The movement of commodities in urban areas represents a complex process that is poorly understood. Although urban transportation planning has become a well-established, decision-making tool with clearly defined procedures and methodologies, the principal focus of most planning efforts has been concerned with the movement of persons and automobiles. Goals and objectives for urban transportation are usually stated to include both the movement of goods and persons, but while they may appear equal in rhetoric they are unequal in expended effort. In fact, very little is known about the movement of urban commodities and the effects of commodity flow on the urban environment. The study of urban commodity flow has been neglected by the transportation profession partly because goods movement is not an organized activity in a way similar to that of the movement of persons. Few records exist of the transactions and related movements of commodities within the city that are of uniform quality and useful in describing the dimensions of the problem.

The Conference on Urban Commodity Flow brought together a group of persons who have been involved in professional areas related to urban goods movement. Through a process consisting of formal papers, panel discussions, workshop sessions, and informal meetings for a period of 2 1/2 days of uninterrupted and intensive activity, the group developed a consensus concerning the issues involved in urban commodity flow and suggested a course of action that will create a better understanding of the urban commodity flow process and will result in improvements to the present means of transporting goods within cities. The stated goals of the conference were to (a) define the issues and alternatives involved in urban commodity movement, (b) synthesize and evaluate information already available relating to commodity flow, and (c) develop approaches to forecasting the demand for urban commodity flow.

In the course of the conference the attendees discussed many issues including the relationship between urban commodity flow and the environment; the impacts this relationship has on the urban community; and the effects of changes in the amount and type or urban freight facilities on the location of industry, on the growth of suburban shopping centers, and on residential locations. The attendees also considered how regulations, labor practices, and new technology will affect the volume and patterns of urban goods movement. The conference was a joint effort of the Canadian Ministry of Transport and the U.S. Department of Transportation.

This summary of the conference proceedings is divided into 5 sections. The first section discusses the various elements of the urban commodity flow problem, the second section discusses public policy issues and the role of government in urban commodity flow, the third section describes the data requirements for urban commodity flow, the fourth section discusses the implications of urban commodity flow on the transportation planning process, and the fifth section describes research and demonstration programs that are recommended. The many points developed by the conference attendees and summarized here are discussed in greater detail in the papers and workshop reports that follow in this Special Report.

THE URBAN COMMODITY FLOW PROBLEM

Urban commodity flow can be viewed as the result of human activity that occurs within a defined space. To maintain that activity requires that materials be imported
for consumption and processing and that manufactured goods be exported. In the process of importing and exporting commodities, an urban metabolism occurs. In the tri-state region in and around New York City, for example, it is estimated that each person annually accounts for 210 tons of fresh water, 7 tons of fuel, 4 tons of general freight, 1 ton of food, and 1 ton of disposable waste.

Intercity Versus Intracity Problems

The movements that are required to transport urban commodities are created by shipments between the urban area and external sources, distribution and deliveries within the urban area itself, and transfers at the interface between external flows and internal distribution systems. Commodities that move between cities and external sources are transported by truck, rail, air, water, and pipeline, usually in large quantities. Commodities that move within the urban area are transported almost entirely by truck. Accordingly, the most visible problem in urban commodity flow is the internal movement of goods by truck both at the terminal points where intercity shipments are transferred and in local pickup and delivery. Some commodity movements into and out of an urban area are concentrated, requiring large-capacity vehicles and special loading and unloading facilities. Internal commodity movements, on the other hand, are more widely scattered, difficult to predict, and utilize many specialized vehicles. Thus, intercity freight problems differ from intracity commodity flow problems because the truck is the exclusive urban mode of commodity transportation. However, intercity freight flows have an impact on urban commodity flow because freight terminals are located within cities and require large acreages in areas of high land values.

Externalities, Efficiency, and Impact

Urban commodity flow problems may be considered in 3 categories. These are problems dealing with externalities such as noise and air pollution; problems dealing with the efficiency and productivity of transporting commodities within an urban area such as reducing interference, consolidation, new technology, labor, and industrial management; and problems dealing with the impact of urban commodity flows on land use and urban development such as new town development and suburbanization. Furthermore, the urban commodity flow problem is an economic and social one created by inefficient transfer between modes and carriers, interference between freight and passenger vehicles, inefficient use of valuable land, and creation of undesirable environmental effects. The economic problem is to determine when resources may be used more efficiently such that the commodities required for consumption, processing, and manufacturing may be transported at lower internal, out-of-pocket, and time costs and with reductions in pollution, congestion, and noise. Quite clearly then, the urban commodity flow planning process should assess the implications of each transportation alternative for moving freight within an urban area, determine the costs and the benefits of each alternative, and advise decision-makers concerning the appropriate strategies for allocating resources for transportation-related activities and facilities.

PUBLIC POLICY AND THE ROLE OF GOVERNMENT

Almost all of the foreseeable improvements in urban goods transportation are within the present state of the art. However, the implementation of improvements will require incentives for testing and evaluating proposed programs and for creating a market for new urban commodity flow systems. Government plays a vital role in urban goods transportation by encouraging innovation in the application of new technology, regulating the transport industry, constructing highways, and enacting legislation that controls the use of urban space.

Provincial, State, and Local Interests

Although improvements in the technology of urban commodity flow are important, the extent to which urban goods transportation receives attention as part of the overall
urban transportation problem will depend on developments in public policy. The resolution of problems created by the internal movement of commodities can only be achieved through some unit of government that is larger than the typical local or city government. Historically these larger governmental units have not been concerned with urban commodity flow for several reasons: At the state and provincial level highway departments have been primarily responsible for highway construction and maintenance outside of urban areas; suburban areas of cities have been growing while central cities have been remaining at a constant level of population; a number of larger metropolitan areas extend across state lines, and there has been little coordination of effort as it relates to urban commodity flow; and individual cities have not had the capabilities to make comparative studies of how their transportation problems compare on a national scale with those of other cities. As a result, it is essential that emerging public policy directed toward urban growth and development include urban commodity flow as an explicit variable.

Coordination of National Transportation Policy

The formulation of transportation policy at a national level in the United States has been unsystematic and uncoordinated and has resulted in uneven approaches to various aspects of policy and programs. One example is the policy of the Interstate Commerce Commission concerning commercial zones and terminal areas; this policy should be reexamined. There should be greater flexibility through initiating actions that will embrace new and important traffic points by motor carriers and shippers to bring individual actions that often result in protracted proceedings. Suburbanization and the formation of large contiguous metropolitan regions create new conditions that require extensions by the Interstate Commerce Commission of commercial zones between 2 metropolitan areas, for example, Washington, D.C., and Baltimore, Maryland. If this were accomplished, motor carriers between these points would be free of economic regulations, and the Commission and other interested parties could observe the results of such operations to determine if there are benefits to the public under such conditions. An innovative action of this kind would furnish a test of economic efficiency in a limited area and would provide valuable information that would be useful for evaluation by other large metropolitan regions that have developed to the point where an intracorridor operation exists and the extension of the commercial zone boundaries is being considered.

Role of the Federal Government

The role of the U.S. Department of Transportation as it relates to urban commodity flow centers around the basic questions of whether the total urban system is being dealt with in a systematic way and whether federal policies and programs within the department are consistent with these objectives. An important aspect of these questions is the organization and responsibility for urban commodity flow within the department. One approach is the creation of a modal administrator for urban freight transportation whose primary function would be to focus on the many problems in urban commodity flow and to implement urban freight demonstration programs, technical studies, and capital grant programs.

DATA REQUIREMENTS

Urban commodity flow data are severely lacking. However, the gathering of data for data's sake alone is to be avoided, and data requirements should emerge from the needs of specific research projects and studies. As part of the ongoing transportation planning activities, information for commodities and vehicles should be collected at the national, provincial, state, and local levels; and the preparation of a data base of urban commodity flow should be coincident with urban commodity flow demonstration projects.

Organizing Existing Data

The knowledge that already exists concerning urban goods movement and its technology should be made available and included in research and other urban studies. To
begin with, an annotated bibliography of urban commodity flow studies should be compiled that indicates the specific contribution to knowledge that has been made. For example, one method of organizing the information and data sources is through a national institute of urban commodity flow that would act as a focal point and intermediary among government, industry, and the research community. In addition to acting as the depository for reference material and related data concerning urban commodity flow, the national institute could also be responsible for coordinating research and planning efforts. The contribution of industry in furnishing data concerning urban commodity flow should not be overlooked, and means should be developed whereby industry could keep records and furnish information concerning the flows of trucks and commodities within the city.

Classification of Commodity Flow Information

A suggested classification of urban commodity flow information for evaluation purposes combines vehicle type with the purpose for which the vehicle is being used. The categories include vehicles that pick up and deliver packaged goods primarily; bulk-haulage vehicles such as dumptrucks hauling sand, gravel, and construction material; single-product, special vehicles such as concrete trucks and tank trucks; service vehicles in which persons and goods are moved together; general cartage trucks that move manufactured goods, farm produce, and household furnishings; automobiles that transport goods; and trucks that transport people.

THE PLANNING PROCESS

The urban commodity flow planning process should be capable of evaluating the full range of consequences created by the various alternative plans for improving commodity movements. Present methods for urban transportation planning in the passenger transportation sector should be evaluated, and the focus of urban transportation planning should be broadened in order to provide inputs concerning the impact that urban commodity flow will have on the metropolitan region. Planning of intrametropolitan highway networks must include provisions for intraurban and interurban goods movement, and greater attention must be given to access of urban goods to the central city. The evaluation of changes in urban form and new developments in communications, which may potentially have an impact on urban goods movement, should include not only the effects on persons movement but also the effects changes in the freight system might likely have on development within cities.

Commodity Flow: An Element of the Urban Transportation Planning Process

The planning process for urban commodity flows should not be an afterthought consideration but should be viewed as a primary factor in the satisfaction of many urban needs. A reevaluation of the 1962 Federal-Aid Highway Act, which called for urban transportation planning of a comprehensive and coordinated nature, should include the subject of urban commodity flows and should determine how effective the planning process has been in achieving more balanced transportation as related to the interfaces between urban freight and urban passengers. Because urban commodity flows affect environmental factors, specialists involved in the transportation planning process should be in a position to assist elected officials in understanding the impacts that planning and urban commodity flow have on the environment.

A Forecasting Model System for Urban Commodity Flow

A framework that consists of 5 separate models is recommended for analyzing urban commodity flows. The models should be flexible in order to perform under varying specifications and thereby provide a variety of information useful to the agency or group studying a particular problem. The models could be considered as micro or macro descriptions of demand; that is, either they could focus on one commodity, one activity, or one building or they could represent an entire urban region and the commodity flows that occur between major industries and concentrations of activity. The
models should be adaptable either for short-term or for long-term perspectives; that is, they could either investigate and describe relationships valid for the present or predict what is to be expected in the future. The models could be either sequential or parallel; that is, either the output from one model could become the input for the next model, or the entire set of models could be solved simultaneously. The 5 models that are suggested include industry location, interindustry transactions, freight flow, means, and networks.

The industry location model defines the location of industry within the urban area and relates it to relevant variables such as location of labor market, rent, quality of transportation facilities, and other factors. The interindustry transaction model determines the outputs of various industries and the demand for commodities that are required from other industries, including the manner in which various industries within the urban area interact with each other. The flow model determines the magnitude of the desired commodity flow over the entire system by using the amount of commodity generation either at the industry level (micromodel) or at the traffic-zone level (macromodel) and the manner in which these units interact with each other. The means model allocates desired flows over the means for transporting commodities between industries or traffic zones. (Although this model is analogous to the modal-split formulation in urban passenger planning, the definition of a mode in urban commodity movement requires additional study and research because the primary vehicle for transmitting urban commodity flows is a truck and the description of the means for transporting commodities should include characteristics of service that reflect distinctions in truck characteristics and methods of handling various commodities.) The network model assigns the means to the transportation system and can be considered as analogous to traffic assignment in passenger transportation planning.

RESEARCH AND DEMONSTRATION PROGRAMS

To improve our knowledge of urban commodity flow and to use this knowledge to develop better transportation alternatives will require increased effort consisting of research, technical studies, data gathering, and investments in new facilities. An urban freight demonstration grant program should be implemented in order to test and evaluate various proposals, suggestions, and ideas for improving urban commodity flow. Without a demonstration program of this type it will be difficult to make generalizations concerning solutions that have merit and that are applicable to other cities. Improvements in commodity flow distribution will yield measurable gains. An estimate of the savings that might be achieved was prepared for the Canadian Ministry of Transport and indicates that streets and traffic improvements could yield an annual gain of approximately $90 per person, consolidation of terminal shipments and pickup-delivery operations could yield annual benefits of approximately $25 per person, improvements in shipping and receiving facilities could yield annual savings of approximately $10 per person, and improvements in commodity flow through new technology could result in annual benefits from $30 to $70 per person. These benefits are not cumulative but serve to indicate the order-of-magnitude savings that would result if greater attention were given to urban commodity flow problems.

Improving Commodity Flow: Short-Term and Long-Term Solutions

Short-term improvements could be attained by better management of the transportation used to move commodities by facility improvements for loading and unloading at warehouses and retail and other local distribution centers. The interference between commodity distribution activity and other urban activities can be reduced either by spatial separation or by temporal separation. Two solutions that have been suggested are evening deliveries and consolidation of commodity shipments. Temporal separation between commodity and passenger flows involves the rescheduling of the delivery of goods to evening or off-peak hours. Commodities are delivered to shops in late evening, requiring that the consignees either remain open to receive the goods or make special arrangements to have goods stored in secured containers. (An experiment of this type was tried in 1968 in London but was beset with many problems that tended to
increase the delivery costs over those experienced during the daytime period.) Con-
solidation of deliveries and provision of off-street loading facilities for trucking move-
ment appear to have a great deal of potential because buildings generally have insuf-
ficient space dedicated to loading and unloading of merchandise.

Long-term improvements in the means of transportation used to move goods in
urban areas could involve either adapting existing transportation facilities in urban
areas to the transport of commodities as well as passengers or supplementing existing
goods-movement facilities with new systems that will not interfere with surface trans-
portation modes. For example, adapting public transit or railroad systems for com-
modity flow, such as for the removal of trash to land fills in rural areas, has been
proposed. Questions that have been raised by planners to this alternative relate to
the volume of commodities that would be made available for transport, the freight de-
mands that could impose a high burden on already loaded facilities, the service to dis-
persed origins and destinations of commodity distribution, the additional physical facil-
ities and cost that would be required for adapting public systems, and the general un-
certainty concerning the practicality and acceptability of combining person and com-
modity movement. On the other hand, there are several significant advantages of using
public systems for commodity flow, including the availability of excess capacity during
off-peak hours and the potential for additional revenue. For these reasons, the long-
term alternative of using public transit systems to move commodities should be care-
fully considered. Careful evaluations would be required on an individual basis to de-
termine the feasibility of such an approach.

Suggested Programs for Improving Commodity Flow

Progress in urban commodity flow will be made in an incremental rather than in a
grandiose manner. Small strides in the process of improving goods movement added
up over many groups engaged in study, research, and implementation can make a large
impact over time. Programs that could be implemented to determine what early action
investments are possible to improve urban commodity flow are listed in the following
paragraphs.

The reduction of interference between trucks and automobiles through the consolida-
tion of routes and deliveries should be studied. The project could be implemented by
a test program in a pilot city using selected commodities and shipments to achieve con-
solidation. The pilot effort would also investigate whether techniques, such as cost
incentives, would induce shippers to consolidate truck deliveries.

Investigation of the application of after-hour delivery to stores and office buildings
should be made in order to determine if staggering deliveries would affect peak-hour
movement of persons and trucks and reduce urban congestion. The project would con-
sider the effect on employees who would be required to work off-hours, the desirability
and implications of such requirements, and the commodity and land use activities that
could effectively operate under such conditions.

Possibilities for physical separation between persons and goods movement should be
studied. Projects that are worthy of evaluation include designating streets for goods-
moving vehicles only; designating certain lanes for exclusive use of specified vehicles,
including trucks; specifying traffic control regulations that would favor urban goods
movement; separating pedestrians by using raised sidewalks and malls; and providing
off-street loading and unloading facilities within new buildings or in redesigned older
buildings.

Reduction in noise and air pollution created by urban commodity movement can be
achieved through existing technology, and study of the operating characteristics of pres-
ent facilities for moving goods should determine the best alternatives for reducing noise
and air pollution. Alternatives such as electric or propane power should be considered.

The efficiency and productivity of the truck-movement system could be improved by
the use of modern management techniques including industrial engineering methods and
improved material-handling procedures. This approach would encourage introduction
of new equipment, better maintenance of older equipment, and means for improved
equipment utilization.
Freight terminal location criteria and factors related to selecting terminal sites should be studied. The study should include terminal location factors from the operator's point of view, such as access to markets, employee availability, transportation-related requirements, and other needs. The study should consider the impact of terminals on adjoining land uses, including noise, pollution, congestion, and other environmental effects. Policy-related questions, including tax structure, zoning, and street facility programs, and possible multiple use of terminal areas should also be considered.

Terminal design and operating methods should be investigated. Included in this investigation would be all types of terminals, all modes, and all types of operation, including local cartage, retail store terminal operation, wholesale and distribution terminals, and intermodal terminals. The study would be industry-related and would assist in improving present terminal operations and future terminal design.

Consolidation of commodity shipments and joint terminal operations is a solution that has been suggested as a panacea for reducing congestion in cities caused by truck movements. The solution is more apparent than real. It is difficult to implement and to coordinate, and no successful joint terminal operations now exist. Accordingly, an area of research is to investigate the conditions necessary for creating a viable joint terminal operation, to develop criteria for locating a consolidated terminal, and to suggest possible tax and other incentives for inducing private carriers to participate in a consolidated or joint terminal venture.

Social costs of urban commodity movement should also be studied. Measurements of social costs associated with terminal and vehicle operations should be made to determine the costs of noise, air pollution, visual intrusions, safety hazards, impact of land values, delays to traffic and pedestrians, required additional pavement construction and maintenance, and other disruptions to the community.

A contribution to the knowledge of commodity flow patterns in urban areas would be made by the study of a small unit within the city such as a single commodity, a single commodity category, an activity center, a single office building, an industrial park, or other identifiable units that would be small enough in scale to understand, measure, and analyze. In addition, the study of urban commodity flow for several prototypical cities should be undertaken. To begin with, a city of moderate size should be selected where the problem of data gathering and analysis would be manageable and the urban commodity flow problems are undoubtedly not severe. These would be followed by studies in larger cities and other selected areas where problems exist and changes are under way.

Urban commodity flow demonstration projects should be implemented in selected cities that represent various sizes and types, have different rates of growth, and are located in different parts of the country. In this way similarities and differences in the characteristics of urban commodity flow movement will be identified.

Summary of Research Areas

In summary there are 5 areas of research, study, and demonstration that should be considered in urban commodity flow. These are investigations related to (a) near-term improvements using existing methods and technology, (b) long-range improvements using new technology, (c) investigations concerning the nature of urban commodity flow, (d) considerations of the impact of regulations, pricing policies, zoning, and other governmental actions that could influence the pattern of urban commodity flow, and (e) investigations concerning the social costs of urban commodity flow, such as congestion, noise, pollution, and accidents. The subject is an important one and should be given attention in the coming decades but will require that the Canadian Ministry of Transport and the U.S. Department of Transportation commit themselves to this important area of urban transportation. Only by the involvement of these agencies and their support of research and demonstration programs will the required information, knowledge, and understanding on the part of professionals concerned with urban transportation be obtained. Although industry, labor, and universities are each involved separately in the urban commodity flow problem, a coordinated effort involving support by the federal government will be required.