AVIATION FACILITIES AND ACTIVITIES STUDY

TRI-COUNTY REGIONAL PLANNING COMMISSION • Lansing, Michigan

LAND USE-NATURAL RESOURCE-TRANSPORTATION STUDY

AVIATION FACILITIES AND ACTIVITIES STUDY

April, 1968

Cooperating Agencies:

City of Lansing
City of East Lansing
Michigan State University
Eaton County Road Commission
Clinton County Road Commission
Ingham County Road Commission
Michigan Department of State Highways
Tri-County Regional Planning Commission

The preparation of this report was financially aided through a Federal grant from the Urban Renewal Administration of the Department of Housing and Urban Development, under the Urban Planning Assistance Program authorized by Section 701 of the Housing Act of 1954, as amended.

Tri-County Regional Planning Commission
535 N. Clippert Street - Lansing, Michigan 48912

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF MAPS

INTRODUCTION

More than sixty years have elapsed since the first flight of an airplane at Kitty Hawk. In these few years air transportation has developed beyond the wildest dreams of its inventors. It has literally revolutionized warfare, improved communications both within and between nations, speeded the flow of people and goods and brought distant points of the world within hours of each other. Once a means of travel for a select group of people, it is now within the range of the average income person.

Not content to stand still, the future impact of air transportation appears even greater. Recent technological innovations promise an even more rapid movement of increasing numbers of people and goods at a lower cost resulting in more competition with other forms of transportation.

For a nation whose transportation needs are expanding rapidly and for the American people who are experiencing more congestion on the streets and highways each year, air transportation promises to serve a vital role as a part of the total transportation network. In addition to serving as an increasingly important link in the transportation system, the airplane has assumed a relatively new role. Due to higher incomes and increased leisure time, air travel for pleasure has achieved a level of use heretofore unknown.

The purpose of this study is twofold. One is to formulate a suggested set of goals and policies which will serve as guidelines in meeting future aviation needs. The other is to determine suggested generalized locations for future airports in the Tri-County Region using these aviation goals and policies as a framework. In achieving these purposes the procedures enumerated below have been followed.

1. Assess present aviation activity.

2. Review aviation trends and projections.

3. Determine present aviation problems and anticipate future problems.

4. Formulate locational goals and policies which will realistically relate aviation facilities to the other elements of the Region's transportation system and integrate aviation facilities with the future land use configuration of the Region.

5. Determine the generalized location of future aviation facilities in the Tri-County Region.

6. Speculate regarding the effect of technology on the future of aviation in relation to other elements of the transportation system.

Each of these items is developed in a separate chapter in this report.

It is hoped that this report will serve as a basis to design a more detailed regional airport plan which can be readily implemented. In developing this more detailed plan, several meetings are envisioned with those agencies and individuals concerned with airport location, design and operation. In preparing this aviation report, a note of thanks is extended to the Michigan Aeronautics Commission for providing the bulk of the data presented in the report and assisting in determining the various projections.

SUMMARY AND RECOMMENDATIONS

Several significant findings were determined during the course of the airport study and, based on these findings, some recommendations have been made. The purpose of this chapter is to highlight these findings and recommendations.

Summary

General aviation is assuming an increasingly significant role in air transportation. While commercial airline aviation (scheduled airline passenger, cargo and mail services) has dominated the air travel scene in the past, general aviation is being used more and more for business and pleasure flying. Excluding military, general aviation accounted for 97% of all aircraft, 79% of all flying hours, and 66% of all miles flown in 1965. In addition, according to the Federal Aviation Administration, there were 9,566 airports in the nation in 1966 of which 8,734 or 91% were serving only general aviation.

The aviation situation in the Tri-County Region is similar to the national picture. The Region is served by twelve airports which have been classified by the Michigan Aeronautics Commission. Of these, eleven (92%) serve only general aviation and the twelfth, Capital City Airport, serves both general and commercial airline aviation. In addition, approximately 56% of the 262 registered general aviation aircraft, based at these twelve classified airports and several unclassified private airstrips located in the Tri-County Region, are owned by businesses. However, in actual number of hours flown, business and personal use are nearly equal.

Since 1960, registered general aviation aircraft based in the Region have increased by 94%, from 135 to 262, which is well above the national average. By 1975, an estimated 470 general aviation aircraft will be based in the Region and, by 1990, the figure will probably reach 840. These figures were determined jointly by the Michigan Aeronautics Commission and the Tri-County Regional Planning Commission. Other figures regarding airport take-off and landing operations, air passengers, air cargo, and air mail indicate similar significant increases in the future.

Several problems regarding aviation face the Region both now and in the future. One is the difficulty of preserving desired airport lands. The pressures of urban expansion often threatens the continued existence of privately-owned airports. Three of the twelve classified airports located in the Tri-County Region (Capital City, Fitch H. Beach and Abrams Municipal) are publicly-owned. The remainder are privately-owned. A second problem is lack of adequate funds to improve or expand present aviation facilities. This problem, particularly, plagues the private airport owner. Failure to view airport planning in a comprehensive manner is a third problem. Art Davis and Abrams Municipal airports are located in the flight pattern of Capital City Airport, thus presenting a potential safety hazard to the adequate air traffic control of all three airports. Adequately satisfying future commercial airline and general aviation demands will require the development of general aviation airports at various locations in the Tri-County Region, as well as improving Capital City Airport facilities.

Recommendations

The Lansing Tri-County Region should approach satsifying air transportation needs in a comprehensive manner. To facilitate such an approach, goals have been formulated, policies defined and a development plan designed. The following goals have been formulated.

1. To design and locate airports so that they will both serve and shape future land use patterns.

2. To develop a regional air transportation design concept integrated with other transportation system components in order to provide an efficient and balanced transportation system for the Region.

A number of policies have been suggested to serve as guidelines in achieving these goals. The goals and policies constitute the airport policy plan.

The airport development plan attempts to translate the policy plan into a physical arrangement of public and private airports. The development plan includes the following elements.

1. Certain existing publicly and privately-owned airports should be improved.

2. New publicly-owned airports should be established before 1990 in the Webberville-Williamston area, Delhi-Alaiedon Township area, and St. Johns area.

3. A fourth new publicly-owned airport is being established by the State of Michigan in Windsor Township.

4. The need for relocating Abrams Municipal and Art Davis airports should be studied.

It is estimated that 12% of the predicted 1990 general aviation aircraft will be based at the three new airports, excluding the State-operated airport, while less than 37% will be based at Capital City Airport.

In view of the existing and future aviation needs confronting the Tri-County Region, it is imperative that appropriate and timely action be taken by responsible citizens and agencies to adequately satisfy these needs. It is hoped that the suggested airport policy and development plans, contained in this report, will assist in achieving this objective.

CHAPTER I

INVENTORY OF PRESENT AVIATION ACTIVITY

Aviation within the Tri-County Region is commonly classified as commercial and general aviation. A third classification is military aviation, however no information is available for this category. Commercial aviation is what enters the public's mind when they think of air transportation. This category includes scheduled airline passengers, cargo and mail services. General aviation includes all air traffic with the exception of military and scheduled airlines. This activity encompasses business, charter, industrial and pleasure flying. Traditionally, general aviation has been an overlooked segment of aviation, however its impact on the Tri-County Region and the activity generated by it exceeds that of commercial airlines.

The importance of general aviation within the total air transportation system is indicated by information presented in the Federal Aviation Administration's, "Statistical Handbook of Aviation." This publication stated that 9,566 airports existed in the nation in 1966, of which 8,734 or 91% were serving only general aviation. Excluding military, general aviation accounted for 97% of all aircraft, 79% of all flying hours and 66% of all miles flown in 1965.

The Tri-County Region is presently served by 19 airports varying in size from small private airstrips with one plane to major facilities with 31 to 141 aircraft. With one exception, all of the Region's airports serve general aviation exclusively.

Twelve of the airports are classified according to the standards of the Michigan Aeronautics Commission. The remaining seven facilities are landing fields which do not meet the minimum standards established by the Commission. Information about, and the location of, each classified airport is presented in Figure 1. Map 1 shows the geographical location of these classified airports within the Region.

Three airports in the Region are owned by the public. Capital City Airport is owned by the State of Michigan, while Beach and Abrams are owned by local governmental units. Together these airports base 73% of the registered aircraft in the Region. Also, they are the only airports which have runways adequate to enable multi-engine aircraft to takeoff and land. Capital City and Beach Airports are open the entire year. Abrams Airport is open during most of the year, however turf runways cause it to be closed during certain periods in the spring. In addition, Capital City is the only airport with an instrument landing system for use in inclement weather conditions.

At present there are 262 registered general aviation aircraft based at the 19 airports in the Region. Approximately 56% of these planes are owned by businesses. However, in reported number of hours flown, business and personal use are nearly equal. Included in the 262 aircraft are 30 multi-engine planes, all owned by businesses. Twenty-eight of these aircraft are based at Capital City Airport. Capital City Airport accommodates 72% of the total number of business-owned planes based in the Region.

FIGURE 1

CLASSIFIED AIRPORTS IN THE TRI-COUNTY REGION, 1968

Area	Ownership	Field	MAC Class	Service Type	Longest Runway	Runway Surface	Lights	Radio Facilities	Aviation Fuel	Service Repairs Major	Repairs Minor
Clinton County											
Bath Twp.	Private	University Airpark	E	---	WSW-ENE 2300	Turf	No	No	No	No	No
Grand Ledge	Private	Pohl's Airpark	E	---	E-W2000	Turf	No	No	No	No	No
Grand Ledge	Public	Abrams Municipal	A	Secondary	E-W2800	Turf	No	No	Yes	No	Yes
E. Lansing	Private	Art Davis	A	Personal	E-W2600	Turf	Yes	Yes	Yes	Yes	Yes
Lansing	Public	Capital City	A	Express	E-W6500	Bit-Conc	Yes	Yes	Yes	Yes	Yes
St. Johns	Private	Archer Field	E	---	N-S1750	Turf	No	No	No	No	No
St. Johns	Private	Dickinson	E	---	E-W2100	Turf	No	Yes	No	No	No
Eaton County											
Charlotte	Public	Fitch H. Beach	A	Secondary	NNE-SSW 3000	Bit	Yes	Yes	Yes	No	Yes
Eaton Rapids	Private	Maple Air Manor	E	---	E-W3800	Turf	No	No	No	No	No
Eaton Rapids	Private	Skyway Estates	E	---	E-W2635	Turf	No	No	No	No	No
Vermontville	Private	Gehman	E	---	E-W2100	Turf	No	No	No	No	No
Ingham County											
Mason	Private	Jewett	E	Personal	E-W2200	Turf	No	No	Yes	No	No

NOTE:

"MAC Class" refers to the classification of airports as defined in the Rules and Regulations of the Michigan Aeronautics Commission and is not to be confused with FAA terms.

"A" - Licensed Airport-meeting all minimum standards for facilities and services, as well as landing area.

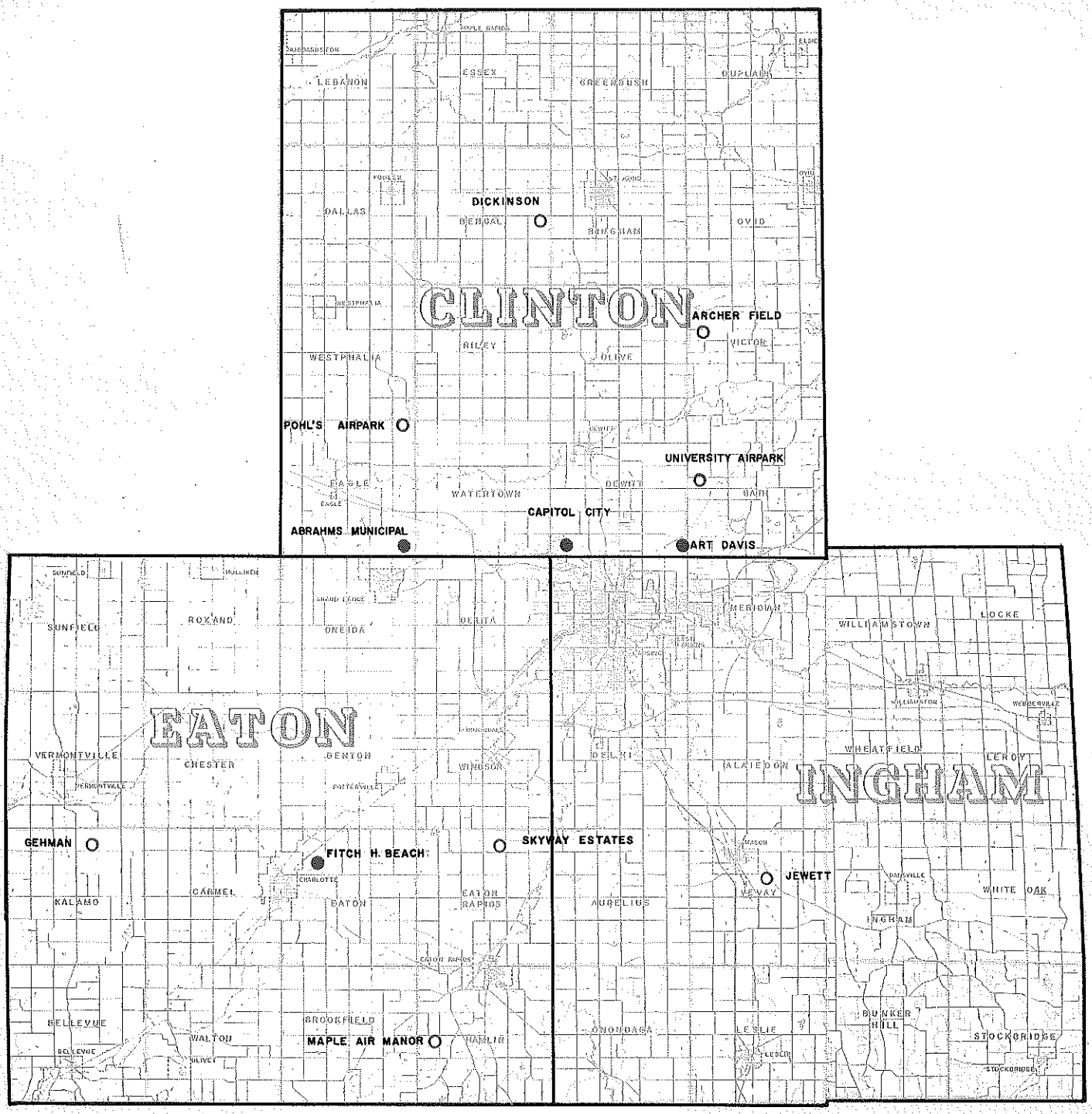
"L" - Licensed Landing Field-meeting all minimum standards except those for hangars, mechanical and repair services, and telephone facilities.

"LU" - Licensed Limited Use Field-deficient in one or more standards for airports and land fields, but providing "adequate" runway for normal takeoff.

"E" - Approved Emergency Field-fields without services and with a minimum of maintenance. "Pilots may use these fields, but do so at their own discretion."

Source: Michigan Aeronautics Commission.

MAP 1
Classified Airports In The Tri-County Region, 1968



LEGEND

- ○ LICENSED AIRPORTS
- ● APPROVED EMERGENCY FIELDS

Nine air fields are located in the Tri-County Region which are not shown on this map. Fields not classified by the Michigan Aeronautics Commission have not been included as these facilities do not meet the standards established by the Michigan Aeronautics Commission.

0 scale in miles 5

TRI-COUNTY REGIONAL PLANNING COMMISSION
535 North Clippert Street, Lansing, Michigan 48912

In addition to serving general aviation, Capital City Airport provides the only commercial airline service in the Region. In June 1967, there were 25 daily scheduled airline flights from Capital City providing direct service to points as distant as Omaha, New York and Minneapolis. Also, nonstop service is offered to Grand Rapids, Detroit and Chicago. Both United and North Central Airlines offer passenger, air cargo and air mail service to the Region. Present passenger and cargo-carrying aircraft utilized are the DC 6 piston engine, Viscount Turbo Prop and Convair 440.

In 1960, a new terminal was opened at Capital City Airport and in 1962, the E-W instrument runway was lengthened to 6,500 feet to accommodate small to medium-size jet aircraft. In 1968, 737 bi-jets, DC 9s and DC 9-30s will provide service from Capital City.

CHAPTER II

AVIATION TRENDS AND PROJECTIONS

In the past few years air transportation has experienced a phenomenal growth rate in the United States. In large metropolitan areas, growth has occurred so rapidly that aviation facilities have been hard pressed to satisfy the demand. This growth is attributed to many factors including technological innovations which have resulted in more efficient aircraft, more leisure time coupled with higher incomes, increasing levels of educational achievement resulting in changes in occupational groups, and a general acceptance of air transportation as an integral part of life by businessmen, governmental officials, educators, and private citizens.

Nationwide statistics from the Federal Aviation Administration (FAA) indicate that, since 1960, commercial airline passengers have almost doubled to 110,000,000 annually, airfreight has nearly tripled from 522,900 tons in 1960 to 1.4 million in 1965, and registered general aviation aircraft has increased 22% over the same period to 95,442 in 1965. These trends seem modest when compared with future projections determined by the FAA. The FAA predicts air passengers to triple to an annual figure of 454,000,000 by 1975, air cargo to increase tenfold by 1977, and general aviation aircraft to increase 76,000 to 171,000 by 1976.

Similar trends have occurred in the Tri-County Region. Both air passengers and air cargo, including mail, have doubled since 1960. In addition, registered general aviation aircraft has increased 90%, which is well above the national average. These and other regional trends and corresponding projections for registered general aviation aircraft, airport operations, air passengers, air cargo, and air mail are discussed below.

Registered General Aviation Aircraft

A knowledge of past and present numbers of registered aircraft is essential in forecasting future aviation activity. Past trends in registered aircraft for the Tri-County Region have shown considerable fluctuation. Between 1956 and 1960, the number of aircraft actually decreased which reflects the general economic conditions of that period. Since 1960, however, the downward trend has reversed as present figures show an increase of 94% in registered aircraft during the past seven years.

Past and present registered aircraft, by airport, are listed in Appendix A. Ingham County is the only area which has shown a continuing decrease. Several factors account for this. One factor is the loss of Aero Manor Airport because of development pressures which resulted in the subdivision of the facility for residential use. A second factor is that Jewett Airport is privately-owned and does not have the resources available to provide the facilities or services furnished by publicly-owned airports in the Region. A third factor is that while registered aircraft in Ingham County have increased considerably, facilities to accommodate this growth are located to the north in Clinton County.

It should be noted that Millers Airport in Eaton Rapids, a private facility, was closed shortly after Beach Airport in Charlotte, a public facility, undertook a major construction program which has made it a model airport for small communities.

Until recently very little attention has been given to forecasting general aviation activity. Some attempts have been made to determine factors which give an indication of future activity. Factors such as population, education, occupation, and income do indicate demand; however, the results from using these factors have varied considerably. In recognition of this problem, the Michigan Aeronautics Commission undertook a study to determine more reliable methods of estimating future commercial and general aviation activity. The Commission conducted a series of regression analyses which considered the above factors, plus many more. The findings, presented in a 1966 publication by Arthur D. Little entitled Transportation Predictive Procedures for Commercial and General Aviation, listed two formulas which were considered reasonably accurate for projecting registered aircraft. One formula used disposable income and the other used persons over 25 years of age with some college education. Both formulas indicated a reliability over 90%. Future aircraft for the Region was projected using the formula for persons over 25 years of age with some college education. (Formula is presented in Appendix F.) The population in this group was determined using Tri-County Regional Planning Commission projections. The following estimates are the result.

FIGURE 2

NUMBER OF REGISTERED GENERAL AVIATION AIRCRAFT IN THE TRI-COUNTY REGION, 1960-90

1960	1962	1965	1966	1967	1970	1975	1980	1985	1990
135	149	231	236	262	340	470	600	720	840

Airport Operations

Airport operations are a measure of the frequency of use of an airport facility. Operations refer to the number of takeoffs and landings. They are commonly classified into three categories: local, itinerant and airlines. Local operations are defined as those which originate and end at the same airport without ever leaving the flight pattern of that airport. Itinerant means departing from one airport and landing at another. Local and itinerant operations indicate general aviation activity. Commercial airline operations are also considered itinerant operations. However, in this report they are listed as airline operations.

In addition to providing a measure of activity, the type of operations at an airport indicate the function of the facility within a community. Generally, those airports which have more itinerant operations serve business and charter flying while those which have greater local operations provide personal and instructional flying. The following operations recorded for classified airports within the Region in 1962 illustrate this point.

FIGURE 3

NUMBER OF OPERATIONS (TAKEOFFS AND LANDINGS) BY CLASSIFIED AIRPORT FOR THE TRI-COUNTY REGION, 1962

	LOCAL	ITINERANT	COMMERCIAL AIRLINES
Capital City-Lansing	34,430	51,459	14,592
Beach-Charlotte	5,815	5,198	0
Davis-East Lansing	66,878	14,326	0
Abrams-Grand Ledge	9,516	3,506	0
Jewett-Mason	6,873	3,446	0

Source: Michigan Department of Aeronautics, Aviation Fact Finder Survey, 1963.

In comparing Capital City Airport with Davis Airport, it is evident that Capital City has a large number of itinerant operations, while Davis has a comparatively small number. This would indicate that Capital City accommodates a high volume of business flying. On the other hand, Davis has almost double the local operations of Capital City. This indicates that it serves predominantly personal flying or people who fly for pleasure. Comparing Beach with Abrams and Jewett, Beach represents a balanced airport serving both business and pleasure or personal flying, while Abrams and Jewett are used predominately for personal flying.

With the exception of the 1962 operation figures presented in Figure 3, no statistics of past operations at general aviation airports are available. However, in most instances the number of operations are directly related to the number of registered general aviation aircraft at each airport.

Additional statistics regarding aircraft operations are available for Capital City Airport. Figure 4 contains air traffic volumes for the even years beginning with 1958. These figures reveal that local operations are constituting a larger percentage of total operations in the last few years. This indicates that Capital City Airport is being utilized more for pleasure or personal flying now than ever before.

FIGURE 4

NUMBER OF AIRCRAFT OPERATIONS AT CAPITAL CITY AIRPORT, 1958-1966

TYPE	1958	1960	1962	1964	1966
Local	36,923	31,416	34,430	48,388	62,087
Itinerant	46,819	43,890	51,459	56,598	69,139
Commercial Airlines	12,967	13,293	14,592	14,780	15,740
Total	96,709	88,589	100,481	119,767	126,866

Source: Michigan Aeronautics Commission.

Registered aircraft are used in estimating future local and itinerant operations. The Michigan Aeronautics Commission presented two formulas in their air transportation predictive procedures report which can be used for the Tri-County Region. Figure 5 shows recent trends and projected operations for the Region as determined from the Michigan Aeronautics Commission formulas. (Formulas are presented in Appendix F.)

FIGURE 5

NUMBER OF AIRCRAFT OPERATIONS IN THE TRI-COUNTY REGION, 1962-1990

TYPE	1962	1970	1975	1980	1985	1990
Local	123,512	223,900	309,200	394,500	473,200	552,000
Itinerant	77,938	140,300	193,700	247,100	276,400	345,800
Commercial Airlines	14,592	20,000	25,000	30,000	35,000	40,000
Total	216,039	384,200	527,900	671,600	804,600	937,800

Source: Michigan Aeronautics Commission and the Tri-County Regional Planning Commission.

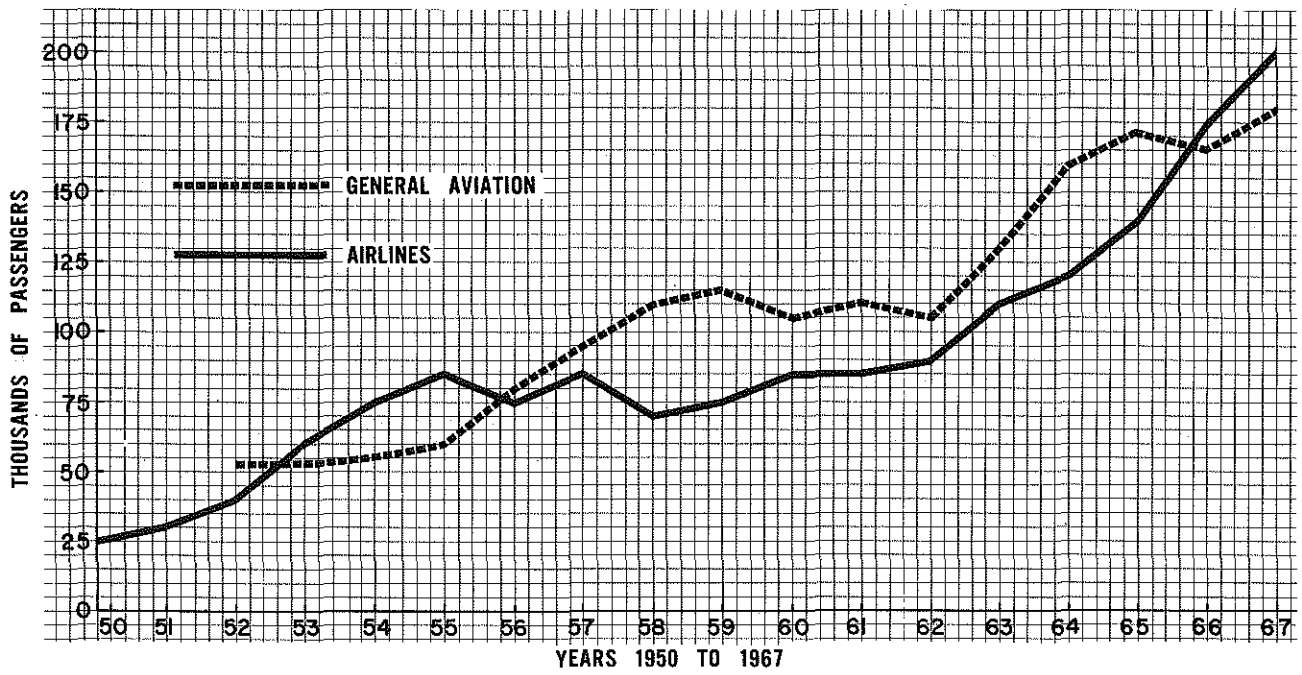
Air Passengers

The results of a Home Survey, conducted in 1965 by a nationally-known market research firm under contract with the Tri-County Regional Planning Commission and the Michigan Aeronautics Commission, indicated that 58% of those interviewed in the survey have been air passengers. Of these, 39% travelled by scheduled airlines, 26% have flown in private planes, and 9% in military aircraft. The total exceeds 58% because many have flown by more than one arrangement. The above statistics reveal the importance of both commercial and general aviation in the movement of people within and outside the Region.

With the exception of Capital City Airport, there are no figures available to establish trends for general aviation passengers. However, past records from Capital City indicate that air travel was both dynamic and stagnate between 1954 and 1961. General aviation passengers more than doubled while commercial air passengers indicated no increase. During this period general aviation passengers exceeded those of scheduled airlines. This stagnation period for commercial airlines is attributed to poor terminal facilities, poor scheduling of flights to other major airports and general economic conditions. Since 1961, the trend has changed and commercial airline passengers have doubled while general aviation passengers increased 59%. In 1966, for the first time in ten years, commercial airline passengers exceeded those carried by general aviation. In addition to good economic conditions since 1961, a new terminal and better scheduling of flights are credited as major factors resulting in the change. Past trends are shown in Figure 6.

FIGURE 6

GENERAL AND COMMERCIAL AVIATION PASSENGERS FOR THE CAPITAL CITY AIRPORT, 1950-66



Source: Michigan Aeronautics Commission.

According to Michigan Aeronautics Commission projections for Capital City Airport, commercial airline passengers will double by 1975 and triple by 1990. Jet service, to be provided in 1968, and terminal expansion will increase the quality of service provided by Capital City Airport. The availability of jet service may attract some of the 35% who live in the Region but drive to Detroit to originate their flights. Should this occur the following projections will be low, as they assume that 35% of all commercial airline passengers living in the Region will continue to begin their flights outside the Region.

FIGURE 7

NUMBER OF COMMERCIAL AIRLINE PASSENGERS USING CAPITAL CITY AIRPORT, 1960-90

1960	1962	1965	1966	1967	1970	1975	1980	1985	1990
82,000	93,502	142,608	172,456	220,370	260,000	352,000	450,000	552,000	650,000

Source: Michigan Aeronautics Commission.

According to the Federal Aviation Administration, general aviation passengers can be estimated by multiplying projected itinerant airplane operations by 2.7 which is the average number of passengers carried by general aviation aircraft. FAA states that local operations do not carry enough passengers to be considered in making future estimates. This method resulted in the following general aviation passenger projections for the Region.

FIGURE 8

GENERAL AVIATION PASSENGERS IN THE TRI-COUNTY REGION, 1962-90

1962	1970	1975	1980	1985	1990
152,000	378,800	523,000	667,200	800,300	933,700

These projections indicate that approximately one and one-half million people, combining Figures 7 and 8, will travel by air each year by 1990 using airports in the Region.

Air Cargo and Air Mail

All cargo and mail service to the Region originates from Capital City Airport. Air mail volume has increased steadily since 1948. Between 1954 and 1960 air cargo volumes remained constant. In 1960, movement of cargo by air experienced an upswing which more than doubled the yearly volume by 1965. Recent development of new and more efficient methods of handling air cargo and a reduction of unit cost in utilizing air transportation should result in a phenomenal growth rate in the future. The following projections were made by the Michigan Aeronautics Commission.

FIGURE 9

AIR CARGO AND AIR MAIL VOLUMES* FOR CAPITAL CITY AIRPORT, 1960-90

	1960	1965	1970	1975	1980	1985	1990
Air Cargo	.9	2.0	4.0	5.2	6.5	8.0	10.2
Air Mail	.4	.6	1.0	2.0	2.7	3.5	4.8
Total	1.3	2.6	5.0	7.2	9.2	11.5	15.0

*In millions of pounds.

Source: Michigan Aeronautics Commission.

The growth projected for passengers, aircraft and operations over the next 23 years will require a planned expansion and reconstruction program at almost every

airport in the Region. The economic impact of this future growth can be measured to some degree. Air passengers alone can be expected to spend $18,700,000 annually by 1990. Expanded aviation services will be required to service the increasing number of planes. New jobs and new businesses will be created and, of course, more taxable income will become available for local governmental units.

One factor that is important, but difficult to measure, is the gain or loss of an industrial or business firm because the community did or did not have an adequate airport facility. It is quite certain that the industrial firm of Owens-Illinois would not have located in Charlotte recently, if that community did not already have a good aviation facility. The above example underscores an important point. The preceding growth projections represent only the potential and unless airport facilities are developed to encourage and accommodate this growth, it will probably not materialize to the degree suggested in this chapter.

CHAPTER III

AVIATION PROBLEMS

Several problems are present which will hinder the expansion of aviation facilities in the Region both now and in the future.

One problem is the lack of assurance to local communities that private airports will remain. The continued operation of a private airport depends on several factors. In the past seven years there have been two private licensed airports in the Region which were permanently closed. In Lansing, Aero Manor Airport, which at one time had 54 based aircraft was closed because land development adjacent to the facility had increased land values to the point where more profit could be realized by selling the airport for residential development. The occurrence of the above situation in some areas of the Region would leave a community without any aviation facility. The least that could happen would be that another airport in the vicinity of the one that closed would suddenly be deluged with more based aircraft than it had anticipated.

A second problem is the shortage of adequate funds to expand and improve private air facilities. Private airports often lack the financial resources or are otherwise reluctant to expand aviation facilities when they are needed. A review of the present airport facilities within the Region, as outlined in the first chapter of this report, indicate that in most instances they are underdeveloped when compared with public facilities.

Public ownership of existing and proposed airports may be the most desirable solution to this problem. Public airports are eligible for State assistance on a matching basis. In the case of airports which appear on FAA's National Airport Plan, such as Capital City and Beach airports, the Federal Government will pay at least 50% of certain improvements with the remainder divided between State and local governments.

Another problem is the difficulty of making governmental units aware of the benefits of, and the need for, public airports. This problem exists in the Lansing-East Lansing area where two units of government have been reluctant to participate in expansion programs at Capital City Airport although it directly benefits them more than any other communities within the Region. For several years the State of Michigan has attempted to transfer the ownership of the Capital City Airport to the City of Lansing, but the City has indicated a continued reluctance to accept it.

One solution to this problem would be to establish a Regional Airport Authority which could operate Capital City Airport, exercise control over other airports in the Region, and assist in establishing new airport facilities. In 1957, the State Legislature passed Act 206, Community Airport Authority Act, which provides a legal basis for airport authorities. The purposes of the act are explained in the following excerpt.

"AN ACT to authorize two or more counties, cities, townships and incorporated villages, or any combination thereof, to incorporate an airport authority for the planning, promoting, acquiring, constructing, improving, enlarging, extending, owning, maintaining and operating the landing, navigational and building facilities necessary thereto of one or more community airports; to provide for changes in the membership therein: to authorize such counties, cities, townships and incorporated villages to levy taxes for such purpose: to provide for the operation and maintenance and issuing notes therefor; and to authorize condemnation proceedings."

Act 206, P.A. 1957,
Community Airport Authority Act

A fourth problem is to insure a compatible land use pattern around existing and proposed airports. An airport requires a large land area and clear approach zones at both ends of a runway. In order to minimize potential safety hazards, land development must be restricted to those uses which are not in conflict with the airport's operation. The airport must also be readily accessible to population centers. In order to insure its accessibility, the airport must be integrated with the overall transportation network. The policies presented in the following chapter are intended to serve as guidelines in solving the aforementioned problems.

CHAPTER IV

SUGGESTED AIRPORT POLICY PLAN

The following general assumptions are essential to serve as a basis for the airport policy plan.

1. Air transportation will serve an increasingly significant role in future movement of people and goods within the Tri-County Region and between regions.

2. Each major subcenter in the Region will recognize the importance of having an airport facility readily accessible to their community.

3. Adequate aviation facilities will be provided to serve projected growth.

1. Goal: To design and locate airports so that they will both serve and shape future land use patterns.

a. Policies.

1. Airports should be readily accessible from present and proposed medium and high density residential settlements as well as existing and proposed industrial and commercial centers.

2. Air facilities which serve the regionwide population should be located near the primary regional population concentration and have convenient access to secondary population concentrations.

3. Airports should be located so that the runway approach zones avoid encroachment on medium and high density residential developments, places of public assembly, and large employment centers.

4. Air facilities should be developed with due consideration given to open space uses.

5. Air facilities should be designed and located to afford sufficient access to serve existing and proposed travel needs, to encourage the development of related land use patterns adjacent to the facility, and to allow only compatible land uses within approach zones.

6. Adequate land should be provided for air facility expansion necessitated by future air travel demands.

b. Incorporation of Policies into Development Plan.

1. Capital City Airport serves the entire Tri-County Region from its centralized location in the Lansing-East Lansing area. The system of freeways and major arterials provide convenient access to and from all subcenters in the Region.

2. Existing and proposed airports within the Tri-County Region are shown in the Development Plan. These airports provide for compatible land uses within the runway approach zones and incorporate a related land use pattern adjacent to the facility.

3. All airports are located adjacent to population centers and have convenient access via the highway transportation system from commercial and industrial centers.

2. Goal. To develop a regional air transportation design concept integrated with other transportation system components in order to provide an efficient and balanced transportation system for the Region.

a. Policies.

1. The regional air transportation system should consist of a hierarchy of air facilities classified according to function (such as trunk, secondary, personal, and heliports) and be integrated with the road and rail systems.

2. The design and location of air facilities should be compatible with existing and future land use patterns.

b. Incorporation of Policies into Development Plan.

1. Air transportation facilities will be classified according to their function by a regional committee composed of airport owners, operators, and other technicians.

2. The development plan shows a hierarchy of airport facilities with Capital City Airport serving as the trunk facility for the Region. A series of secondary-commuter airports are located at major subcenters througout the Region. Each of the facilities are integrated with the existing and proposed land use pattern.

CHAPTER V

SUGGESTED AIRPORT DEVELOPMENT PLAN

The suggested airport development plan attempts to satisfy the two goals stated in the suggested airport policy plan in accommodating the Region's future aviation demand, estimated to be 470 general aviation aircraft by 1975 and 840 by the year 1990.

To accommodate these increases, it is recommended that certain existing airports must be improved and three additional public general aviation airports should be established. New public general aviation airports are suggested for the Webberville-Williamston area, the Delhi-Alaiedon Township area, and the St. Johns area. A fourth public general aviation airport is indicated on the development plan, Map 4. This facility is being constructed at M-78 and I-96 by the State of Michigan to accommodate State-owned aircraft.

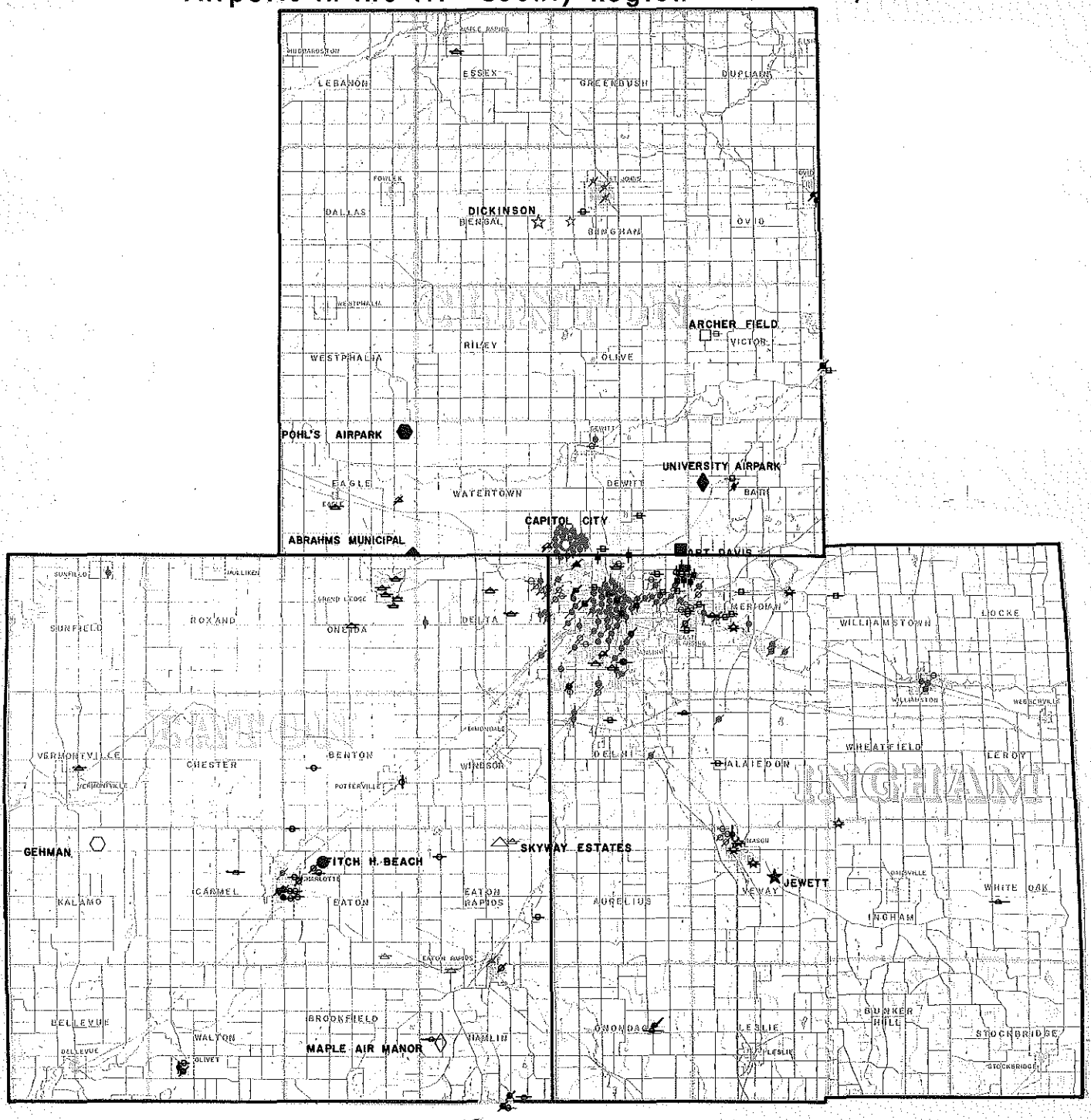
In designing the suggested airport development plan, certain procedures were followed in distributing future aircraft and selecting generalized locations for future airports in the Tri-County Region.

1. A map of the Region (Map 2) was prepared indicating the residence of every 1967 registered general aviation aircraft owner whose home was in the Region. This map also depicted the airport at which said aircraft was based, the ownership of the aircraft (business and individual), and the use of the aircraft (business, pleasure, or both).

2. The Region was divided into six subregions, indicated on Map 3, using the following criteria: (a) each subregion constituted an airport service area delimited by approximating a service radius for each existing classified airport and observing the location of aircraft owners in relation to the airport at which their aircraft was based, (b) each subregion contained at least one primary or secondary population center, (c) the boundaries of each subregion were concident with township and county boundaries, (d) each subregion was generally homogeneous, (e) each subregion had an estimated 1990 population of at least 12,500 which is the minimum number of persons required to support an airport assuming 0.8 aircrafts per 1,000 population, and (f) each subregion is served by at least one major arterial which connects the subregion to the central city of the Tri-County Region and urban places outside the Region.

3. The 1967 and future populations were determined for each subregion. The percentage of the present and future population residing in each subregion was also estimated.

MAP 2
Location of Owners of Aircraft Based at Airports in the Tri—County Region — Summer, 1967



LEGEND

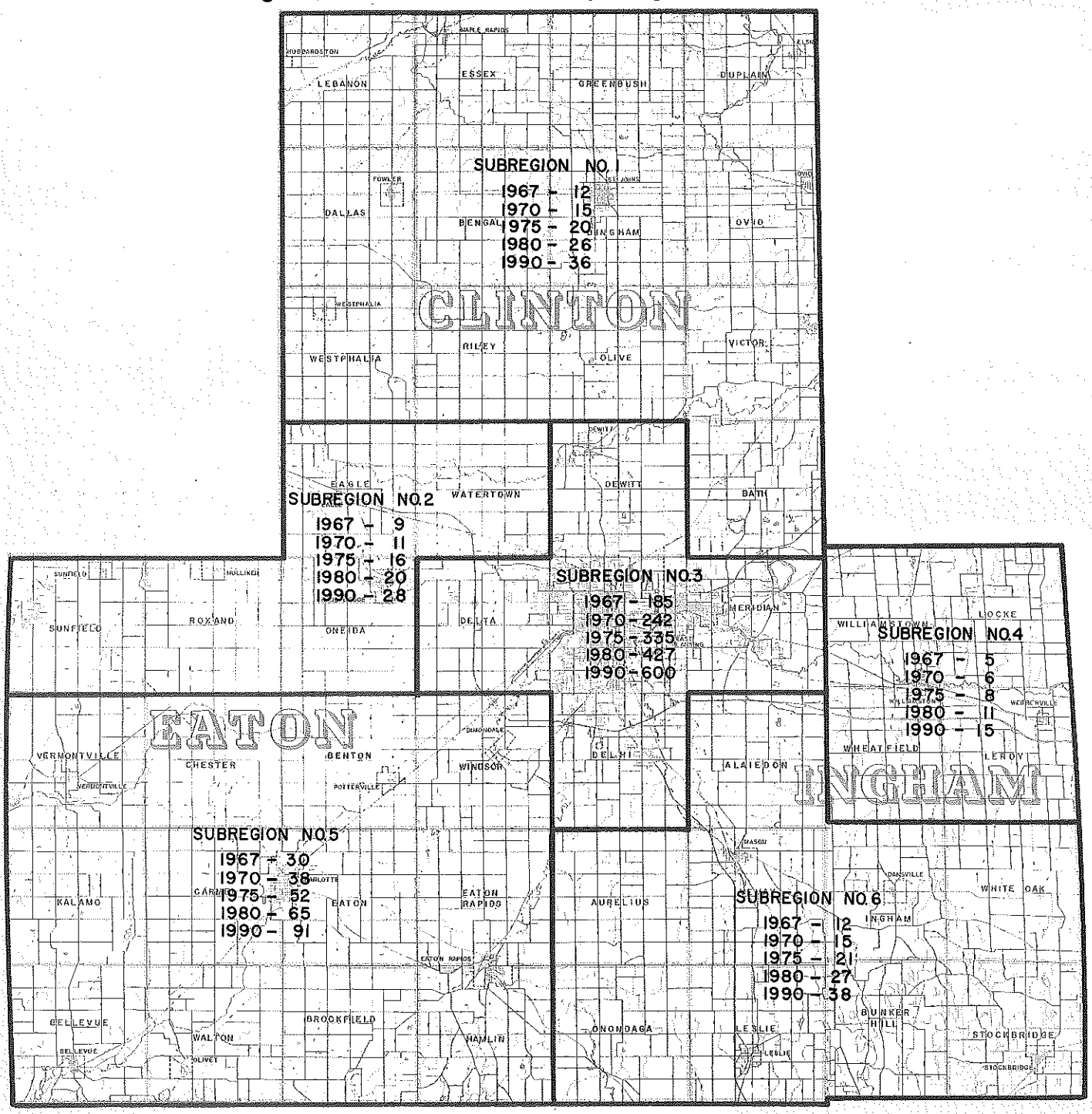
- ∘ INDIVIDUAL OWNERSHIP
- • BUSINESS OWNERSHIP
- | USED FOR BUSINESS
- — USED FOR PLEASURE
- / USED FOR BOTH BUSINESS AND PLEASURE

Each symbol represents one general aviation aircraft. Each airport has a different symbol. Aircrafts are indicated with the same symbol as the airport at which they are based.

0 scale in miles 5

TRI-COUNTY REGIONAL PLANNING COMMISSION
535 North Clippert Street, Lansing, Michigan 48912

MAP 3
Number Of General Aviation Aircraft By Subregion For The Tri-County Region, 1967—1990



LEGEND

SUBREGION BOUNDARIES

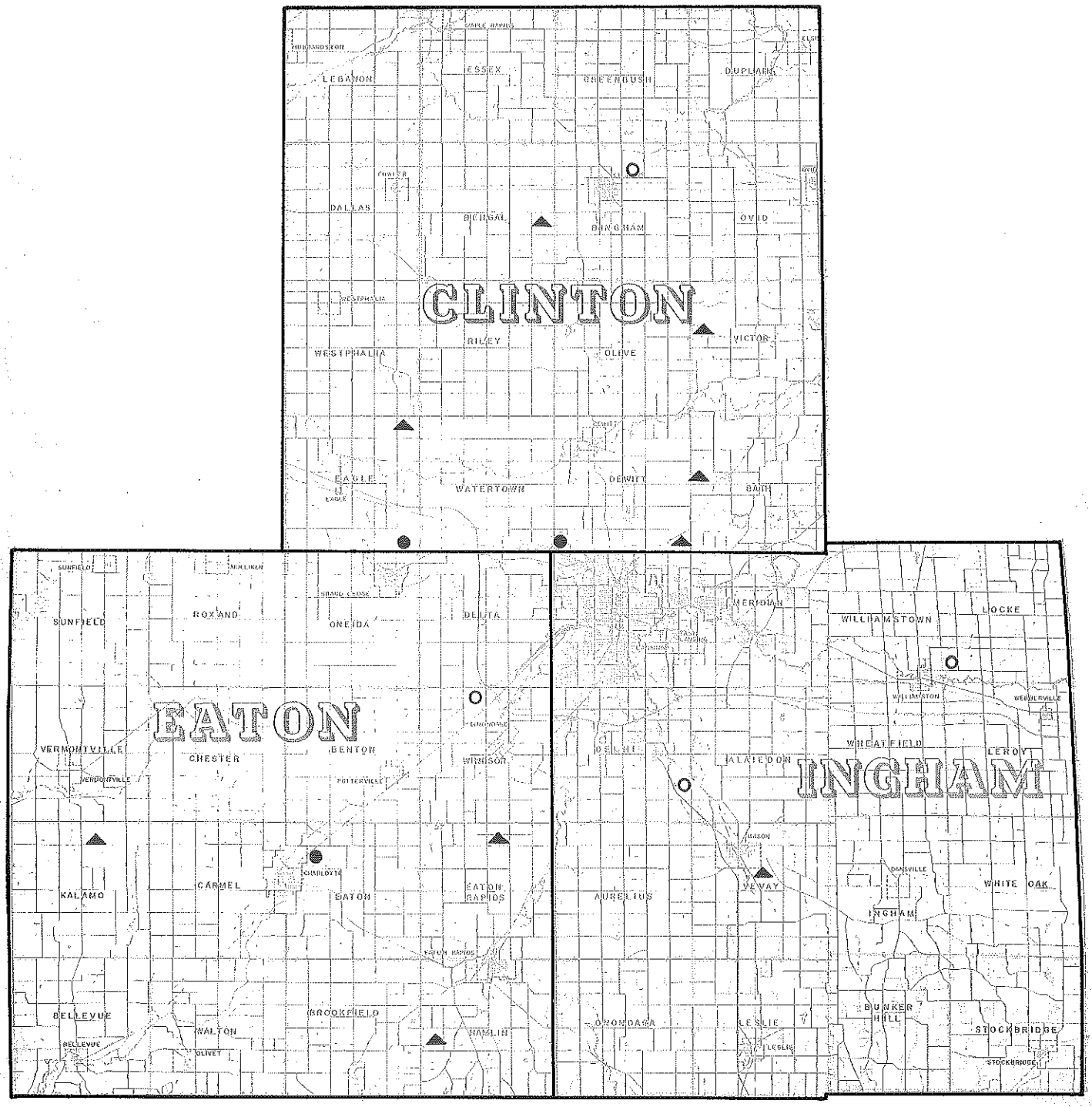
1990 - 91 YEAR AND NUMBER OF AIRCRAFT

Each subregion is characterized by having, as a minimum, one primary or secondary population center, one major arterial connecting it to the City of Lansing, and a total population of 12,500 persons by 1990.

0 scale in miles 5

TRI-COUNTY REGIONAL PLANNING COMMISSION
535 North Clippert Street, Lansing, Michigan 48912

MAP 4
Suggested Airport Development Plan For The Tri-County Region, 1990



LEGEND

- ▲ EXISTING AIRPORTS (PRIVATELY-OWNED)
- ● EXISTING AIRPORTS (PUBLICLY-OWNED)
- O PROPOSED AIRPORTS

It is suggested that publicly-owned airports be established in the general area shown by the symbols. The symbols are not intended to indicate specific sites.

0 scale in miles 5

TRI-COUNTY REGIONAL PLANNING COMMISSION
535 North Clippert Street, Lansing, Michigan 48912

4. The number of registered general aviation aircraft by place of ownership in each subregion in 1967 and the percentage of general aviation aircraft by place of ownership in each subregion in 1967 was determined. The percentage of general aviation aircraft based at airports in the Region, but owned by persons residing outside the Region, was also noted.

5. The ratio of general aviation aircraft, by place of ownership, to population in 1967 was determined for each subregion. This same ratio was calculated for 1970, 1975, 1980, and 1990 for the Region as a whole using estimated population figures for these years and the number of general aviation aircraft determined in Chapter II.

6. These ratios were applied to the 1970, 1975, 1980, and 1990 estimated population figures for each subregion to obtain the number of general aviation aircraft by place of ownership for each subregion. These numbers and ratios are presented in Appendix B.

7. The percentage of the total number of general aviation aircraft by place of ownership in each subregion in 1967 based at each airport, regardless of subregion, was then calculated. These numbers and percentages are indicated in Appendix C.

8. The number of general aviation aircraft estimated for each subregion for the years 1970, 1975, 1980, and 1990 were distributed to each existing airport in the Region using the percentages presented in Appendix C. The results of this process are presented in Appendix D.

It was assumed that the increased number of general aviation aircraft could be accommodated by improving or maintaining existing airports in most cases. However, in some instances, present trends suggested that the likelihood of adequate air facility improvement was not probable. Therefore, to accommodate the additional aircrafts, new airports were recommended. This was the case in subregions one and six. In subregion four no airport was in existence, therefore one was recommended to serve the increased general aviation aircraft ownership realized in that subregion. In all three instances, the standard recommended by the Michigan Aeronautics Commission was applied. This standard is that ten based general aviation aircraft are necessary to operate a financially-sound enterprise. The suggested airport development plan is presented on Map 4.

These recommendations could be altered by unforeseen technological changes. Some of the foreseeable technological advances are discussed in Chapter VI. An attempt has been made to account for the impact which these innovations might have on the air transportation system both in formulating the suggested policy plan and determining these suggested airport development plan recommendations.

CHAPTER VI

FUTURE TECHNOLOGY IN AVIATION IN THE TRI-COUNTY REGION

An awareness of technological trends in aircraft is essential since the size and type of future aircraft will dictate the size of future airports including the length and bearing capacity of runways. In addition, new types of aircraft may require different service facilities than those which exist today. Commercial and general aviation aircraft will be considered separately since facilities serving commercial airlines require larger facilities and more services.

Future commercial aviation services to the Region can be expected to include trunk airlines and commuter airlines. It is expected that future trunk airline services to the Region will be provided by refinement of jet aircraft already developed. In 1968, jet service will be initiated from Capital City Airport. These jets will be small and capable of utilizing the present facilities at Capital City. As passengers and air cargo increase at Capital City there will be a need to expand passenger and storage facilities. Runways, to enable larger jet aircraft to serve the Region, will also require improvements.

It is not anticipated that the "jumbo" and "supersonic" jet presently on the drawing board will directly service the Region as passenger and air cargo projections do not indicate a level of demand which would make the operation necessary.

Regarding commuter airlines, there is an increasing trend and desire of passengers to fly all the way from their home community to their destination. Before 1990, it is expected that a commuter service will connect small local communities within the Region to trunk airline facilities. The type of aircraft utilized will be either a short take-off and landing aircraft which can utilize aviation facilities in the smaller communities or a vertical lift aircraft which can operate from the downtown areas of the various centers in the Region.

One possibility is the type of aircraft now on the drawing boards at Lockheed Aircraft Corporation. This is referred to as a short-haul, winged air commuter carrying 30 to 90 passengers. It is being designed to make vertical take-offs and landings in the center of a city and also operate between airports and communities within a 250 mile radius at speeds of 300 miles per hour. This type of aircraft will require a heliport, or some other similar facility, in the downtown area of Lansing and other major population centers in the Region. Airports in outlying communities developed to handle general aviation should be able to accommodate this operation. Both trunk and commuter airlines will utilize aircraft with a capability of converting to either passengers or air cargo or both.

Future general aviation aircraft will continue to be compatible with the aircraft of today. Most of these will be single or multi-engine planes carrying the business segment of general aviation. They are expected to make increasing use of jet aircraft. Present business jets on the market carry from 8 to 30 persons depending upon the type of aircraft. Curently in the development stages are supersonic jet aircraft for business purposes. These aircraft

will utilize the same facilities as trunk airlines. Capital City Airport will probably be the only facility capable of accommodating this type of aircraft in the Region. It is expected that general aviation will be involved in air cargo services which is now almost exclusively handled by commercial airlines. This will require storage facilities at general aviation airports.

In summary, the information and projections presented in this report indicate a bright future for aviation in the Region, however it only represents a potential and unless adequate and readily accessible facilities are available, future growth will not reach expectations. This report has attempted to provide background information for planning adequate aviation facilities. It is the first phase of a program which will result in a detailed airport facility plan for the entire Region.

APPENDICES

APPENDIX A

NUMBER OF REGISTERED GENERAL AVIATION AIRCRAFT BY COUNTY AND AIRPORT IN THE TRI-COUNTY REGION, 1956-67

	YEAR											
AIRPORT	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
Clinton County												
Abrams Municipal	12	7	4	4	7	7	6	8	14	12	18	17
Archer Field	-	-	-	-	-	-	-	-	-	2	2	2
Art Davis	22	21	19	25	22	25	28	38	33	35	38	43
Capital City	67	59	77	67	63	71	77	108	111	126	128	141
Dickinson	-	-	-	-	1	2	2	2	3	4	4	2
Pohl's Airpark	-	-	-	-	-	-	-	-	-	-	-	1
University Airpark	-	-	-	-	-	-	-	-	-	-	-	1
Clinton County Unclassified	4	4	3	4	3	3	4	3	3	3	4	6
Clinton County Total	105	91	103	100	96	108	117	159	164	182	194	213
Eaton County												
Fitch H. Beach	16	19	10	9	7	9	6	8	13	24	23	31
Gehman	1	1	1	1	1	1	1	2	1	1	0	0
Maple Air Manor	-	-	-	-	-	-	-	-	-	-	-	1
Millers	6	5	3	2	2	5	7	6	(no longer in existence)			
Skyway Estates	-	-	-	-	-	-	-	-	2	4	4	4
Eaton County Unclassified	2	4	5	2	2	2	2	4	3	3	4	2
Eaton County Total	25	29	19	14	12	17	16	20	19	32	31	38
Ingham County												
Aero Manor	21	18	19	19	13	11	2	(no longer in existence)				
Jewett	4	5	10	13	11	12	12	12	10	10	6	6
Ingham County Unclassified	4	4	3	3	3	3	2	3	5	7	5	5
Ingham County Total	29	27	32	35	27	26	16	15	15	17	11	11
Region	159	147	154	149	135	151	149	194	198	231	236	262

Source: Michigan Aeronautics Commission.

APPENDIX B

NUMBER OF GENERAL AVIATION AIRCRAFT BY PLACE OF OWNERSHIP, TOTAL POPULATION, AND CORRESPONDING RATIOS BY SUBREGION FOR THE TRI-COUNTY REGION, 1967-90

Number of General Aviation Aircraft by Place of Ownership

	1967		1970		1975		1980		1990	
	No.	%	No.	%	No.	%	No.	%	No.	%
Subregion 1	12	4.6	15	4.4	20	4.3	26	4.3	36	4.3
Subregion 2	9	3.5	11	3.3	16	3.3	20	3.3	28	3.3
Subregion 3	185	70.3	242	71.3	335	71.2	427	71.1	600	71.4
Subregion 4	5	1.9	6	1.9	8	1.8	11	1.8	15	1.7
Subregion 5	30	11.6	38	11.2	52	11.0	65	10.9	91	10.9
Subregion 6	12	4.6	15	4.4	21	4.5	27	4.5	38	4.5
Outside Region	9	3.5	13	3.5	18	3.9	24	4.1	32	3.9
Region	262	100.0	340	100.0	470	100.0	600	100.0	840	100.0

Total Population

	1967		1970		1975		1980		1990	
	Number	%	Number	%	Number	%	Number	%	Number	%
Subregion 1	29,000	8.0	30,500	7.7	33,400	7.6	37,100	7.6	43,800	7.4
Subregion 2	15,100	4.2	15,800	4.0	17,600	4.0	19,700	4.0	23,900	4.0
Subregion 3	250,000	69.5	277,400	70.5	310,600	70.6	344,700	70.6	420,000	70.9
Subregion 4	8,300	2.3	8,700	2.3	9,600	2.2	10,600	2.2	12,600	2.1
Subregion 5	35,600	9.8	37,900	9.6	42,100	9.6	46,400	9.6	56,700	9.6
Subregion 6	22,400	6.2	23,400	5.9	26,400	6.0	29,400	6.0	35,600	6.0
Outside Region	--	-	--	-	--	-	--	-	--	-
Region	360,400	100.0	393,700	100.0	439,700	100.0	487,900	100.0	590,600	100.0

Number of General Aviation Aircraft Per 10,000 Persons*

	1967	1970	1975	1980	1990
Subregion 1	4.1	5.0	6.7	7.1	8.2
Subregion 2	6.0	5.5	8.0	10.2	11.7
Subregion 3	7.3	8.6	10.6	12.6	14.3
Subregion 4	6.0	8.0	8.0	10.2	11.7
Subregion 5	8.4	9.5	13.0	13.0	16.4
Subregion 6	5.4	7.1	7.0	9.2	10.6
Outside Region	-	-	-	-	-
Region	7.3	8.7	10.7	12.2	14.2

*Number of general aviation aircraft per 10,000 persons was 4.5 in 1960 and 6.8 in 1965.

Source: Michigan Aeronautics Commission and the Tri-County Regional Planning Commission.

APPENDIX C

NUMBER OF GENERAL AVIATION AIRCRAFT BY PLACE OF OWNERSHIP BASED AT EACH AIRPORT IN THE TRI-COUNTY REGION, 1967

AIRPORT	Subregion 1		Subregion 2		Subregion 3		Subregion 4		Subregion 5		Subregion 6		Outside Region		Region	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Clinton County																
Abrams Municipal	1	7.1	8	8.0	7	3.9	0	0	1	3.2	0	0	0	0	17	6.4
Archer Field	2	14.3	0	0	0	0	0	0	0	0	0	0	0	0	2	.8
Art Davis	4	28.6	0	0	36	19.8	1	20.0	0	0	1	8.4	1	11.1	43	16.4
Capital City	0	0	1	10.0	128	70.7	4	80.0	1	3.2	3	25.0	4	44.5	141	53.8
Dickinson	2	14.3	0	0	0	0	0	0	0	0	0	0	0	0	2	.8
Pohl's Airpark	0	0	1	10.0	0	0	0	0	0	0	0	0	0	0	1	.4
University Airpark	1	7.1	0	0	0	0	0	0	0	0	0	0	0	0	1	.4
Clinton County Unclassified	4	28.6	0	0	1	.6	0	0	0	0	0	0	1	11.1	6	2.3
Clinton County Total	14	100.0	10	100.0	172	95.0	5	100.0	2	6.4	4	33.4	6	66.7	213	81.3
Eaton County																
Fitch H. Beach	0	0	0	0	6	3.3	0	0	22	71.1	0	0	3	33.3	31	11.8
Gehman	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maple Air Manor	0	0	0	0	0	0	0	0	1	3.2	0	0	0	0	1	.4
Skyway Estates	0	0	0	0	0	0	0	0	4	12.4	0	0	0	0	4	1.5
Eaton County Unclassified	0	0	0	0	0	0	0	0	2	6.4	0	0	0	0	2	.8
Eaton County Total	0	0	0	0	6	3.3	0	0	29	93.6	0	0	3	33.3	38	14.5
Ingham County																
Jewett	0	0	0	0	2	1.1	0	0	0	0	4	33.3	0	0	6	2.3
Ingham County Unclassified	0	0	0	0	1	.6	0	0	0	0	4	33.3	0	0	5	1.9
Ingham County Total	0	0	0	0	3	1.7	0	0	0	0	8	66.6	0	0	11	4.2
Region	14	100.0	10	100.0	181	100.0	5	100.0	31	100.0	12	100.0	9	100.0	262	100.0

Source: Michigan Aeronautics Commission and the Tri-County Regional Planning Commission.

APPENDIX D

NUMBER OF GENERAL AVIATION AIRCRAFT BY AIRPORT WHERE BASED FOR THE TRI-COUNTY REGION, 1960-90

AIRPORT	YEAR 1960 No.	1960 %	1965 No.	1965 %	1967 No.	1967 %	1970 No.	1970 %	1975 No.	1975 %	1980 No.	1980 %	1990 No.	1990 %
Clinton County														
Abrams Municipal	7	5.2	12	5.2	17	6.4	26	7.5	43	9.0	54	9.0	76	9.0
Archer Field	0	0.0	0	0.0	2	0.8	2	0.6	3	0.6	4	0.6	5	0.6
Art Davis	22	16.3	35	15.2	43	16.4	59	17.4	89	19.0	115	19.0	143	17.0
Capital City	63	46.7	126	54.5	141	53.8	160	47.0	190	40.4	220	36.7	310	36.9
Dickinson	1	0.7	4	1.7	2	0.8	2	0.6	3	0.6	4	0.6	5	0.6
Pohl's Airpark	-	-	-	-	1	0.4	2	0.6	5	1.2	7	1.2	10	1.2
St. Johns Area (New Airport)	-	-	-	-	-	-	-	-	-	-	18	3.0	34	4.0
University Airpark	-	-	-	-	1	0.4	4	1.2	5	1.2	7	1.2	10	1.2
Clinton County Unclassified	2	1.5	5	2.2	6	2.3	9	2.6	14	2.8	9	1.5	8	1.0
Clinton County Total	95	70.4	182	78.8	213	81.3	264	77.5	352	74.8	437	72.8	601	71.5
Eaton County														
Fitch H. Beach	7	5.2	24	10.4	31	11.8	44	12.9	66	14.0	84	14.0	118	14.0
Gehman	1	0.7	1	0.4	0	0.0	1	0.3	3	0.6	4	0.6	5	0.6
Maple Air Manor	2	1.5	2	0.9	1	0.4	2	0.6	3	0.6	7	1.2	10	1.2
Skyway Estates	0	0.0	0	0.0	4	1.5	2	0.6	3	0.6	7	1.2	10	1.2
Eaton County Unclassified	1	0.7	5	2.2	2	0.8	11	3.3	16	3.6	8	1.4	8	1.0
Eaton County Total	11	8.1	32	13.9	38	14.5	60	17.7	91	19.5	110	18.4	151	18.0
Ingham County														
Delhi Township Area (New Airport)	-	-	-	-	-	-	-	-	-	-	18	3.0	42	5.0
Jewett	11	8.1	10	4.3	6	2.3	8	2.4	12	2.6	12	2.0	8	1.0
Williamston Area (New Airport)	-	-	-	-	-	-	-	-	-	-	18	3.0	25	3.0
Ingham County Unclassified	3	2.2	7	3.0	5	1.9	8	2.4	15	3.2	5	.8	13	1.5
Ingham County Total	14	10.2	17	7.3	11	4.2	16	4.8	27	5.8	53	8.8	88	10.5
Region*	135	100.0	231	100.0	262	100.0	340	100.0	470	100.0	600	100.0	840	100.0

*1960 figures include two general aviation aircraft based at Miller's Airport and thirteen at Aero-Manor. Neither airport was in operation in 1965.

Source: Michigan Aeronautics Commission and the Tri-County Regional Planning Commission.

APPENDIX E

NUMBER OF OPERATIONS AND GENERAL AVIATION PASSENGERS BY AIRPORT FOR THE TRI-COUNTY REGION, 1962-1990

AIRPORT	Local Operations 1962	1970	1975	1980	1990	Itinerant Operations 1962	1970	1975	1980	1990	General Aviation Passengers 1962	1970	1975	1980	1990
Clinton County															
Abrams Municipal	9,500	16,800	27,800	35,500	49,700	3,500	10,500	17,400	22,200	31,100	7,300	28,400	47,000	60,000	84,000
Archer Field	--	1,300	1,900	2,400	3,300	--	800	1,200	1,500	2,100	--	2,200	3,200	4,100	5,700
Art Davis	66,900	90,000	115,000	140,000	190,000	14,300	20,000	25,000	30,000	40,000	30,000	54,000	67,500	81,000	108,000
Capital City	34,400					51,500					107,700				
Dickinson	--	1,300	1,900	2,400	3,300	--	800	1,200	1,500	2,100	--	2,200	3,200	4,100	5,700
Pohl's Airpark	--	1,300	3,700	4,700	6,600	--	800	2,300	3,000	4,100	--	2,200	6,200	8,100	11,100
St. Johns Area (New Airport)	--	--	--	11,800	22,100	--	--	--	7,400	13,800	--	--	--	20,000	37,300
University Airpark	--	2,700	3,700	4,700	6,600	--	1,700	2,300	3,000	4,100	--	4,600	6,200	8,100	11,100
Clinton County Unclassified	--	5,800	5,900	5,900	5,500	--	3,600	5,400	3,700	3,500	--	9,700	14,600	10,000	9,500
Clinton County Total	110,800					69,300					145,000				
Eaton County															
Fitch H. Beach	5,800	28,800	43,200	55,300	77,400	5,200	18,200	27,100	34,600	48,300		49,100	73,300	93,400	130,400
Gehman	--	800	1,900	2,400	3,300	--	400	1,200	1,500	2,100	--	1,100	3,200	4,100	5,700
Maple Air Manor	--	1,300	1,900	4,700	6,600	--	800	1,200	3,000	4,200	--	2,200	3,200	8,100	11,300
Skyway Estates	--	1,300	1,900	4,700	6,600	--	800	1,200	3,000	4,200	--	2,200	3,200	8,100	11,300
Eaton County Unclassified	--	7,400	11,100	5,500	5,500	--	4,600	6,900	3,400	3,400	--	12,400	18,700	9,200	9,200
Eaton County Total	5,800	39,600	60,000	72,600	99,400	5,200	24,800	37,600	45,500	62,200		67,000	101,600	122,900	167,900
Ingham County															
Delhi Twp. Area (New Airport)	--	--	--	11,800	28,000	--	--	--	7,400	17,400	--	--	--	20,000	46,800
Jewett	6,900	5,400	8,000	7,900	5,400	3,400	3,350	5,000	4,900	3,600	7,200	9,000	13,500	13,200	9,700
Williamston Area (New Airport)	--	--	--	11,800	16,400	--	--	--	7,400	10,300	--	--	--	20,000	27,700
Ingham County Unclassified	--	5,400	9,900	3,200	8,200	--	3,350	6,200	2,000	5,200	--	9,000	16,700	5,400	13,900
Ingham County Total	6,900	10,800	17,900	34,700	58,000	3,400	6,700	11,200	21,700	36,300	7,200	18,000	30,200	58,600	98,100
Region	123,500					77,900					152,200				

Future local and itinerant operations for the Region were determined using the following formulas as recommended by the Michigan Aeronautics Commission in the Arthur D. Little, Inc., report entitled Transportation Predictive Procedures: Commercial and General Aviation.

1. (Local Operations-Counties with Air Carrier Airports) $y = 866 + 656x$ (Based general aviation aircraft).

2. (Itinerant Operations-Counties with Air Carrier Airports) $y = 525 + 411x$ (Based general aviation aircraft).

The projections for each airport were determined by dividing the number of aircraft predicted for each airport by the number of aircraft predicted for the Region. This ratio was then multiplied by the number of local and itinerant operations predicted for the Region to determine the number of operations for each airport.

Projected local and itinerant operations for Art Davis and Capital City airports were adjusted to reflect the different nature of each facility. The formulas predicted an excessive number of local operations at Capital City Airport and not enough local operations at Art Davis Airport. The opposite was true regarding itinerant operations.

General Aviation Passengers were determined by multiplying the number of itinerant operations by 2.7. This procedure was recommended by the Michigan Aeronautics Commission.

Source: Michigan Aeronautics Commission and the Tri-County Regional Planning Commission.

APPENDIX F

BACKGROUND REGARDING FORMULAS USED TO PREDICT THE NUMBER OF BASED GENERAL AVIATION AIRCRAFT AND OPERATIONS

The formulas used to predict the number of based general aviation aircraft and the number of operations made by these aircraft were determined by Arthur D. Little, Inc., through multiple linear regression analysis. The formulas are presented in their publication entitled Transportation Predictive Procedures: Commercial and General Aviation, Technical Report Number 9A, December, 1966.

The number of based general aviation aircraft in the Tri-County Region for 1970, 1975, 1980, 1985, and 1990 presented in Figure 2 were estimated using the following Arthur D. Little formula.

1. Based general aviation aircraft = 4.51 + (0.00980) (Population over 25 years of age with some college education).

Two additional formulas, determined by Arthur D. Little, Inc., were used to predict the number of based general aviation aircraft operations. The results of the following equations are presented in Figure 5.

2. Local operations (for air carrier airports) = 866 + (656) (Based general aviation aircraft).

3. Itinerant operations (for air carrier airports) = 525 + (411) (Based general aviation aircraft).

APPENDIX G

GLOSSARY OF TERMS

In this report, a number of aeronautical terms are used without definition. It is suggested that the reader refer to the following glossary of terms.

1. BASED AIRCRAFT. Those housed, tied down, or parked on a continuing basis.

2. COMMERCIAL AVIATION. The scheduled airlines, passenger and freight. (Accounts for 27% of the itinerant operations in the United States).

3. CONTROL TOWER AIRPORTS. Where FAA traffic controllers govern air traffic within a designated airport control zone. There are eleven control tower airports in the State of Michigan. Capital City Airport is one of them.

4. GENERAL AVIATION. All aircraft other than military and scheduled airlines. Includes private and business-owned aircraft. (Accounts for 60% of the itinerant operations in the United States).

5. HOME BASE. Where the aircraft is housed, tied down, parked on a continuing basis.

6. ITINERANT OPERATIONS. A flight which originates at one airport and terminates at another airport. It is also a flight which travels over five miles from the local flight pattern.

7. ITINERANT PASSENGER. One whose flight originates at one airport and terminates at another or travels over five miles from the local flight pattern.

8. LOCAL OPERATION. A flight which originates and terminates at the same airport and does not go five miles beyond the flight pattern.

9. OCCUPANTS. Passengers and pilots of general aviation aircraft. Commercial aviation passengers are known as just that - "passengers."

10. OPERATION. Either a takeoff or landing constitutes one operation.

APPENDIX H

BIBLIOGRAPHY

Conference on "The Issues and Challanges of Air Transportation" Hartford, Connecticut, November 1-3, 1961; Connecticut General Life Insurance Company, a series of background papers.

Brewer, Stanley H., What's the Market for Air Cargo?

Hartranft, J. B., Jr., A Realistic Policy for General Aviation.

Howard, John T., Regional Planning and the Airport Problem.

Lawton, William K., Terminal Facilities for Private Aircraft.

Lederer, Jerome, Airports and Safety.

Lethbridge, Maurice, What Are the Implications of Air Travel Potentials?

Zwick, Charles, Jr., Getting To and From the Airports.

Lansing Planning Board, Comprehensive Master Plan 1960-1980, Lansing, Michigan, December, 1960.

Michigan Aeronautics Commission, Department of Commerce:

Michigan Aviation Fact Finder Survey Report, June, 1963.

Michigan Laws Relation to Aviation, 1967.

Transportation Predictive Procedures: Commercial and General Aviation, December, 1966.

Tri-County Facts About Aviation Passengers - Clinton, Eaton and Ingham, September, 1967.

Passaic County Planning Board, Airport Survey for the Passaic County Area, Patterson, New Jersey, 1959.

Tri-County Regional Planning Commission:

Transportation - An Inventory, January, 1962.

Tri-County Regional Transportation Study: Transportation Facilities and Service Levels, November, 1964.

Tulsa Metropolitan Area Planning Commission, 1975 Metropolitan Tulsa Airports and Their Relationship with Surrounding Land Uses, Tulsa, Oklahoma, June, 1960.