevitable part of all studies. Proponents should be aware of these and state them explicitly in the document. It is also highly advisable to consult the environment ministry during the process.

There is no specific process for completing an environmental assessment, since each project is unique. An acceptable methodology or combination of methodologies should allow for adequate analysis of the environment, alternatives, potential environmental effects and mitigation measures. It should provide comparisons, evaluations and trade-offs.

The 10 basic steps of the environmental planning process are:

1. identify purpose;
2. identify alternatives;
3. study environment that may be affected by alternatives;
4. predict potential effects;
5. identify mitigation possibilities;
6. evaluate alternatives;
7. decide on most acceptable alternative;
8. prepare EA document and submit;
9. implement with approved mitigation measures, and
10. monitor.

2.3 REFERENCES

1 . *General Guidelines for the Preparation of Environmental Assessments, Second Edition,* Environmental Approvals Branch, Ministry of the Environment of Ontario, 1981.

2. *Environmental Construction Guidelines for Municipal Road, Sewage and Water Projects,* Municipal Engineers Association, 1987.

3. *Class Environmental Assessment for Municipal Road Projects,* Municipal Engineers Association.

3.0 TRANSPORTATION IMPACT STUDIES

3.1 OBJECTIVE

Transportation impact studies are carried out for individual developments, development blocks and subareas. Their primary purpose is to determine the transportation requirements associated with the development and their impact on immediate and wider areas. These studies ensure the workability of the street system regarding site access, adjacent intersections and any other areas on which there is significant impact. Also defined are the transit service and terminal facilities required to satisfy the plan.

3.2 STUDY CONSIDERATIONS

Transportation impact studies are carried out for the various levels of the planning process, including official plans, secondary plans, zoning and site plans. For an official plan, the impact study would cover a very wide area and consider transportation planning elements as well as traffic operational considerations. At the zoning level, the study would consider the more immediate area, with the wider area considerations having been covered in the official plan designation. Impact studies for site plans are detailed, and generally cover only the local area and site.

The following are normally covered in transportation impact studies:

- proposed land use(s) on the site;
- the difference between the proposed and the current designation;
- an inventory of the existing road infrastructure and transit service;
- establishment of existing travel characteristics;
- inventory of planned transportation improvements;
- an estimate of future travel demand for the periods to be tested;
- a calculation and identification of future levels of service;
- identification of deficiencies;
- impact of the travel demands on the existing and planned road facilities and on transit service;
- access requirements to serve the development;
- area transportation facilities required to serve the development;
- impact on adjacent areas (other than traffic);
- site circulation and parking, and
- a summation of the requirements and impacts.

3.3 REFERENCES

Several municipalities, including Metropolitan Toronto, the City of North York and the Region of Waterloo, have prepared guidelines for transportation impact studies. While they are similar, development size and/or location dictate the amount of detail required. Also, the Institute of Transportation Engineers Publications Catalogue lists several references on traffic impact studies.

4.0 BICYCLE FACILITY PLANNING

4.1 OBJECTIVES

Bicycle facility planning aims to increase the use and safety of bicycles in urban and rural areas. In addition to the planning and construction of bicycle facilities, comprehensive bicycle planning should include secure parking facilities, safety campaigns oriented towards cyclists and potential cyclists, public awareness campaigns aimed at motorists, anti-theft campaigns and selective improvement of

road maintenance programs to facilitate increased bicycle use. Other considerations include the assessment of bicycle use as a component of travel demand/ modal split and climate's effect.

4.2 STUDY CONSIDERATIONS

The following guidelines will ensure comprehensive and safe integration of cyclists into a community's transportation system:

4.2.1 Engineering

- plan for continuity of cycling travel, both on-road and off-road;
- plan for access to all destination points;
- plan for parking facilities at intermodal transfer and destination points;
- design safe road surfaces;
- design sufficient lane width so that vehicles can pass safely, and
- maintain a smooth, clear road surface unobstructed by potholes and debris, and with proper maintenance of drainage components.

4.2.2 Education

- emphasize that roadways are to be shared by all road users;
- ensure that motorists are made aware of the rights of cyclists on the roadway and that motorists respect rules pertaining to interaction with cyclists;
- teach cyclists the rules of the road and to obey them, and
- teach bicycle-handling skills.

4.2.3 Enforcement

- compliance with the rules of the road;
- reduction of the number and degree of accidents;
- reduction of bicycle theft, and
- development of public relations programs to encourage all of the above.

4.2.4 Encouragement

- promote public awareness and acceptance of cycling;
- develop incentives for using bicycles for commuting;
- provide amenities such as safe bicycle storage areas at places of employment, education and recreation and at transit stations;
- provide shower and change facilities at places of employment;
- work towards a safer environment for all types of cyclists, and
- provide assistance to bicycle clubs.

4.3 REFERENCES

1. *Community Cycling Manual–A Planning and Design Guide*, Canadian Institute of Planners, 1990.

2. *Guidelines for the Design of Bikeways*, Transportation Association of Canada, 1983.

3. *Bicycle Policy Review and Update,* Ministry of Transportation of Ontario, May 1992.

4. *Bicycle Compatible Roadways–Planning and Design Guidelines*, New Jersey Department of Transportation, 1982.

5. *Bicycle Facilities Planning and Design Manual*, State of Florida Department of Transportation.

6. *Guide to Cycle Facilities*, National Roads Board, Urban Transport Council, Wellington, New Zealand, 1985.

7. *Guide for Development of New Bicycle Facilities*, American Association of State Highway and Transportation Officials, 1981.

8. Institute of Transportation Engineers, Publications Catalogue, selected references on pedestrians and bicycles.

5.0 NEIGHBOURHOOD IMPACT STUDIES

5.1 OBJECTIVE

Neighbourhood impact studies are carried out for specific areas within a municipality. There is no requirement that a study be initiated only if changes are proposed as a result of new development. A study may be initiated if the neighbourhood in question has transportation concerns related to existing operations. Studies are usually undertaken by municipal agencies to address the operational concerns raised by affected area ratepayers, business associations, school groups and interested individuals. They can address a broad range of transportation considerations or a very narrow range of issues or specific concerns. A number of recommended actions, including implementation phasing and cost/benefit analysis, should be the final result. Recommendations are usually implemented over one to five years and impact oil residents when addressing infiltration.

5.2 STUDY CONSIDERATIONS

A neighbourhood impact study should include community consultation. It is highly recommended that a working committee structure be included as part of the study process.

Consideration should be given to the following:

- the existing traffic volumes on the neighbourhood street system;
- traffic travel patterns into, out of and within the neighbourhood;
- functional classifications of the road system;
- pedestrian movements;
- pedestrian operations;
- safety concerns;
- accident profiles and identification of accident-prone locations;
- traffic control devices;
- traffic infiltration utilizing vehicle licence plate trace studies;
- existing or proposed developments, schools, plazas or high volume strip generators;
- identification of road and sidewalk improvements that would be beneficial;
- identification of parking requirements both on- and off-street;
- review of transit operations and suggested touring improvements;
- identification of existing deficiencies or problem areas such as narrow bridges, at-grade railroad crossings, critical curves, grades, etc.;
- the development of a traffic improvement plan, indicating the extent, estimated cost and priority of the improvements recommended;

- information centres and community involvement throughout the process;
- transit routes;
- future model split objectives;
- bus movements, and
- bicycle use patterns.

5.3 REFERENCES

1. Residential Traffic Studies, Institute of Transportation Engineers.
2. *Manual of Traffic Engineering Studies, Fourth Edition,* Institute of Transportation Engineers.
3. *Transportation and Traffic Engineering Handbook, Second Edition,* Institute of Transportation Engineers.
4. *Manual of Uniform Traffic Control Devices for Ontario,* Ministry of Transportation Ontario.
5. Institute of Transportation Engineers, Publications Catalogue, selected references on residential streets.
6. *Guide to Transit Considerations in the Subdivision Design and Approval Process,* Transportation Association of Canada, 1990.

6.0 TRAFFIC SAFETY STUDIES

6.1 OBJECTIVE

The onus is on road jurisdictions to take reasonable steps to identify and correct road safety problems. Initiatives should address problem prevention and/or reduction. A road jurisdiction should demonstrate that it is expending a reasonable amount of its resources to monitor and resolve the problems. These initiatives serve two major objectives: to provide both a safe road environment for road users and an improved position for the road jurisdiction to respond to liability claims.

6.2 IDENTIFICATION OF THE NEED FOR A STUDY

Traffic safety is a measure of how a road system performs and is usually indicated through some form of collision indicator (e.g., total number of collisions, total number of collisions per volume of traffic, type of collision, etc.).

A study is typically needed when traffic conditions deteriorate, as shown in an increased number of collisions, or a change in the type or location of collisions.

6.3 STUDY CONSIDERATIONS

Traffic safety problems can usually be identified by:

- present adequacy of the road jurisdiction to undertake traffic safety reviews, including: the collection of data needed to measure safety levels and trends; the evaluation of the data to identify problems in the road network; the identification and implementation of corrective measures;
- roadway geometrics: the adequacy of design standards; deficiencies in existing roadway designs (horizontal and vertical curves, superelevation, crossfall, lane and shoulder widths, turning radii, etc.); sight restrictions at intersection and entrance locations; the frequency of access and egress locations;
- structures on and near the roadway: roadway overpass/underpass pier and abutment protection; sidewalk and handrail locations; underpass height restrictions; culvert protection; buildings located adjacent to the roadway;
- need and warrant criteria and installation, operation and maintenance practices for traffic control

devices: traffic signal systems, stop signs, yield signs, speed zoning, pedestrian crossovers, illumination and supplementary flashers;

- application and maintenance of traffic signing: policy for regulatory, warning, information, and temporary sign usage; sign location schemes, layouts and dimensions; methods of installation and maintenance; the removal of undesirable roadside field signing;
- application of roadway delineation: lane, stop bar and edge line pavement markings; roadside delineators and snow plow markers;
- roadway maintenance policy and procedures: removal of accumulated debris (particularly at intersections); shoulder rutting and edge of pavement dropoff; pavement cracking, rutting and heaving; pavement skid resistance;
- roadside hazards: program of roadside hazard identification, hazard protection through the application of guide rail or hazard removal;
- quantity and quality of traffic volume information: vehicle volumes (Average Annual Daily Traffic, Design Hourly Volume, 24 hour counts); traffic characteristics (truck percentages pedestrians, bicycles, etc.); pattern type; variations from roadway type classification (local, collector or arterial); future volumes and growth rates; roadside land use development and site impact analysis, and
- roadway operations: standing, stopping and parking controls; on-street versus off-street parking; recurring areas of congestion; operating speeds versus posted speeds; collision analysis (number, type, severity, location, contributing factors, statistical comparisons); unusual temporary or permanent conditions (ferry docks, stadiums, special events, flea markets, hotels, bars, etc.).

The study undertaken should also include recommendations of remedial improvements or physical changes in response to identified problems.

6.4 REFERENCES

1. *Traffic Engineering Handbook, Fourth Edition*, Institute of Transportation Engineers, 1991.
2. *Procedural Guides for Highway Safety Evaluation*, available from the U.S. Federal Highway Administration.
3. *Manual of Uniform Traffic Control Devices for Ontario*, Ministry of Transportation Ontario.
4. Institute of Transportation Engineers, Publications Catalogue, selected references on traffic safety.
5. *Manual of Uniform Traffic Control Devices (Canada)*, Transportation Association of Canada.

7.0 TRAFFIC OPERATIONS STUDIES

7.1 OBJECTIVE

Traffic operations studies develop a combination of traffic operational improvements to improve the efficiency of the street network and the effective movement of people. When systematically applied within an established plan and schedule, benefits include: improvements in traffic flow, reduction of accidents and energy conservation. Recommendations are normally implemented over three to five years.

Studies of new routes and/or links with recommendations that are likely to span a longer time period are typically called transportation planning studies.

The need for a traffic operation study is typified by deteriorating traffic conditions, including: an increased number of accidents, a change in the type of accidents occurring, poor traffic flow, increasing periods of traffic congestion and changing demands for traffic movements or parking.

7.2 STUDY CONSIDERATIONS

Consideration should be given to:

- present adequacy of the street network in terms of: surface condition (need for repair), traffic volumes and capacity (mainline and major intersections) based on existing traffic volumes and five year projections, if required;
- functional classification of roads and their ability to serve these needs;
- need for such traffic data as traffic volumes (peak-hour and off-peak), vehicle occupancy, trip generation and attraction, turning movements, operating speeds, roadway speed and delay profiles, pedestrian movements, transit movements, parking inventory and turnover, illegal parking location and duration;
- identification of existing deficiencies or such problem areas as narrow bridges, at-grade railroad crossings, critical curves, grades, etc.;
- identification of accident-prone locations and an assessment of the corrective measures required to reduce or eliminate hazardous situations;
- parking requirements of the commercial area and the impact of prohibiting on-street parking in commercial areas and on major thoroughfares;
- identification of road improvements that would be beneficial to traffic flow, including: intersection improvements (widening of lanes, channelization, addition of turning lanes, adjustments to curb radii), the provision of pedestrian crossing facilities and the elimination of "jogs" in the road;
- review of existing traffic control devices, with detailed proposals for the installation, upgrading or removal of signs, traffic signals and equipment, pedestrian crossovers and pavement markings, including a review of signal timing plans and signal progression;
- review of other mechanisms for improving the efficiency of the transportation network such as revised parking regulations, enforcement, transit stop locations and transit routing, plus goods movement strategies including delivery schedules and loading facilities, and
- development of a traffic improvement plan, indicating the extent, estimated cost and priority of the improvements recommended. The operational improvements should make optimal use of the existing street network for the movement of people. Estimated person-time savings and energy savings should be outlined. A commentary on the municipality's organization and staffing, in relation to their ability to undertake the implementation, operation and maintenance of the improvement plan should be included.

7.3 REFERENCES

1. *Transportation and Traffic Engineering Handbook, Second Edition,* Institute of Transportation Engineers, 1982.
2. *Manual of Traffic Engineering Studies, Fourth Edition,* Institute of Transportation Engineers, 1976.
3. Highway Capacity, Ministry of Transportation Ontario, seminar notes.
4. *Canadian Capacity Guide for Signalized Intersections, First Edition,* February 1984 (Second Printing with Revisions, August 1985) Institute of Transportation Engineers, District 7.
5. *Manual of Uniform Traffic Control Devices for Ontario*, Ministry of Transportation Ontario.
6. Institute of Transportation Engineers, Publications Catalogue, selected references on traffic operations and control.

8.0 PARKING

8.1 OBJECTIVE

Providing and effectively managing parking is essential to the functioning of individual develop-

ments, as well as to various areas in towns and cities. Parking policies and regulations ensure that appropriate parking is provided and maintained. Some key objectives include:

- regulated on-street parking allowing movement of traffic, protection of residential amenities and maintenance of the street system;
- self-sufficient developments in suburban retail and commercial areas to eliminate parking on major streets;
- parking availability in downtown areas to foster an active business environment;
- the promotion of modal split objectives to produce the desired urban form, thereby identifying appropriate parking levels, and
- a rate structure for parking in downtown areas to address short- and long-term parking pricing/supply-demand relationships.

8.2 STUDY CONSIDERATION

Parking Studies should make a realistic assessment of parking needs and policies. The following should be considered:

8.2.1 Inventory Studies

To determine the parking situation in a selected area, several studies are required. Engineers should establish the existing conditions through an inventory of spaces. Usage and turnover studies will give the number of vehicles parking, the length of stay and the number of different vehicles parked in the same location.

8.2.2 Development Studies

Parking requirement studies of proposed developments are essential to land use considerations. They should be specific to the development and recognize the development's location

8.2.3 Zoning Studies

Parking is a primary component of the zoning process. At this stage, parking requirements are evaluated with respect to the zoning of surrounding developments and parking facilities.

8.2.4 Comparative Planning Studies

When planning for a larger area, a parking study must be a part of tile plan so that the supply of parking can meet both demand and transit modal split objectives.

8.3 PARKING POLICIES

Parking policies should be part of the overall development strategy. For some developments, it may be necessary to provide parking on an area or some other basis. Consequently a "cash in lieu" policy may be appropriate. Another means of financing parking is to consider the benefit that public parking would provide to an area, and thus set tip a fee schedule–a "benefit assessment policy." This would consolidate the parking facilities in an area. Other policies must ensure the viability of a certain area or for another specific reason.

8.4 REFERENCES

Institute of Transportation Engineers, Publications Catalogue, selected references on parking design, operations and planning.

9.0 TRANSIT STUDIES

9.1 OBJECTIVE

A transit study typically addresses two major objectives:

- assessment of the need for a transit service and the manner in which it is to be established, and
- review of the effectiveness and efficiency of an existing transit service to determine the need for service changes, improvements or expansion.

9.2 IDENTIFICATION OF THE NEED FOR A STUDY

Investigating the need for a transit service usually arises in a municipality when growth approaches a critical point. Alternatively, transit service may be used to support desired growth in an area. There may be a desire to include transit service as part of the official plan. This results in a requirement to develop, evaluate and recommend options for addressing the role that transit service will play in the future urban mobility requirements.

A study may assess concerns about an existing transit service: its physical characteristics, operational procedures and management. The need for such a study may arise from changes in jurisdictional boundaries, land use plans or service/mobility policy.

9.3 STUDY CONSIDERATIONS

Consideration should be given to:

- transit service's role in a municipality's long-term plans;
- potential demand and demand variations for transit service in view of existing and future municipal development;
- routes, schedules, level of service (stop spacing, route coverage, maximum headways) and type of service to be provided (basic, peak or special service, service for people with physical disabilities, service to key employment or recreation centres or special events, commuter service, express service);
- integration of local, express and transit services provided by adjacent municipalities (including regional/provincial services);
- integration of transit service with land use, the road network, and other facilities (bicycle and pedestrian paths);
- location and design of stations/terminals;
- maintenance practices, policies, service facility requirements and the location of transit service maintenance facilities;
- fare structures, productivity and performance, and
- organization and staffing requirements;

Note: For more information, contact the Transit Office, Ministry of Transportation Ontario.

9.4 REFERENCES

1. Various planning and design guidelines, available from the Transit Office, Ministry of Transportation Ontario.
2. *Transportation and Traffic Engineering Handbook, Second Edition,* Institute of Transportation Engineers, 1982.
3. Institute of Transportation Engineers, Publications Catalogue, selected references on transit design, transit operations and transit planning.
4. *Canadian Transit Handbook,* Canadian Urban Transit Association and Transportation Association of Canada, 1990.
5. *Guide to Transit Considerations in the Subdivision Design and Approval Process*, Transportation Association of Canada, 1990.
6. *Transit Supportive Land Use Planning Guidelines*, Ministry of Transportation Ontario and Ministry of Municipal Affairs Ontario, April 1992.

10.0 TRAFFIC MANAGEMENT MEASURES TO REDUCE ENERGY CONSUMPTION

10.1 OBJECTIVE

Engineers should develop, evaluate, implement and monitor traffic management measures to reduce energy consumption and improve air quality.

Opportunities typically exist by improving the operating efficiency of a municipal transportation system. Each municipality should undertake a review of its own requirements so that a rational and comprehensive program of energy conservation can be established.

10.2 STUDY CONSIDERATIONS

Consideration should he given to:

- traffic operations: such physical and geometric alterations to the infrastructure as roadway widening, high occupancy vehicle lanes, turning lanes, turning movements and lane use restrictions, reversible lanes, pedestrian malls, bus bays, etc.;
- traffic control: the application of such traffic control strategies as the elimination of unnecessary traffic control devices (all-way stops, yield versus stop signs, unwarranted signals or pedestrian crossovers, etc.), improved signal timing, signal coordination, nonactuated versus actuated signals, etc.;
- parking management: the application of such parking control strategies as on-street versus off-street parking, standing, stopping, and parking controls, location of loading zones, etc., and
- other measures: such specific strategies not applicable to all municipalities as freeway ramp metering, transit preemption of signals, transit priority at signals, vehicle access restrictions to urban zones, etc. Such strategic issues as the compactness of the urban form and the distribution of population and employment centres could also be reviewed.

Note: Ontario's ministries of Environment and Energy and Transportation have prepared a Transportation Energy Analysis Manual (TEAM) that guides municipal decision makers and transportation professionals to reduce energy consumption and improve air quality within their municipalities. For more information, contact the Transportation Energy Management Program (TEMP) office, Ministry of Transportation Ontario.

10.3 REFERENCES

1. *Transportation Energy Analysis Manual* (TEAM), the Transportation Energy Management Program (TEMP), Ministry of Transportation Ontario.
2. *Traffic Management Measures to Reduce Energy Consumption,* the Transportation Energy Management Program (TEMP), Ministry of Transportation Ontario.
3. *Traffic Engineering and Energy–Curriculum for Municipal Training Courses,* the Transportation Energy Management Program (TEMP), Ministry of Transportation Ontario.
4. Institute of Transportation Engineers, Publications Catalogue, selected references on energy and the environment.

11.0 TRANSPORTATION SOCIAL PLANNING STUDY

11.1 OBJECTIVES

A social planning study evaluates a transportation option, taking into account both social benefits and impacts. Social benefits are the public's increased opportunities for more efficient movement (e.g. improved service). This benefit is a function of improved accessibility and mobility, which can limit an individual's freedom. That is, a transportation facility must not only be readily available for use, but the public must also have the ability to use the facility. Accessibility represents the ease with

which different locations may be reached and may be dependent upon the public's knowledge of transportation opportunities available. Socio-economic characteristics such as psychological make-up, income level, stage in life and physical condition determine individuals' ability to use the facility and thus, their mobility. Both these factors should be taken into account when planning a transportation facility.

A social impact of a transportation facility is defined as the negative consequences that may result to individuals or communities. These may include displacement and disruption effects from the transportation facility.

A social planning study is usually required for transportation projects where either a new facility is proposed or an existing facility is to be expanded/improved. It addresses the type of facility that would best serve the public and any potential negative consequences, with discussion on how negative impacts can be reduced or eliminated.

11.2 STUDY CONSIDERATIONS

A social planning study for transportation projects should consider:

- the social equity of the proposed facility (e.g., is the facility that is potentially negatively impacting a community also serving its transportation needs?);
- socio-economic characteristics of the intended users of the proposed facility;
- barriers to the use of the proposed transportation facility by the intended users;
- the willingness of the intended users to use the proposed transportation facility (e.g., does it require an attitude/behavioural change?);
- activity patterns for which the proposed facility will serve (e.g., is it work or community oriented?);
- how well the facility serves the user group's transportation needs;
- displacement and relocation of residents, commercial establishments and community/recreation features;
- barrier effects on social interaction within and between communities (e.g., effects on visiting patterns and neighbouring);
- disruption effects (e.g., noise and air pollution) to residents, commercial establishments and users of community/recreation features;
- barrier effects on businesses and community/recreation features (e.g., are clientele cut off?);
- safety (e.g., effects on the facility's users and non-users);
- effects (e.g., physiological and psychological changes that may result);
- environmental quality effects that could change people's enjoyment of their environment;
- land use changes in neighbourhoods/residential areas (e.g., commercial development may be promoted in an established residential area as a result of the facility);
- visual aesthetic impacts;
- change in character of a community (e.g., potential to influence a resident's satisfaction with the residents community and community image);
- change in community cohesion /structure (e.g., potential change in neighbourhood patterns and loss of resident attachment to place);
- compatibility with future plans (land use/development orientation) for the local area;
- change in satisfaction of community as a place to live;
- potential for economic impacts (e.g., employment, municipal finance, property values), and
- potential for incompatibility with community's future aspirations.

12.0 DEMAND MANAGEMENT

12.1 OBJECTIVE

To date, the primary emphasis in transportation systems planning and implementation efforts has been on the provision and maintenance of road and transit infrastructure and the improvement of the operational efficiency of transportation facilities and services (transportation systems management). However, demand management, which includes trip reduction, has been implicit in a supplementary role in many transportation and land use initiatives.

As space, funding and environmental constraints limit the ability of municipal governments to provide new or improved transportation facilities, demand management becomes more attractive as a partial solution to congestion on the transportation system.

By itself, demand management cannot be relied upon to satisfy the travel requirements associated with population and employment growth. It must be viewed as a supplement to expansion and improvement of the road and transit networks. It is, nonetheless, an important tool in achieving modal split objectives.

Many transportation planning efforts completed to date have assumed the status quo, or a continuation of past trends with respect to the various parameters that determine trip generation. These parameters include modal split, auto occupancy, trip frequency and timing. More recent efforts have focused on trying to change these basic parameters to reduce the number of automobile trips required to maintain necessary or desirable levels of personal mobility and accessibility.

12.2 STUDY CONSIDERATIONS

Possible policy directions or strategies include:

- consideration of demand management measures as an alternative or complementary to physical or operational improvements required to manage the transportation impacts of new developments and redevelopment;
- guidelines for site layout and design of new development and redevelopment that encourage and facilitate walking, cycling, and transit use as an alternative to travel by automobile;
- encouragement of area-wide demand management through appropriate policies in municipal official plans, secondary plans and transportation plans;
- encouragement and coordination or technical support for retroactive demand management through the formation of Transportation Management Associations (TMA), and
- investigation of special demand management initiatives such as ride-sharing promotions, auto-free zones, tolls, telecommuting, innovative work scheduling, etc.

Specific measures which might be pursued in the context of these policy directions or strategies include:

- subsidized transit use by employers or TMAs;
- preferred locations for transit stops;
- ride-sharing coordination;
- preferred parking for high occupancy vehicles;
- shuttle or community bus services;
- weather-protected pedestrian facilities;
- bicycle storage facilities;
- staggered work hours;
- compressed work weeks, and
- working at home.

13.0 SUSTAINABLE DEVELOPMENT

13.1 OBJECTIVE

The environment impacts our well-being both directly and indirectly. Directly, it provides life support with air, water and amenities. Indirectly, it provides natural resources, which in turn provide food, economic goods, services and employment. Sustainable development aims to enhance the quality of our life support systems and economic activities to meet our needs and those of future generations. The ultimate goal is a sustainable future where both the standard of living and our quality of life are enhanced, and where economic progress and prosperity can be achieved within a healthy environment.

The challenge is to bring the environment more into the mainstream of transportation planning for the future, so that we can take advantage of the opportunities that arise when addressing environmental concerns.

13.2 STUDY CONSIDERATIONS

The following principles of sustainable development should be considered:

- anticipation and prevention;
- full cost accounting;
- informed decision making;
- living off the interest;
- quality of development over quantity, and
- respect for nature and the rights of future generations.

Engineers may wish to implement directional changes to:

- develop sustainable land use policies that allow for growth and development while conserving and enhancing Canada's natural resource base;
- increase urban population densities;
- review the impacts of different growth patterns: sprawl vs. compact, centralized vs. decentralized, and their compatibility with sustainable development;
- reduce the need to travel through setting modal split objectives pursuing demand management and high occupancy strategies;
- increase the use and provision of public transit;
- introduce means to reduce the emissions of low level air pollutants;
- develop, adopt and market high efficiency end-use transportation technologies and techniques such as Intelligent Vehicle Highway Systems (IVHS);
- accelerate the diversification of local economies;
- increase public involvement and degree of local control over resource development decisions, and
- improve environmental education within and outside the formal education system.

13.3 REFERENCES

1. The Ontario Round Table on the Environment and the Economy.

2. *Modal Shift to Transit Study*, Canadian Urban Transit Association, 1992.

14.0 TRAFFIC SYSTEMS AUTOMATION STUDIES

14.1 OBJECTIVE

Traffic systems automation studies are conducted to optimize the use of computer systems for traffic engineering purposes.

The benefits of traffic management and engineering are widely recognized. In order to implement the various concepts, there is an increasing need to gather, sort, process, file, manipulate and assess vast quantities of data. Traffic engineering professionals, especially in the municipal sector, should know available computer systems, traffic analysis software, and how these could provide traffic management efficiencies.

A study may also be required to assess the status of traffic offices that have previously implemented automation, to determine appropriate future plans. Traffic operations centres should have an active program to review systems' effectiveness.

14.2 STUDY CONSIDERATIONS

Traffic engineering processes can be grouped into:

- administrative duties: human and financial resource management, project management and monitoring, work scheduling and coordination, records management, action item tracking, etc.;
- data management: data acquisition, editing, storage, access, and manipulation related to collisions, traffic characteristics, roadway network and geometrics, traffic control devices, street furniture, maintenance and traffic regulations;
- operations evaluation: traffic volumes, composition, occupancy, origins/destinations, growth expectations; types, severity and location of collisions; operating speeds versus speed zoning; intersection analysis (traffic control warrants, level of service, traffic signal timing and phasing, etc.), link analysis (traffic signal coordination and optimization, level of service, collision rates, etc.), network analysis (traffic signal network coordination, speed and delay, one way street use, and warrants for transit priority treatments);
- traffic signal system operation: the mobility objectives to be achieved through the traffic signal system, and the data requirements for input and use of automated traffic signal control equipment, which are typically stand-alone systems;
- the use of a structured systems analysis approach to review the business processes used for each of the four major areas noted above. This approach should be used to determine existing data/information flows, integration requirements with other areas, current applications of automation, potential areas for future automation, and related hardware/software needs;
- an assessment of the possibility of using systems, systems staff, and systems components available elsewhere in the municipal offices to avoid duplication and redundancy;
- an assessment of the application of available traffic engineering software and hardware products;
- the abilities of existing staff to operate and maintain computer systems, to determine training and staff or service acquisition needs, and
- the benefits and costs associated with automation.

14.3 REFERENCES

1. For automated traffic signal control studies, contact the District Office of the Ministry of Transportation Ontario.
2. Institute of Transportation Engineers, Publications Catalogue, selected references on traffic operations and control.

Prepared by:
Harold Anders, P.Eng., Ministry of Transportation Ontario
Paul Hill, P.Eng., M.M. Dillon Ltd.
John McGill, Borough of East York
Ivan Novak, P.Eng., General Motors of Canada
David Richardson, P.Eng., Marshall Macklin Monaghan Limited

Professional Engineers
Ontario

40 Sheppard Avenue West
Suite 101
Toronto, Ontario
M2N 6K9

Tel: 416 224-1100 or 1-800-339-3716
Fax: 416 224-8168 or 1-800-268-0496

Enforcement Hotline: 416 224-9528 Ext. 1444

Website: www.peo.on.ca