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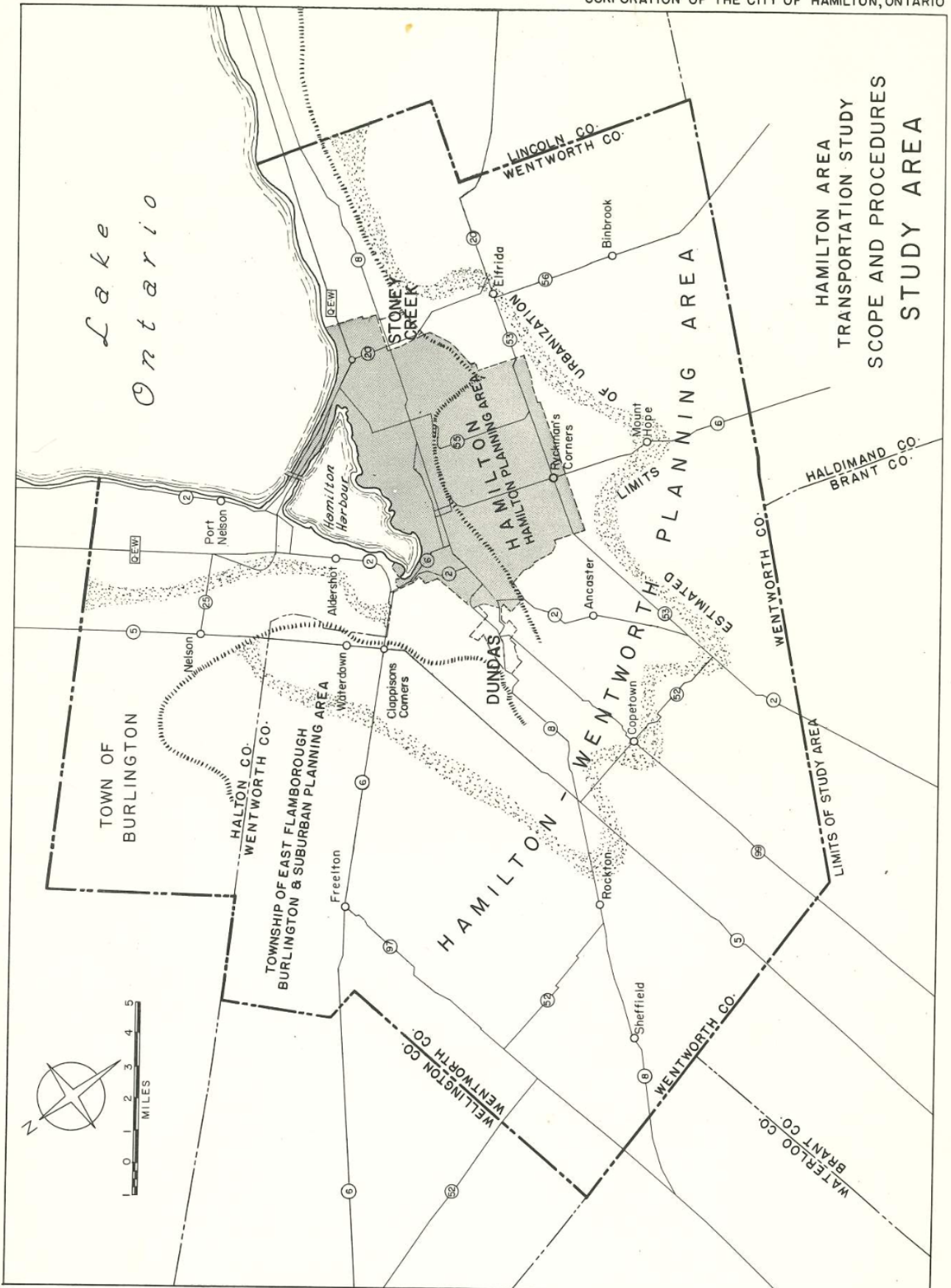
CORPORATION OF THE
CITY OF HAMILTON, ONTARIO

HAMILTON AREA
TRANSPORTATION STUDY

SCOPE AND PROCEDURES

This Volume

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HAMILTON AREA
TRANSPORTATION STUDY
SCOPE AND PROCEDURES
STUDY AREA

Fig. 1

CORPORATION OF THE
CITY OF HAMILTON, ONTARIO

**HAMILTON AREA
TRANSPORTATION STUDY**

SCOPE AND PROCEDURES

C. C. PARKER & PARSONS, BRINCKERHOFF LTD.
CONSULTING ENGINEERS
795 MAIN STREET WEST
HAMILTON, ONTARIO
CANADA

April 6, 1961.

His Worship Mayor Lloyd D. Jackson
and Board of Control of the City Council
Corporation of the City of Hamilton
City Hall,
Hamilton, Ontario

Gentlemen:

Our Agreement with the City of Hamilton dated October 14, 1960, provided for our services in the preparation of the Scope and Procedures for a comprehensive transportation study for the Hamilton Area. Working closely with the Technical Coordinating Committee for the Study and with the various interested agencies they represent, we have completed the Scope and Procedures phase and are pleased to present our Report.

The study plan presented will provide a factual basis for programming transportation improvements for the foreseeable future and provide an effective planning tool on a continuing basis which conveniently can accommodate unforeseen developments. It is a sound, practicable plan and is essential to the orderly development of the fast-growing Hamilton area.

For the comprehensive study, there are recommended newly-developed techniques through which the area planners and engineers can combine their separate but necessarily complementary skills in providing coordinated transportation. The resulting plan would be based on sound factual information with professional judgment. Needed transportation facilities of high priority would be indicated on the plan so that the responsible agencies may proceed with their early realization and so that other related developments may proceed without conflict.

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It is important to note now that the development of a transportation plan, and more importantly its successful implementation, is not an engineers' and planners' effort alone. The needed effort in the political, legal, legislative, fiscal, and public relations areas must be recognized at the outset.

The various individuals and agencies who participated in the development of this study plan have demonstrated a commendable degree of cooperation, ability, and foresight. We are pleased to be identified with this undertaking and look forward to participating in its successful accomplishment.

Very truly yours,

C. C. PARKER & PARSONS, BRINCKERHOFF LTD.

A handwritten signature in cursive script that reads "Alfred Hedefine".

Alfred Hedefine

ACKNOWLEDGEMENTS

The Scope and Procedures for the Hamilton Area Transportation Study were developed under the direction of the Technical Coordinating Committee with Mr. W. E. Ewens, Director of Traffic, City of Hamilton, as Chairman. Members of the Committee are:

Waldo A. Wheten	City Engineer	City of Hamilton
J. Thomas C. Waram	Planning Commissioner	City of Hamilton
Alan E. Argue	Acting Urban Studies Engr.	Department of Highways Ontario
John L. Vardon	Route Analysis Engineer	Department of Highways Ontario
Paul Pirie	Planning Director	Hamilton-Wentworth Planning Area Board
Norman Pearson	Planning Director	Town of Burlington Planning Department
W. H. H. Smith	Superintendent of Operations	Hamilton Street Railway

The Consulting Engineers participated in formal meetings of the full committee and in many discussions with the members and their staffs. Their willing assistance and understanding made this cooperative undertaking gratifying.

Many other agencies and individuals were consulted and provided helpful information. Among them are:

Metropolitan Toronto Coordinated Transportation Study Group

Hamilton Harbour Commissioners

Canadian National Railways

Oakville-Trafalgar Planning Board

Traffic Research Corporation, Ltd.

Mr. Alan M. Voorhees, Automotive Safety Foundation

Mr. William L. Mertz, Washington Regional Highway
Planning Committee

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SUMMARY

In this Report are presented the scope and procedures for a comprehensive urban transportation study for the Hamilton, Ontario, area. Included are highways, streets, transit, parking, and terminal facilities.

The objectives of the comprehensive study are to develop factual data on traffic and land use, formulate a feasible plan for meeting the needs for coordinated urban transportation through 1985, and to establish transportation planning for the area on a continuing basis.

The study area should consist of Wentworth County and the Town of Burlington, a total of 512 square miles with a population of 350,000. This study area covers completely three existing, cooperating planning areas and, for the purposes of the Census of Canada, is designated the Hamilton Metropolitan Area.

The Area's transportation problem arises from severe topographic restrictions and the inability of existing facilities to accommodate, in peak periods, the rapidly increasing traffic volumes.

Much existing data are relevant and useful in the comprehensive study. New data on traffic, land-use, and socio-economic characteristics will be developed.

A gravitational traffic model will be developed, together with a new limited home interview survey, to establish present and forecast travel patterns by origins and destinations and modes of travel. Electronic computers and other business machines will be employed.

Various transportation system plans will be formulated and tested considering traffic service, user and general benefits, and cost.

A recommended, balanced transportation plan will be presented with locations, types, and estimated cost of new facilities.

Priorities will be established for improvements to existing transportation facilities and for new facilities, including those presently considered and those additional facilities found in the study to be needed.

Feasible stage construction for larger projects will be indicated.

A general appraisal will be made of financing.

Methods will be suggested for establishing coordinated transportation planning on a continuing basis.

OBJECTIVES

For the past several years, the City of Hamilton has been concerned with a growing transportation problem. The need for developing a plan to cope with this problem has been recognized by City and Provincial officials and agencies. In 1960, the City of Hamilton selected C. C. Parker & Parsons, Brinckerhoff Ltd. as their consultants in conducting a study defining the objectives and scope as a first stage of a comprehensive urban transportation study.

This Report presents the findings of this first stage of the comprehensive study of urban transportation in the Hamilton, Ontario, area. The comprehensive study will be the basis for the expenditure of millions of dollars and considerable effort devoted to the development and construction of a safe, efficient transportation system. The transportation system, in turn, will be a major factor in the continued growth and economic well-being of the Hamilton area. With so much at stake, it is imperative that the comprehensive study be of high quality and of sufficient scope to assure sound planning. Such studies have been made for many cities in the past few years. They require the close coordination of many specialists, such as city planners, highway and traffic engineers, transit operators, and bridge and tunnel engineers. Some studies require a great amount of time and money. For example, \$2,450,000 has been appropriated for the Philadelphia-Camden Area study, which is expected to take three years to complete.

It was decided that the first stage of the transportation study for the Hamilton area should include a determination of the best study techniques at the least possible cost to achieve the required results. This scope and procedures study was undertaken to make such a determination.

The objectives of the Scope and Procedures study were to:

1. Establish the extent of the area to be included in the comprehensive transportation study.
2. Make a preliminary appraisal of the urban transportation problem of the area to ascertain its order of magnitude and the planning necessary to provide solutions.
3. Determine the basic data needed to provide a sound basis for transportation planning, what relevant existing data are useable, and what new data are required.

4. Select from among the currently-accepted techniques applied in other cities those which are best suited for the Hamilton area and which can be applied at minimum cost.
5. Present a recommended study program with estimates of cost and duration.

STUDY AREA

Extent

The planning of transportation facilities for the movement of people in the Hamilton area is considered to be one of the various elements in the total planning effort such as housing, water supply, schools, and recreation. It is desirable, therefore, from the standpoint of consistency and the practicability of accomplishing successfully the transportation planning effort and the implementation of the plan, that the area for transportation planning be the same as that in which these parallel elements are treated. In addition, it is commonly recognized that traffic and transportation problems are not limited by political boundaries. Transportation improvements made in the heart of a city very often have a pronounced influence on the travel habits of people living in the surrounding suburban and rural regions. Conversely, traffic by-passes constructed outside city limits can have an appreciable affect on the downtown street system.

By annexations, the City of Hamilton has revised its limits several times in recent years, but its continuously urbanized area even now overflows the extended city limits. The anticipated growth in the period covered by the transportation study extends well into Wentworth and Halton Counties. This urbanization is foreseen to be limited to the south, west, and north, but will merge with that of the Toronto area to form a strip city, or urban region, along Lake Ontario with Toronto and Hamilton as the principal centres. The opinion of the Technical Coordinating Committee is that the transportation study should cover that portion of this larger region in which Hamilton, in travel or transportation, has a stronger influence than Toronto. The limits of this area are shown in Fig. 1, the frontispiece to this Report. These limits contain in their entirety, the following three existing planning areas:

1. The Hamilton-Wentworth Planning Area, which includes all of Wentworth County except the Township of East Flamboro and the Village of Waterdown.
2. The Hamilton Planning Area, which covers the City of Hamilton only and is officially subsidiary to the Hamilton-Wentworth Planning Area.

3. The Burlington and Suburban Planning Area, which includes the Town of Burlington in Halton County and the Township of East Flamboro and the Village of Waterdown in Wentworth County.

The foregoing planning areas are legally constituted under the Planning Act, 1955, of the Statutes of Ontario, and have active planning boards and staffs. Each area is represented on the Technical Coordinating Committee for the transportation study.

Consideration was given to restricting the study to a lesser area than that covered by the three planning areas since they contain sections in which no urban transportation problems can be foreseen reasonably. This concept was rejected because the limits of this smaller area would not coincide conveniently with any recognized boundaries and would not be a unit with an official or legal status. A further advantage of the larger study area is that planning data and other statistical information for the three planning areas are already compiled and are more conveniently available. Maintaining transportation planning data on the necessary continuing basis would be more convenient and practicable for these areas than for some newly-contracted area. The study area is officially designated by the Dominion Bureau of Statistics as the Hamilton Metropolitan Area and will be covered as such in the 1961 Census of Canada.

The study area comprises a workable unit for area planning purposes in the larger Toronto-Hamilton Urban Region. At present, a continuing transportation study similar to that planned for Hamilton is being conducted in the Metropolitan Toronto Planning Area. This area extends west to the Peel-Halton County line. That portion between the Hamilton and Toronto transportation planning areas is the legally constituted and active Oakville-Trafalgar Planning Area; also suitable as a transportation planning unit.

It should be recognized that although the study area is fairly extensive, most of the effort of the comprehensive transportation study will be devoted to the urbanized portions. The limits of expected urbanization will be used to locate the external cordon line for roadside origin-destination interviewing. Limited home interviewing will be conducted only within the urbanized area, and most of the traffic counts, speed and delay runs, and other surveys will be made within the external cordon. The study will be confined to transportation improvements which are of area significance and which will be required by 1985. Improvements or projects of local concern only and not directly relating to area-wide problems will not be included. Similarly excluded will be those projects which are primarily of rural significance. Generally, projects included in the plan will be within the indicated limits of expected urbanization, though their effect throughout the entire study area will have been evaluated.

Description

The Hamilton area, as defined for transportation planning purposes and designated the study area, contain 512 square miles; 340 in the Hamilton-Wentworth Planning Area, 126 in the Burlington and Suburban Planning Area, 85 in the Town of Burlington, and 46 square miles in the City of Hamilton. The urbanized portions now contain about 60 square miles. The planning agencies estimate that this urbanization will increase by the year 1985 to cover about 160 square miles.

The location of the study area at the head of Lake Ontario makes it of strategic importance as a highway and rail transportation centre in the Golden Horseshoe region from Toronto to Niagara Falls and Buffalo, in the Province, and the Dominion. With an unusually large, completely protected harbour on Lake Ontario and the St. Lawrence Seaway, Hamilton is a fast-growing lake and ocean port.

The City is located in an area of equable climate, and is an important agricultural and trading centre with access to populous market areas. Hamilton is also the largest steel-producing centre in Canada, and the attendant manufacturing is extensive, varied, and expanding rapidly.

The population of the Hamilton area is now about 350,000 and is expected to reach about 528,000 in 1985.

One of the principal physiographic features of the area is the 300-foot high Niagara escarpment, which roughly parallels the shores of Hamilton Harbour at a distance of two or three miles. This barrier, with the resultant dissected terrain and the configuration of the shore, has caused distortions and restrictions in the growth of the city and has produced unusual transportation problems.

PRELIMINARY APPRAISAL OF THE URBAN TRANSPORTATION PROBLEM

Transportation Trends

In a preliminary appraisal of the transportation problem in the Hamilton area, some illustrations of transportation trends will demonstrate the reasons for the present problems, why these problems will grow, and why new problems will appear. For instance, there are now twice as many automobiles and trucks in the area as there were in 1950 and three times as many as there were in 1940. Not only are there more vehicles, but the use of each of these types of vehicles is increasing. The number of miles driven each year by the average automobile owner continues to rise steadily. Burlington Street in 1950 carried 7,750 vehicles in a 16-hour period. This same street carried 13,000 vehicles during a corresponding period in 1960. The Department of Highways of Ontario estimates that present traffic volumes in the Hamilton area will increase four-fold by 1982.

The growth of the use of the private automobile has reduced transit patronage in spite of population increases. The peak of transit use occurred during World War II as a result of increased wartime activity and the restricted use of private automobiles. However, the relative decline in transit use in recent years does not mean that public transportation is not a vital factor in urban development. As our urban centres grow larger and more complex, physical and economic restrictions will limit the use of the private automobile. Transit, therefore, with technological improvements, must play an increasingly important role.

Existing and Programmed Transportation Facilities

Highways. In the Hamilton Area, the arterial highway system consists principally of about 225 miles of King's Highways, 35 miles of which are within city limits. These primary highways are under the jurisdiction of the Province. The Queen Elizabeth Way, a controlled-access facility of advanced design when opened in 1940, is being converted to freeway standards. Other programmed freeways include the Chedoke Expressway through the west side of Hamilton and the connecting Freeman Cut-off through the Burlington area, which will be Route 403.

Streets. The street pattern of Hamilton is generally rectangular, but topographic barriers restrict arterial traffic to a few corridors which become overloaded and congested in peak hours. The application

of traffic engineering techniques and spot improvements in recent years has brought some relief. It is readily apparent that a continued and accelerated program of such remedial improvements is essential for needed accommodation of growing traffic volumes now and in the immediate future.

Transit. The transit system in the area consists principally of bus service on the streets and highways. Except for a few instances of specialized or local feeder nature, this service is provided by the Hamilton Street Railway Company and its subsidiary, the Canada Coach Lines Ltd. The Hamilton Street Railway Company operates 204 vehicles over 237 round-trip route miles, and the Canada Coach Lines Ltd. operates 88 vehicles over 372 round-trip route miles. In December 1960, the City of Hamilton purchased the system for operation by the Hamilton Transit Commission. No major improvements or extension of the system are presently programmed.

There is no rail rapid transit in the area and local service on the existing railroads is negligible.

Parking. The necessary restrictions on curb parking in recent years to accommodate the growing traffic volumes have reduced the supply of this traditionally convenient space, particularly along the principal arteries. At the last inventory in Hamilton, in 1960, there were 425 curb spaces in the Central Business District. More of this curb parking space will be lost because of the greater need for street space to accommodate moving vehicles. Much of the off-street parking space, about 3,400 spaces in the Central Business District at present, is on land which will be used to provide for the increasing demand for building space, thus reducing the supply of parking space and at the same time increasing the demand. Reasonable permanency of some of the off-street parking space is assured by municipal ownership and operation through the Hamilton Parking Authority of three facilities with about 1,000 spaces. The recently-opened City Market four-level parking garage is the first of that type to be constructed and operated by the Authority.

Transportation Planning

Transportation planning in the Hamilton area generally has been extensive and of good quality. Its extent is shown, in part, by the following list of reference material furnished for this study of scope and procedures.

1. Major Street System - Wilson & Bunnell, 1950
2. External Origin-Destination Survey-City & D. H. O., 1956

3. Traffic and Transportation Plan - Wilbur Smith, 1956.
4. Queen Elizabeth Way Connections and Chedoke Expressway - Parsons, Brinckerhoff, Hall & MacDonald, 1956.
5. Urban Renewal Study, 1958.
6. Urban Needs Study - D. H. O., 1958.
7. Parking Studies (2) - A. D. Margison & Associates, 1958.
8. The Hamilton Street Railway - Wilson, MacGillivray, Foulds, 1960.
9. A Highway Plan for the Hamilton-Wentworth Area - D. H. O., 1960.

There are several agencies in the Hamilton area directly concerned with transportation planning. Most of these agencies are represented on the Technical Coordinating Committee, whose membership was listed previously. Their activity and competence are commendable, and the efficient functioning of the Committee is an encouraging demonstration of the cooperative spirit essential to the realization of a sound transportation plan.

Of necessity, most of the past studies and much of the present work of the planning agencies are concerned with specific projects and not with the problems of the area as a whole. Even so, these efforts accomplished a great deal toward defining the transportation problem and pointing out possible solutions. The study made in 1960 by the Department of Highways of Ontario - "A Highway Plan for the Hamilton-Wentworth Area." for instance, indicates the need for:

1. Crosstown Expressway - in five or ten years.
2. Hamilton Ring Road - in ten or fifteen years.
3. North-South Expressway - in fifteen or twenty years.

In this same study it was also concluded:

"However, a comprehensive transportation study is the only way to obtain a full picture of the conditions and of possible solutions, and it is strongly recommended that one be carried out in the Metropolitan Area.

The preliminary appraisal of the urban transportation problem leads the Consultants to concur with the recommendations contained in many of these previous studies. Accordingly, it is considered that the comprehensive transportation study should in general:

1. Consider jointly highways, transit, and terminal facilities on a system basis rather than as isolated projects;
2. Integrate transportation planning with a comprehensive land-use plan;
3. Make engineering analyses to determine location, physical feasibility, and cost of the proposed improvements;
4. Evaluate proposed solutions and determine priorities for specific projects.

More specifically, the study would be concerned with:

1. Easing traffic bottlenecks caused by natural and man-made topographic barriers.
2. Obtaining maximum utility from existing facilities.
3. Integrating new facilities with existing facilities so that each, selectively, can provide the type of traffic service for which it is best suited.
4. Locating new facilities, such as freeways, to provide a high level of traffic service and other benefits with minimum damage to affected properties.
5. Achieving a reasonable and feasible balance between public and private transportation.
6. Providing sufficient terminal facilities.
7. Avoiding deterioration of established areas due to lack of transportation or parking.
8. Providing transportation service to newly-developing areas.

9. Determining priorities for the expenditure of foreseen revenues.

Although these urban transportation problems are to be found in many other metropolitan areas, they are never found in the same combinations. Generalizations about solutions are dangerous; there are no easy cures for urban transportation ills, and for some of the problems there may be no complete solutions. But it is evident and recognized that a sound attack on these problems cannot be made without a plan - a comprehensive plan based on facts and formulated with experienced judgment and foresight.

REQUIRED DATA

The comprehensive transportation study must rest upon a firm, factual foundation. The data needed to provide such a foundation are described in the manual, "Better Transportation for Your City - A Guide to the Factual Development of Urban Transportation," published by the National Committee on Urban Transportation. In this manual is summarized the experience of many cities which have developed transportation plans. The recommendations in the manual were followed generally, but some modifications were made to suit the specific needs of the Hamilton area.

As noted previously, transportation planning in the Hamilton area has been extensive and of good quality but not comprehensive in scope. The work presently underway by various agencies as part of their normal functions is also of high quality. The comprehensive transportation study will draw upon these past and present efforts as much as possible in order to reduce costs. It is anticipated that extensive use will be made of the existing inventory of land use and traffic-counting program. Some of the material contained in past studies, such as the roadside origin-destination interviews and transit-rider interviews, either will be updated or used as general background information.

A considerable amount of new data must be collected and analyzed in order to update existing information or because such data were not obtained previously. Included are speed and delay runs and limited home interviewing to determine travel habits. Details concerning the data which will be gathered from all sources and the uses of these data are described in a subsequent section of this Report.

EVALUATION OF TECHNIQUES

One of the major objectives of the Scope and Procedures Study was to determine the feasibility of the use of a "gravitational traffic model" rather than a conventional home interview survey to determine present travel habits. Studies made in a number of cities during the past few years have included successfully the use of a traffic model. A traffic model is a series of mathematical equations expressing the relationship between travel patterns and the land-use and socio-economic characteristics of the area. The major advantage of such a model is that it reduces considerably the cost of a comprehensive study. A further advantage is that such a model provides a continuing means with an electronic computer for evaluating the effect of a transportation system on future land use and vice-versa. While the use of traffic models is based on extensive and impressive research, they must still be used with caution since they are a relatively new approach to the transportation problem.

It was concluded that a traffic model could be used in the Hamilton area if a limited home interview survey were employed in its development, together with relevant data gathered from past studies.

THE RECOMMENDED TRANSPORTATION STUDY

General Procedures

The most essential aspects of this broad study are outlined as follows:

1. The present travel patterns are established; that is, a determination is made of where people are coming from and where they are going, when, how often, why, and what means of transportation they are using.
2. Since the transportation plan must be adequate for future as well as present traffic, the travel patterns are projected into the future by studying anticipated land use, population growth, and other factors.
3. The capacities of the present street and transit systems are calculated and are compared with the present needs.
4. Improvements in the existing transportation system are planned and the resulting increases in capacity are computed and compared with the future needs.
5. If the comparisons of needs with capacities has shown that additional capacity is required, alternative plans to provide this additional capacity are studied.
6. The more economical alternatives are combined to form a master transportation plan. This plan normally includes street improvements, new or improved highways, and improved transit service.
7. Priorities based on the urgency of needs are assigned to the projects included in the master plan. These priorities are then used to guide the expenditure of funds for new or improved facilities.

Specific Procedures

The specific procedures to be followed in conducting the 11 elements of the transportation study are outlined in the following pages. Many of these study elements are closely related, or even overlap, and will be carried out concurrently.

1. Present Traffic-Generating Characteristics

A By Consultants

1. Coordinate and guide the participating planning agencies in developing existing land-use inventory, population distribution, and employment data.
2. Divide study area into about 200 suitable traffic zones based on land-use and the arterial network.
3. Assemble pertinent traffic-generating characteristics data for each zone in a form suitable as input for the traffic model.

B By the Planning Agencies

1. Furnish the Consultants with an inventory of the existing land-use within the Study area.
2. Furnish sufficient information for the Consultants to determine for each of the traffic zones:
 - a. Resident population
 - b. Number of jobs of all kinds
 - c. Number of jobs in retailing
 - d. Predominant land-use or uses
 - e. Economic level of resident population
3. Furnish, if practicable, sufficient information to enable the Consultants to determine also for each zone:
 - a. Number of jobs in manufacturing and industry
 - b. Number of dwelling units
 - c. Retail floor space

C By the Department of Highways of Ontario

1. Arrange for the services of Motor List Company of Toronto (or equivalent) to provide motor vehicles registrations by zones within the internal study area.
2. Provide services of specialized consultants on traffic models as required to evaluate such data.

11. Limited Home Interview Survey

A. By Consultants

1. Make about 1,000 full interviews in a sample selection of representative zones, including the following:
 - a. Determine the appropriate standard sample size for each zone.
 - b. Select specific homes for interview.
 - c. Design and furnish questionnaires.
 - d. Prepare Coding Manual.
 - e. Code interviews.
 - f. Determine expansion factors.
2. Furnish detailed instructions for the machine work involved in expanding and tabulating the interviews. In general, the Consultants will work closely with the agencies responsible for the planning, programming, and operation of the electronic computer and accounting machines to be used throughout various phases of the study.

As nearly as practicable, this limited home interview survey will be conducted in accordance with the recommendations of the National Committee on Urban Transportation, modified only to meet the specific needs of the Hamilton area and the models employed.

B. By the City of Hamilton (based on technical specifications furnished by the Consultants)

1. Key punch and verify about 7,000 forty-column cards.
2. Expand the sample by means of a series of addition, subtractions, multiplication, and division operations on the content of the cards.
3. Sort the expanded cards and produce a deck of summary cards.
4. Sort the summary cards and print out various tables.
5. Arrange for public relations efforts to obtain public acceptance and cooperation.

111. Traffic Surveys

A. By Consultants

1. Make a minimum of six speed and delay runs in each direction during the off-peak and p. m. peak hours over approximately 120 miles of urban streets.
2. Summarize results of the runs to provide average operating speeds over all urban arterials and feeder streets.
3. Coordinate similar work by the Department of Highways of Ontario, who will furnish operating speeds on the King's Highways in the rural portions of the Study Area.
4. Expand and collate 16-hour turning movements counts at approximately 200 intersections furnished by the City of Hamilton.
5. Produce an A. D. T. flow chart for the Study Area, employing expansion factors from counts from continuous master stations operated by the D. H. O. and the City.
6. Expand and collate machine volume and turning movement counts made by the D. H. O. at about 20 locations in the Study Area outside the City of Hamilton.
7. Determine design hour volumes from daily and seasonal traffic trends and peak-hour relationships.
8. Make such additional traffic counts as may be needed at proposed interchange locations and special problem areas.
9. Gather from City and D. H. O. files an inventory of traffic control devices and accident records for the purpose of planning improvements.
10. Participate in planning the external cordon survey to be conducted by the D. H. O.
11. Collect and analyze sufficient data on truck and taxi operation to evaluate their role in Hamilton Area transportation.
12. Assess the role of railroads in serving commuter's needs.

B By the D. H. O.

1. Supply sufficient data to enable the Consultants to determine operating speeds on about 200 miles of King's Highway in rural portions of the Study Area. (It is estimated that six speed and delay runs in each direction during off-peak and

p. m. peak-hours over approximately 70 miles of highway will be required).

2. Supply sufficient data to enable the Consultants to construct a 24-hour ADT flow chart for about 200 miles of King's Highway in rural portions of the Study Area and for the arterial streets outside the City of Hamilton. (It is anticipated that the traffic study made in Burlington this past year by the D. H. O. will provide most of the data for this item and that the rural areas will require machine and/or manual counts at about 20 intersections in addition to counts taken at roadside interview stations).
3. Conduct roadside interviews with volume and peak-hour classification counts at external cordon stations on rural routes carrying an appreciable volume of traffic. (It is estimated that a maximum of 18 such stations will be required, with interviewing to be done in one direction for 16 Hours).
4. Expand, summarize, and tabulate the results of the roadside interviews.
5. Furnish the Consultants with, and assist in the interpretation and use of, physical inventory data, accident history, volume counts, inventory of traffic control devices, etc., contained in their files.

C. By the City of Hamilton

1. Schedule their normal traffic counting program to furnish volumes on screen lines and cordon as soon as possible. (No additional work beyond that already planned for normal traffic engineering needs is expected).
2. Furnish the Consultant with, and assist in the interpretation and use of, physical inventory data, inventory of traffic control devices, volume counts, accident history, etc., contained in their files.
3. Arrange for public relations efforts to obtain public acceptance and cooperation.

IV. Traffic Model Development

A. By Consultants

1. Develop a traffic model generally using the "Gravity Model" technique of Mr. Alan Voorhees, as described below, considering initially these six trip categories:
 - a. Through
 - b. Work
 - c. Social
 - d. Non-Home-Based
 - e. Shopping, Commercial, and all other
 - f. Truck
2. Treat through trips, since they are not a function of land use within the Study Area, as a separate category.
3. Assume through trips' growth rate will be determined by trends of population, motor vehicle mileage, and motor vehicle registration in the Province.
4. Analyze data from 1956 and 1961 external cordon surveys to check through-trip assumptions.
5. Similarly determine induced traffic on the Burlington Beach Skyway.
6. Analyze data from the limited home interview survey to determine correlations, percentage distributions, etc., and check these findings against results obtained in similar studies.
7. Determine relationship between labor force and total population for each zone using limited home interview data.
8. Adjust labor force, using curves derived from the home interview data, to account for transit riders and auto passengers.
9. Distribute the work trips using employment opportunities in each zone as the attraction and travel-time factors derived from the home interview data.
10. In a manner similar to that for work trips, determine quantity and distribution of other types of trips, using factors derived from the Hamilton home interview data. Factors from other similar studies will be used only when necessary.
11. Check model in three separate ways:
 - a. Comparing existing patterns as predicted by the model against those found in home interview and 1956 external survey conducted by the D. H. O.

- b. Compare summer 1960 shopping and work patterns as predicted by the model against those found in the Burlington home interview survey of that date.
 - c. Comparing traffic volumes as predicted by the model with those measured in the 1961 counts at screen lines.
12. Adjust model as required for trip volumes and patterns.
 13. Produce a final rectangular summary table of 24-hour origin-destination movements, through, into and within the Study Area.
 14. Assist D. H. O. in planning and preparing electronic computer programs for model application.

B By the D. H. O.

1. Develop, with the assistance of the Consultants, the required computer programs. (It is anticipated at this time that the programs will be similar to the "Gravity Model Distribution Program" written by the Computing Center of the Iowa State Highway Commission. This program was reported on by Mr. K. L. Heald at the 1961 Highway Research Board annual meeting in Washington, D. C.)
2. Provide computer time and E. A. M. services as needed.

V Forecast of Zonal Characteristics and O. D. Patterns

A By Consultants

1. Review and evaluate future land-use, population, and employment data developed by the planning agencies.
2. Project automobile ownership in each zone.
3. Study the inter-relationship of land use and highway access.
4. Prepare input factors for the traffic model, based on the forecast of zonal characteristics supplied by the planning agencies.
5. Utilize the traffic model to obtain future O. D. pattern.

6. Provide services of specialized consultants in land use as required.

B By the Planning Agencies

1. Estimate for each traffic zone the most probable 1985 values for each of the following:
 - a. Resident population
 - b. Number of jobs of all kinds
 - c. Number of jobs in retailing activities
 - d. Predominant land use or uses
 - e. Economic level of the resident population

C By the D. H. O.

1. Furnish computer time and E. A. M. Services as required.

VI Parking

A By Consultants

1. Determine present and future overall parking requirements of the Hamilton Area only to the extent that they affect the area transportation system.
2. Relate inventory data furnished by the City to present and future requirements to measure overall deficiencies.
3. Evaluate the effect of removing curb parking from all major arterials.
4. Develop general criteria or standards for needed parking facilities.

B By the City of Hamilton

1. Furnish the Consultant a copy of the data obtained from the CBD cordon counting and parking inventory study conducted by the City in 1961.

VII Transit

A By Consultants

1. Gather basic inventory data on present transit operations,

such as passenger volume, travel time, speed, service coverage, and frequency.

2. Develop a transit-rider O. D. table by means of the traffic model and the limited home interview survey.
3. Determine the present and future relative role of transit in the Hamilton Area.
4. Determine the need for rapid transit, taking into account the applicability of new methods and types of equipment.
5. Determine transit terminal requirements.
6. Consider express bus operation both on freeways and on exclusive transit lanes.

B By the City of Hamilton

1. Furnish basic inventory data on present transit operations, such as passenger volume, travel time, speed, service coverage, and frequency.

Much of the work relating to this study item will be accomplished under Item VIII, Definition of Problem and Evaluation of Alternate Plans.

VIII Definition of Problem and Evaluation of Alternate Plans

A By Consultants

1. Evaluate existing and proposed transportation systems by consideration of:
 - a. Volume-Capacity Relationships
 - b. Operating Speeds
 - c. Conformity to Travel Desire Lines
 - d. Accident Experience
 - e. Integration with Land Use.
2. Assist the D. H. O. in preparation of an electronic computer program to assign traffic to existing and proposed networks.
3. Evaluate the following general types of transportation systems:
 - a. Existing without improvements
 - b. Existing streets and highways with optimum improvements
 - c. Traffic engineering improvements to existing streets

and highways, assuming little or no improvement in the transit system

- d. Optimum improvements to streets, highways, and transit
- e. New Freeway System; existing transit
 - i. Alternate New Freeway System
 - ii. Second Alternate New Freeway system
- f. Type "e", with optimum transit improvements

4. Select a recommended plan for presentation considering:

- a. Capital Costs
- b. User Costs
- c. User Benefits
- d. Traffic Service
- e. Area Benefits
- f. Effect on Land Use

5. Determine design-hour volumes for the recommended Freeway System.

6. Determine needed freeway capacities and interchange location and types.

7. Determine capacities, deficiencies, and needed improvements for residual traffic on highways and arterial streets.

8. Suggest to planners possible land-use plan modifications to lower cost or raise traffic service of proposed transportation plan.

9. Re-assign traffic in accordance with any resulting practicable land-use plan modifications.

B. By the D. H. O.

1. Develop, with the assistance of the Consultant, computer programs for determining minimum path between zones and for traffic assignment.

2. Furnish computer time and E. A. M. services as required.

C. By the Planning Agencies

1. Assist the Consultant in evaluating the effect of alternate transportation plans on land use and general community objectives.

IX Priorities, Benefit-Cost Analysis, Financing

A By Consultants

1. Assign priorities to needed improvements or new facilities under the recommended transportation plan, based on:
 - a. Benefit-Cost Ratios
 - b. Traffic Service
 - c. Integration with Land Use
 - d. Construction Problems
 - e. Functional Integration of Projects or Stages with existing System and with other Related Improvements, such as Urban Redevelopment.
2. Evaluate traffic conditions at the various recommended stages of the construction program.
3. Consider means of financing the Recommended Plan, taking into account normally foreseen revenues.
4. Recommend a procedure to keep the Transportation Plan current as an effective continuing planning function.

X Delineation of Facilities and Cost Estimates

A By Consultants

1. Select design standards and criteria.
2. Gather all available, pertinent, and existing aerial photography, topographic maps and data, subsurface information, and any plans or route studies for proposed facilities.
3. Make a field reconnaissance of the area and in particular of the prospective routes.
4. Prepare preliminary plans and profiles of the routes and facilities studied only in sufficient detail to determine physical and functional feasibility and to estimate construction costs for comparative and programming purposes. This material will be made available to the clients.

5. Indicate approximate right-of-way lines.
6. Estimate operating and maintenance costs.

B. By the City of Hamilton

1. Furnish to the Consultants all pertinent, available, and existing aerial photography, topographic maps and data, subsurface information, and any plans or route studies for proposed transportation or related facilities.
2. Supply estimated right-of-way costs with sufficient accuracy for estimating purposes.
3. Furnish design standards and criteria and typical structure designs.
4. Furnish unit construction costs.

XI. Report Preparation, Printing, and Presentation

A By Consultants

1. Attend periodic meeting of the Technical Coordinating Committee and to make such interim presentations and progress reports as required.
2. Prepare a printed, bound, well-illustrated report.
3. Furnish copies of background and supporting material not included in the report.
4. Make a reasonable number of private or public appearances for a period not to exceed three months after the Report submission to assist in obtaining adoption and implementation of the Transportation Plan.



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