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AN INFORMATION SYSTEM FOR URBAN PROPERTY INVESTMENT ANALYSIS

A thesis submitted in partial fulfilment

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by

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Abstract

Considerable potential exists for the development and provision of information able to assist urban property investment decision-making. This thesis revolves around the potential of information as a productive resource to the analysis of real estate investments.

Current information requirements are suggested to be related to the type of analysis carried out by practitioners. The current state of the art of property investment analysis is reviewed, incorporating a survey of practicing analysts. The potential of information as a resource to the real estate analysis field is investigated and related to major changes taking place within the property environment. The nature and components of a number of information sources are considered while reviewing the current status of information services to the property analysis field; it is concluded that current information sources are inadequate.

Potential for the development of an information system within this field is identified; it is suggested that the ability to achieve this potential is becoming a reality. The direction of future developments are considered in the conceptualisation of a comprehensive information system that could develop within the field of property investment analysis. The ability to move in the direction of achieving a comprehensive system is illustrated in the development of a specific computer-assisted information system. The purpose of this system, is to provide decision-support information on the financial feasibility of predefined investments; an application of the computer-based system (model) illustrates the type of approach to investment analysis, made possible through the availability and use of the model. Finally, areas offering the potential for further research and development are discussed.

Keywords : Information; System; Decisions; Management; Property; Model; Computer; Investment Analysis; Real Estate.

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INTRODUCTION

The Nature of Property

The image of property is held by many to be the tangible objects of bricks and mortar, and of land and all its natural features. Yet the concept of property encompasses more than land and buildings. It embraces physical, aesthetical, environmental, social, legal and economic attributes which interact upon each other to create the unique characteristics of each and every unit of property.

Property has been described (Speedy, 1974) in terms of rights - property means any right which gives an owner of an asset an indefinite power or liberty of use or disposal. It includes any estate or interest in both real or personal property, and any bad debt or thing in action, or any right or interest. This definition introduces an important distinction between the physical object and the rights of ownership. The "bundle of rights" concept (Denman, 1978) identifies property as consisting of a number of tangible (visible) and intangible (abstract) rights, each which can be bought or sold (Barrett and Blair, 1982); the aggregate of the rights is property, each individual right in itself is not (Denman, 1978).

Land

In its widest sense, land is regarded as all natural resources created without human hand (Speedy, 1974). It includes not only the surface of the land but everything beneath and above the surface, and carries with it rights to the air space above the land (Jefferies, 1978).

For the legal transfer of land, a formal wide definition is used; land means all land, tenements (property subject to tenure) and hereditaments (inheritable property), whether corporeal or incorporeal, and all chattels or other interests therein and all trees growing or standing thereon (Frizzell, 1979).

Property

In general terms property has a number of meanings depending upon the context in law as to what is owned. The distinction is important when considering property as an investment.

Real property means land and buildings and is sometimes called realty. It refers to the rights inherent in the ownership of the physical real estate. Personal property generally refers to moveable items such as chattels, the key being its non-fixed, non-permanent nature. Real estate is the term given to the physical land and buildings, and other structures permanently fixed to the land (Jefferies, 1978).

Ownership of Property

In New Zealand, the concept of ownership evolved from the laws of England dating back to the fuedal days. It had often been thought that an owner had complete freedom to do as he pleased with his property, even if using it to the maximum economic advantage involved waste or destruction. The ownership of land has however, always involved some degree of restriction, as it has been subject to the rights of the crown in Parliament and to the fundamental common law Doctorine of Nuisance (Speedy, 1974).

Absolute - Simple Ownership

The Crown, who acquired the land by conquest or by cession, holds the absolute ownership of the land with unrestricted freedom of acquisition, use and disposal. This freedom is commonly exercised, such as in the resumption of land under the principle of the Doctorine of Eminant Domain. Owners rights to things in the soil or earth such as minerals, petroleum and geothermal power are reserved to the Crown by statute. The right for aircraft to fly in air space is also provided for by statutory provisions.

Freehold land is often referred to as an estate is fee simple and is the highest form of ownership able to be held by an individual in New Zealand; "fee" refers to the ability to pass by succession, "simple" refers to the degree of ownership.

Content of Ownership

Property right is a form of power and Denman (1978) relates the content of ownership to a number of powers;

- power to use
- power to alienate or transfer the rights of property
- power to pass by succession
- power to claim title to
- power to assimilate, which refers to the accumulation of wealth incorporating the ability for property to provide the necessary supportive resources to put the land and wealth to productive use.

Denman (1978) reports that the powers of ownership have been eroded over time. The public concern which has evolved in recent years over pollution and aesthetics, and for the social and economic well being of society, have justified in the eyes of the planners and decision makers, the increasing control placed on the use of land in recent years. A property owner has the underlying right to use and develop his land to best advantage, however now within the town planning as well as the statutory and common law limitations.

Expanding Property Base

The disruptions of the second World War enabled many countries to develop a new philosophy and approach to economic and social well being. A new direction was suggested by Maynard Keynes; he taught the Western World to examine economics in terms of the "whole" rather than the parts - ever since then, economists and politicians have become addicted to attempting to control the fortunes of nations by drawing up national plans (Denman, 1978). Economic planning and land use planning have evolved from this addiction.

Keynes's teachings had a major influence on the direction of national development - he suggested a simple paradox; the more spent on investment, the more saved, riches multiplied where wisely spent. The message was accepted by the post war world, which was then in a position to put the philosophy into action. The criteria of economic success became the degree of economic growth in a nation, measured in aggregates (Denman, 1978).

Economic growth from income ploughed back in investment, meant more factories, more shops, more harbours, more houses and hotels, and more warehouses. The age of economic growth was also the age of the Third World - great dams, harbours, and new town complexes took form.

From these developments emerged a new awareness of the economic and social significance of property, especially in the rapid transition of land from its rural to an urban state, and of property rights in resources. Property was rapidly gaining in importance.

From the individuals point of view, the urge to personal and economic freedom to choose and own, is strong in western man. The reason for owning property originally revolved around its value in use. Epley and Millar (1980) have suggested that this concept incorporates aspects of :

(i) price in ownership - property gives the owner something to visit, live in, touch, show to friends, paint, repair and model. In short property can reflect feelings of pride in accomplishments.

(ii) leisure - recreational property can serve as an instrument and as an outlet for leisure activities.

(iii) retirement asset - depending upon local market conditions, by purchasing property at an early age, a person can obtain a sizeable net worth by retirement age.

And in more recent years,

(iv) high returns - the return of income from property can equal or exceed returns from alternative investments such as stocks or bonds.

(v) income tax benefits - the ownership of property can create tax shelter than reduces the total tax liability.

A further reason for owning property, and one which has attracted overwhelming attention to real estate in recent years, is the value of property in exchange. This concept incorporates aspects of :

(i) capital gain - property is attractive for speculative purposes. A great deal of the attention directed at property in recent years has arisen from its potential to provide capital gain.

(ii) hedge against inflation - property is generally viewed as an asset which keeps pace with, and often exceeds, increases in the prices of other goods.

The value in use and value in exchange attributes of property ownership have stimulated over the years, the expenditure of vast amounts of capital and labour - physical and mental - on property, by individuals and firms.

The development of property, on behalf of individuals and nations, over the last century has been dramatic. Property has grown to command a great deal of attention and a large share of the resources of individuals, organisations, and Government. The increasing importance of property has over the years, stimulated the emergence and development of a number of property based professions. The nature and the function of these, has been moulded by the way in which property has developed. In order to gain an understanding of the property analysis field as it exists in New Zealand, the following discussion attempts to examine briefly the way in which that field developed.

Historical Development of Property Analysis in New Zealand

The history of New Zealand has been interwoven with the importance of land in the economy. "The first act of the Governor, the Treaty of Waitangi, dealt principally with land; Wakefields theories of colonisation had as their central core a sufficient price for land; Grey's 1853 cheap land regulations encouraged settlement; the Maori wars were fought over access to the land; the Vogal era was based on the opening up of the land by expenditure on public works; the Liberals rose to power on their land policies; the questions of leasehold, freehold and cheap finance were burning issues in the early years of this century" (Babe, 1974).

With land at its core, the economy as a whole was tuned to land related matters. As land was all important it brought forward the need for those professions aligned to it. A diverse and disjointed group of individuals emerged with "professional" interests in property, such as surveyors, valuers (or valuators as they were then known), land agents,

auctioneers, architects, engineers and appraisers. Individuals within this group were unable to be identified by function or by task; anyone who considered they had the necessary skills, was prepared to undertake any property related task. It was only towards the end of the nineteenth century that any trend towards specialisation could be identified.

Land Agents

One group of individuals to emerge were those who could be described as the founders of todays real estate agents. These individuals had a twofold interest in property : firstly, they acted as agents in bringing together buyers and sellers, and secondly, the collection of rents for absentee landlords. Disparities of wealth have always meant that some individuals own property and others who are unable or unwilling to, rent property. During these early years, many land owners were not interested in occupying their land but in leasing their sites for whatever rental could be obtained (Babe, 1974). This landlord/tenant relationship has existed throughout history and it appears it formed the basis for early property management.

The functions of these agents can be traced back to well before the turn of the century. The Baker Brothers Estate Agents Limited, one of the oldest real estate firms (founded in 1877) was for example, performing at that time what could be simplistically described as property management. "The property management side was big in grandfathers days - he even had a man employed full time as a rent collector, whose sole job was to go round on his bicycle collecting rent ... " (Real Estate, July 1977). It appears that it was this function that set the term property manager and rent collector as synonomous.

Valuation

From the time of European settlement, the increasing importance of land created the need for individuals able to conduct acceptable property valuations. In the early days the land surveyor was most in demand and generally the practice of valuation was an adjunct to that profession. The early practice of valuation relied almost entirely on experience. Individuals were following procedures acceptable to the communities from which they had come. In valuation, as in all other property based

practices, the early settlers had no desire to innovate. Individuals conducting property valuations generally operated independently, although much of the work was done under contract for the Government. This created problems, as sometimes a number of valuations were performed by different people on the same property, often resulting in a number of substantially different value estimates and general confusion (Babe, 1974).

The Liberal Government's solution to the fragmentation of valuation practice was the passing in 1896 of the Government Valuation of Land Act. This in effect created the Valuation Department, which was charged with the duty of estimating the value of property in New Zealand for taxation and other Governmental purposes, and in specific instances for local rating purposes.

The general prosperity of the early years of the Twentieth century, coupled with the Liberal Governments's concentration on land development, both urban and rural, encouraged the rapid development of towns. Accompanying this was a substantial increase in land and property prices. As a result, the services of those involved in real estate, both Governmental and private, became more in demand. The situation soon developed where many individuals were devoting all their time to the property sector.

Not surprisingly, the freedom of entry to the property based practices resulted in many different attitudes and approaches to real estate, widely differing methods and techniques, and the emergence of fundamental problems, such as unethical behaviour. Individuals concerned with these issues responded by promoting the formation of various groups or associations able to represent and provide some order to the disjointed practices that had emerged.

Real Estate Institute

Although minor associations had formed on a regional basis, 1916 saw the formation of the Dominion Estate Agents and Auctioneers Association of New Zealand. Although only three districts were represented at the inaugrial meeting, this association prospered to become what is now known

as the Real Estate Institute of New Zealand (Inc). It appears that one reason for the formation of this association was to create a unified group of practitioners with some backing and political influence, which could approach Government and other authorities on issues seen as important at the time. Later developments saw, amongst other things, the introduction of examinations and controlled entry.

Valuation Institutes

Those involved with the practice of valuation recognised and responded to the need for formal recognition. Individuals promoted the formation of regional bodies and although enthusiasm was initially lacking, various associations subsequently formed:

- Real Estate Valuers Association of Auckland (formed in 1910 and later renamed the Auckland Valuers and Arbitrators Association).
- The North Island Land Valuers Association (1923).
- The New Zealand Government Valuers Institute (1936).
- The Auckland Municipal Valuers Association.

It appears that the early valuation associations had, in the main, similar motives and objectives. These were a recognition of a common valuation methodology; a uniformity in examination requirement, syllabus and practical requirement; a desire for statutory recognition and backing; and the exchange of ideas and experience. It was not until 1938 that the valuation profession of New Zealand came together under a single nationwide valuation institute (introduced below).

The post World War I period saw a severe drop in the prices for primary produce, and prices for farm property plummetted. In general however, urban property values did not fall. For the cities, the twenties was a period of extensive commercial and residential development as the pace of New Zealand's change from a rural to an urban society became more pronounced (Babe, 1975). Urban development was characterised by a substantial growth in residential sectors. This was stimulated by large sums of money made available through the State Advances Office, for lending on residential properties, sometimes up to 95% of valuation. All this increased activity swelled the ranks of those involved in the property sector.

Similar developments, but on a more pronounced scale were taking place elsewhere in the world. The turn of the century saw for example, America attempting to address the problems of congestion and overcrowding in urban areas, by developing multi-storey buildings and particularly the tenement apartment building (McMahan, 1976). These were seen by developers as the logical answer to increasing the intensity of land use, for commercial as well as residential, in the presence of rapidly rising urban land prices. Property was rapidly gaining in importance.

The 1920's saw a rapid growth in the New Zealand economy. In order to provide the housing, the commercial and industrial buildings for the surge in the New Zealand economy, large sums of money were devoted to new construction. Urban areas experienced rapid expansion. It is interesting to note that it was around this time that "society" began to plan for urban development on a general scale. The spread of cities and urban areas in New Zealand, demonstrated the need for orderly planning, and in 1926 the Town and Country Planning Act was passed.

During this time, rising property prices encouraged increased land speculation. This attracted to the property sector, individuals with more than a fundamental interest in the physical attributes of real estate. The opportunity for investment in property was becoming more widely recognised.

Urban property prices reached their peak in 1929 and along with the rest of the economy plunged into the depths of the great depression of the early thirties. By 1932 the earnings of farmers were on the average 42% lower than for the period 1926 to 1930, and this loss was reflected throughout the economy (Babe, 1975).

During the depression activity in the property market was greatly reduced. Wages, rents and interest were cut, many mortgages were foreclosed while other mortgagors accepted what interest they could obtain. Shops and business premises became vacant, but not extensively so as most landlords chose to carry the tenants at nominal rentals rather than have vacant premises (Rolle, 1976). Properties became virtually unsaleable. One real estate firm did not register a single sale for a period of six months - "We survived on the commission on rents collected and a little valuation work" (personal communication, R. Baker).

Various moves to ease the plight of property owners were introduced by Central Government; the 1931 mortgage moritorium available to farmers was extended in 1932 to urban property holders. The Mortgagors and Tenants Relief Act (1933) provided for the postponement of capital repayments under mortgages for two years, and reduced rates of interest. The first attempt to deal with capital adjustments came with the Rural Mortgagors Final Adjustment Act (1935). Before action could be taken however, this legislation was repealed by the incoming Labour Government, which replaced it with the Mortgagors and Lessees Rehabilitation Act (1936). This was of special interest to those concerned with real estate as it was based on the value of property. It provided for an immediate and final adjustment to mortgage liabilities both as to capital and interest, and to the outstanding rents payable under leases. It applied to both urban and rural properties. Of the 34,500 applications for relief, 21,000 went for hearing before the commissions set up to administer the legislation; 10,000 rural and 11,000 urban (Babe, 1975).

The severity of the above measures serve to illustrate that during these troubled times, the property sector was subject to overwhelming intervention by Central Government. Never before, for example, had valuations both Governmental and those provided by private practitioners been required on such a large scale, to be subject to such searching scrutiny before a judicial tribunal. Many of the decisions were reported, and valuers were given a ready guide as to what was expected of them.

The review of the liabilities of mortgages and leases was completed by 1939. However, in 1936 the Government had passed the Fair Rents Act which was subsequently amended numerous times. This particular piece of legislation was to be a source of concern and employment for individuals involved in real estate, for over 30 years.

Many saw the depression as a useful period for the property based professions as a whole - "The weedy individuals of the early twenties went to the wall, and only the solid and reputable concerns kept afloat" (Rolle, 1976). From this period on, the associations representing the property professions appeared to gain strength.

National Institute of Valuers

Although almalgamation had been suggested some ten years earlier, in August of 1938, the New Zealand Institute of Valuers (NZIV) was formed. This replaced the individual associations which had formed prior to 1938, and represented the first national association of valuers. At that stage, the Institute had no statutory recognition or backing.

The following year saw the outbreak of World War II. As the war intensified and moved to the Pacific, the property sector was again subject to statutory intervention. The Government saw it necessary to implement a policy of economic stabilisation. Part of this policy was the control of prices, and in conformity with this, the level of property prices was stabilised (as at 15 December 1942) by the Servicemans Settlement and Land Sales Act, 1943.

Under this act a firm control was placed on the sale prices of all real property, and tribunals were set up to administer the legislation. The valuation of property was under strict control and because land sales control was in force, real estate agents were not required to sell property. During this period the property practices experienced little in the way of development. The Act remained in force until 1950, when in January of that year urban property was freed from control, followed by farm land in November.

In 1948 the Government took steps to formally recognise the profession of valuation. In that year the Valuers Act was passed setting up the administrative machinery to compile a register of valuers and to raise the status of the NZIV. Since 1948 the responsibility for the development of the valuation profession in New Zealand has rested with the NZIV, and the Valuers Registration Board, itself created by the Institute.

By the middle of the twentieth century, both the Institute of Valuers and the Real Estate Institute were well established. Both organisations had recognised and acted on the need for the controlled development of each practice. Education was seen as a fundamental part of that development. The Real Estate Institute reported its first examinations in 1927 with 111 entries (Real Estate, June 1975). In 1928 the need for controlled entry to

the valuation profession (including examination requirement) had been voiced, however it was not until 1949 that this became a reality, stemming from the power given the NZIV under the Valuers Act of 1948 (Babe, 1975). Since these times, the education requirement and the facilities enabling the achievement of this requirement, have been continually revised and undated, and are now comprehensive. These facilities will be outlined later in this study.

Since their formation, both organisations have developed to an extent where they are able to exert considerable control over practicing individuals. Their influence has extended to control the type and direction of activity together with the methodology used and importantly the conduct of individual members. Today, both organisations appear to be well founded with the basic aim of developing, maintaining and protecting the professional and practical interests of members.

Increasing Investment Potential

Demand for Rental Space

Over the last 30 or so years, the potential for investment in urban real estate has greatly increased. This has stemmed, in part, from an increase in the demand for rental space; many commercial and industrial organisations preferred to retain their capital for market research and expansion rather than commit it to long term property ownership; expanding companies and relocating corporations created a high demand for commercial and industrial space; zoning and other Government restrictions, citizen action groups, and the high cost of construction and financing have prevented, in many mature real estate markets, new construction and renovations keeping up with demand - at the same time physical deterioration and functional obsolescence caused by normal ageing and innovations in energy efficient building materials and systems, have reduced supply (Korpacz and Roth, 1983); increasing land prices have encouraged an intensification of real estate in central business districts; the increasing mobility of individuals, coupled with an alarming increase in the cost of construction, and of established residential properties, has increased the demand for residential rental space.

Increased Returns from Property

These forces joined with cost push inflation to stimulate dramatic increases in rental levels for urban property. Because investment property prices are strongly linked to potential rental income, spiralling rents promoted a rapid increase in the price achievable for investment property.

The effect of these trends is to create unusual opportunities for higher rates of growth in the cash flow and equity value of investment property.

Investment opportunities in the real estate sector were recognised by a wide variety of individuals and organisations, some with little or no knowledge of property and property related matters. The farming community for example, recognised the opportunity to spread their capital investments into the commercial sector and thereby cushion their income in times of market fluctuations. These individuals turned to anyone seen to have the knowledge and the skill in real estate matters to provide investment advice. Because they were continually involved with the property market, and were tuned to the financial aspects of it and the general economy, practitioners such as lawyers, architects, real estate agents, consultants, accountants, engineers, surveyors and valuers were called upon to provide advice on specific or general property investment matters.

All this increased activity in the urban sector stimulated a growth in the size of and the number of commercial, industrial and residential properties offering rental space. Typical investors were not interested in providing the day to day management of their investment properties and passed the task on to "specialists". Again a wide variety of individuals and firms took on the property management function. Although a greater involvement with the property was encouraged by such institutes as the Real Estate Institute of New Zealand, this function traditionally comprised the collection of rents, the supervision of maintenance, and as far as possible ensuring minimum vacancies.

The last decade has been an important period of development for the New Zealand property based professions. The growing importance of property and the rise in the number of individuals involved with the real estate

industry, lead in 1977 to the formation of the Property Management Institute (Inc) if New Zealand. The main objectives of this organisation are to provide a professional society for men and women engaged in property management, to provide for the training, the education and examination of candidates for admission to membership of the Institute, to foster high ethical standards and to secure and maintain public recognition of the Institute for the benefit of its members (Property Management Institute Yearbook, 1983). The Institute currently have branches in Auckland, Hamilton, Wellington, Christchurch and Dunedin, as well as an overseas branch. It is comprised of individuals from a wide range of backgrounds including valuers, engineers, surveyors, real estate agents and accountants. It appears to be well founded with a growing membership (542 at the 30th June 1983), and is likely to play an important role in the future development of property management in New Zealand.

Investment Analysts

It becomes apparent that over the years, the opportunities and the magnetism of property have attracted to the field of property investment analysis, individuals from a wide range of professions and backgrounds. The development of the investment analysis field, and an analysis discipline, has been haphazard; it is characterised by individuals whose primary expertise lies in other directions, such as real estate brokerage, valuation, financial consultancy and basic to more involved property management. These individuals have largely relied on intuition and on experience to survive professionally.

The following discussion attempts to illustrate that the growing complexity of the property sector and the economy in general, is making this intuitive approach increasingly difficult.

The scope of this study revolves around one of the factors leading to the establishment of an improved discipline with respect to property investment analysis. It will become clear that the achievement of an improved discipline is reliant on two factors. The first is attaining an improved standard of education and degree of competence on behalf of

analysts, with respect to the development of a broad analysis background and specific analytic skills. The second is the development of effective information services to analysts, enabling the acquired skills to be put to use.

The primary objective of this study is to lay the foundation, and to provide a general direction, for the development and achievement of superior information services to individuals involved in the analysis of urban real estate investment. The aim of this study is to focus on the potential of information as a resource to investment analysis, and to consider the potential for the development of an information system within the industry. Chapter one examines the nature and the general characteristics of information leading to its potential as a resource, and examines the factors leading to the specific potential information offers the real estate analysis industry. Chapter two draws from this discussion in reviewing the current status of information services to the industry, and examines in some detail the future potential of an information system within this industry. A number of ideas are combined in chapter three which attempts to conceptualise the nature of an information system that could be developed within the industry.

The study centres on the development of a computer assisted information system for investment analysis. The aim is to develop an autonomous investment analysis model able to provide decision support information with respect to the financial feasibility of a specific investment in urban property. Although actually designed and developed as an information system independent and complete in itself, the study conceptualises and introduces the model in the context of, and as a component of, the comprehensive information system considered in chapter three. Chapter four provides a detailed coverage of the nature and the components of the investment model. Chapter five provides an example application of the model, in an attempt to illustrate the type of approach to the analysis of any particular urban property investment, made possible through the availability and use of the model. Finally, a number of conclusions drawn from the study are presented, together with areas offering potential for further research and development.

CHAPTER ONE

Information : An Evolving Resource

> "Man is today confronted with an evergrowing abundance of facts and information owing to rising standards of literacy, education and knowledge, the proliferation of information producing organisations and increasingly sophisticated means of communication."
>
> C.S.Barnard

The decision-making process in real estate investment rests squarely on information available to investors, analysts and policy-makers. The objective of this chapter is to examine the nature and the characterisics of information that combine to lead to its potential as a productive resource, and to consider the status of information as a resource to property investment analysis. The discussion attempts to review the past treatment of information within the property analysis industry, and to consider the potential that this resource offers the industry.

1.1 The Nature of Information

Much of the literature which concentrates on aspects of information and information systems (Bonnen 1973, Bonnen 1975, Barnard 1979, Blackie and Dent 1979) suggest that there is no single theory of information; the theories which have evolved have been developed to focus on the unique aspects of the disciplines from which they emerged (Riemenschneider and Bonnen, 1979). It is therefore helpful to develop a general framework for understanding information. The following discussion attempts to descibe the nature of information, to make clear the difference between data and information, and to stress the important concepts inherent in the effective development of the two related by distinct resources.

1.1.1 Data and Data Systems

Every data system involves an attempt to represent some aspect of the real world. Data are the result of measuring or counting. Bonnen (1975) identifies three distinct steps which must be taken to produce data able to represent some aspect of reality; these are conceptualisation, operationalisation of the concept, and measurement.

(i) Conceptualisation

Conceptualisation involves defining the aspects or the concepts of the real world which are to be measured - a set of concepts able to provide a greater understanding of some portion of the real world are developed: the concepts are a representation of some aspect of reality, data are a symbolic representation of these concepts (Bonnen, 1975).

(ii) Operationalisation of the Concept

A concept is an abstract idea (Riemenschneider and Bonnen, 1979) and as such it is unable to be measured. The data system involves a transformation or an operationalisation of these concepts into variables (categories of empirical phenomena) which are able to be measured; defined through the concepts they attempt to represent, these variables are as highly correlated as possible with the reality of the "object" of study.

(iii) Measurement

The final stage in the development of data is measurement, which follows from the statisticians' usual definition of the term.

Reliability of Data

Data collection, then, is made up of three distinct steps that represent the essential components of the data system; conceptualisation, operationalisation of the concept, and measurement. With these aspects in mind, Riemenschneider & Bonnen (1979) have suggested that statistical reliability takes on three meanings:

(i) reliability of the concept - is the concept an accurate representation of reality and are the concepts pertinent to the decisions being made.
(ii) reliability of the variables representing the concepts, ie the categories of empirical variables should be as highly correlated with the conceptual representation of reality.
(iii) reliability of measurement.

This categorisation is generally supported by that of Barnard (1979), who breaks data reliability down into three closely linked components of accuracy, relevancy and comprehensiveness, as follows.

(i) accuracy implies the estimates of particular phenonema are not significantly different from their true population parameters (reality).
(ii) relevancy implies that they are suited to the purpose in hand.
(iii) comprehensiveness implies that all the variables are included which have a significant bearing on the outcome of the analysis.

The failings and limitations of any one of the components of the data system (conceptualisation, operationalisation, and measurement) constrain and limit the quality and characteristics of the data produced (Bonnen, 1975). The great improvements in statistical methodolgy and data processing techniques over the last few generations for example, cannot offset a failure at the conceptual level, ie the system may be measuring the wrong thing.

1.1.2 Information and Information Systems

Data are not information. Bonnen (1975) notes a confused but common vocabulary erroneously equating data with information, and a general failure to distinguish the distinctive steps in the process by which data and information are produced.

Decision makers rarely use raw data. Rather, there are intervening acts of interpretation and analysis which transfer the data into information by placing them in a specific problem-solving context. For data to become information, they must become associated with a problem and be useful for problem solution (Riemenschneider and Bonnen, 1979); hence, "data processing" and "information formation" can be separated conceptually (Eisgruber, 1973). Symbolic data acquire most of their "meaning" and value from the context and design of the information system in which they appear; an information system not only includes a data system, but also the analytical and other capabilities necessary to transfer the data into pertinent information (Bonnen, 1975). Given this understanding of an information system, three major components of the system become obvious : a data system, the analytical capability necessary to transfer the data to information, and the decision-maker.

Figure 1.1 provides a diagramatic representation of the components, and the component relationships, of an information system.

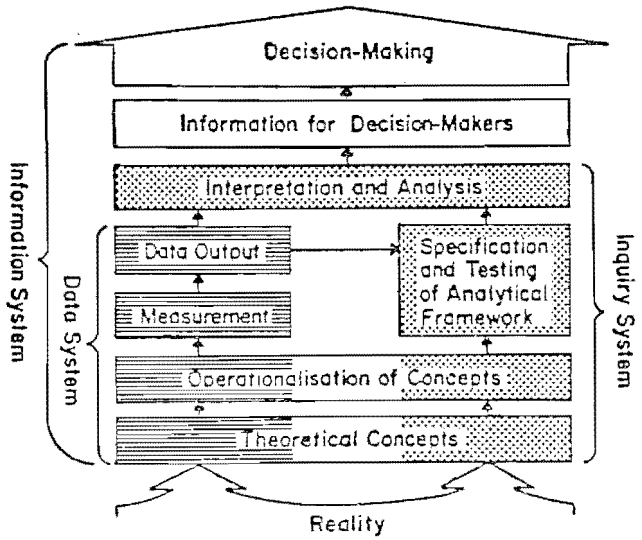


Fig. 1.1 An Information System : Components and Relationships
(Source : Bonnen, 1975)

1.2 The Value/Potential of Information

The potential and the value of information as a resource arises from its ability to aid problem solution and decision-making (Eisgruber, 1967).

Uncertainty and Decisions

The need to make decisions is a direct result of the uncertain environment facing the human species, coupled with their desire to make rational choice from alternative courses of action; if knowledge were complete (that is if there was no uncertainty), decision making would not be necessary because the desirable course of action in any situation would be simply a matter of logic in the light of the individuals objectives (Barnard, 1979).

Information and Uncertainty

Uncertainty (imperfect knowedge) introduces tangible costs because decisions made and actions taken are unlikely to be optimal in light of the decision makers objectives. Bonnen (1973) suggests that the cost of poor decisions and subsequent lack of appropriate information is extremely high. Barnard (1979) describes these costs as "net opportunity costs" being the difference between the returns that would have accrued to action based on perfect knowledge and the returns actually realised in a state of imperfect knowledge.

Information relevant to a problem reduces, if even to only a small extent, the degree of uncertainty that prevails so that better informed decisions can be made; appropriately designed information reduces uncertainty and allows decision makers to manage its undesired consequences (Bonnen, 1975). Hopefully, improved decisions lead to a more effective action - approaching the optimum - than if the information had not been available; the payoff is increased and net opportunity costs reduced (Barnard, 1979).

1.3 Characteristics of Information as a Resource

In addition to those outlined above, information possesses a number of characteristics and attributes which lead to its potential as a productive resource. The following discussion attempts to outline a number of these, and to provide a greater understanding of the nature of the resource.

1.3.1 Dynamic Resource

Information is, and must be developed as, a dynamic resource. Bonnen (1975), argues that one of the essential elements of an ideal data system is an internal capacity for renewal or redesign of the data system itself. He suggests that in the absence of this element, two types of obsolescence will evolve within the information system.

(i) Conceptual Obsolescence - conceptual obsolescence can be broadly described as a change in the questions which the information system is expected to answer, without an associated change to the conceptual base of the information system itself; when normative or positive change occurs either in the object being represented by data, or in the environment of the object, conceptual obsolesence is almost certain to follow (Bonnen, 1975).

(ii) Institutional Obsolescence - rapid or steady long term technological, organisational, and associated value changes create obsolescence and mis-matching in the institutional structure of statistical systems; as a result of institutional obsolescence or reorganisation, current administrative structures often do not bring the necessary information together at the time and places in the structure where it is most needed by decision makers.

While providing no definite solutions on how to construct the components leading to a dynamic system, Bonnen (1975) identifies that the capacity for renewing any system must involve feedback or learning loops within the information system itself. Hampson (1981), also promotes the control-through-feedback philosophy of system design.

Information and Time

Barnard (1979) identifies the potential for obsolescence within data itself; existing stocks of data become obsolete very quickly, so that a regular flow of new data is required just to maintain the status quo. Eisgruber (1967), supports this suggestion linking the continuous evolution of new problems with a continuous need for new data. Stemming from the potential for this type of obsolescence, an important characteristic of information is that it is specific to a time and situation. The value or potential of the information therefore decreases as time and conditions change. By and large it is not a resource which is able to be stored or accumulated (unless this was the purpose of assimilating the information), this characteristic distinguishing it from many other resources.

It would appear that the requirement for dynamic design exists at two levels; the continued effectiveness of the system itself is reliant on its ability to develop with and adapt to changing conditions and system requirements, and at the supply level, the information provided must be dynamic and continuous to cater for the specific information requirements placed on the system.

A characteristic detached but related to its dynamic nature, is that information is not a free good; the acquisition of information requires the prior application of other resources in a similar way to the general production process. Because the basic inputs (resources) necessary to develop or acquire information are not set and static over time (as is the case for a number of goods), they are able to be changed and adapted with time to suit the changing requirements of the information system. This attribute enhances the potential for the continued development of information as a dynamic resource.

1.3.2 Quality of Information

The increasing availability of data and information does not in itself mean that individuals, businesses, government agencies or society as a whole are better informed than in the past. Barnard (1979) suggests that this is due to questions of information quality and usefulness to the recipient.

In addition to questions of accuracy and reliability (discussed above) there are several possible reasons for information being useless. Nelson (1967) lists these as:

(i) Irrelevant data resulting from inadequately specified objectives.

(ii) Partial data useful for limited objectives may be useless for further analysis because of missing physical quantities of data.

(iii) Inadequately identified data useless for further objectives beyond those defined prior to collection.

(iv) Over aggregated data caused by aggregation within the system prior to permanent storage.

(v) Trivially detailed data restrictive at the collection and storage level as a glut on resources and facilities. Data carrying more detail than needed can be quickly aggregated and for this reason are not "useless".

Eisgruber (1967) is also concerned with the quality of information and stresses the danger of amassing mountains of useless data. He relates the management and control of this danger to the purpose of the information system; the objective is providing a means for supplying the decision maker with information - the particular challenge in the development of information is evaluating data with respect to their potential usefulness for decision makers. It seems that the quality of information as a resource is, in part, dependent upon the degree to which the information system meets this challenge.

1.3.3 Economic Considerations

There are a number of characteristics of information which combine to affect its allocation as a resource in the economy. It possesses a number of attributes of public goods which lead to allocation inefficiencies when compared to purely private goods in a competitive market. Riemenschneider and Bonnen (1979) broadly labelled these as uncertainty, indivisibility and non-appropriability. The following discussion, briefly outlines the nature of these characteristics.

Non-Appropriability and Resource Control

The suppliers of information are unable to fully realise the returns to information production since they are unable to charge for further uses of the same information once it is disseminated. The non-appropriability of information stems, in part, from a difficulty in controlling the resource. The advantage held by individuals or organisations with exclusive use of information encourages the holder to exert strict control over the resource. To obtain a return from it, they must put the information to productive use. In doing so, they lose control over the resource as the general nature of the information is directly or indirectly dispersed to other users. In disseminating information, supplies automatically lose a certain amount of control over the resource; in utilising the resource, information holders also automatically lose a certain degree of control over the resource.

Non-Exclusive Resource

A characteristic adding to the potential of information as a resource, however also adding to the difficulty in controlling information, is its non-exclusive nature; information is able to be utilised by as many users as have access to it, and futhermore, such use does not deplentish the resource. Reselling or redistribution of information is possible and is encouraged by the characteristic of increasing net returns in the use of the resource.

Indivisibility of Information

Information is generally unable to be divided up into a number of parts, either for use or dispersal. If it is to be passed to other users, the information must generally be transferred in the form it was obtained. In addition to this, the wide dispersal and use of information does not deplentish the resource. These factors, coupled with the high fixed costs usually associated with acquiring the resource, create the potential for increasing net returns from information; the initial purchasers or users of information are able to pass along the information at a cost lower than the original supplier (Riemenschneider and Bonnen, 1979). The fact that the original suppliers are unable to charge subsequent users creates allocation inefficiencies in that the high fixed costs of acquisition cannot be spread over all users.

Uncertainty of Value

From an economic point of view, a characteristic of information greatly affecting its efficiency of allocation is its uncertainty; the existence of uncertainty is inherent in the definition of information.

The value of information is discovered only in a decision-making context, so the demand for information is determined by its value to the decision process of individuals, firms and other users. A decision maker or purchaser of information does not know the exact value of information until it is obtained and used (Riemenschneider and Bonnen, 1979). Furthermore, because the value of information arises from its ability to aid decision making, a primary determinant of the value of the resource will be the value of the decision(s). Individuals and firms are likely to benefit differently from the improved decisions resulting from the availability of information - a further characteristic of the resource is that its value is user specific. Complicating this is the fact that the value to any particular user alters over time with changing conditions, questions and decisions.

It becomes apparent that the determinants of value for information as a resource, from an economic and a productive point of view, are less than "normal" in the purely competitive market sense of demand and supply. The nature and characteristics of the resource introduce uncertainty with respect to the value placed on it by developers or suppliers, and by the purchasers or eventual users of the resource.

1.4 Real Estate Investment Analysis

Past Analysis Practices

Historically what might be broadly labelled the scientific approach has been absent from the field of real estate investment analysis; while in other disciplines, mastery of the subject has been achieved through academic study, in real estate, expertise has been the product of accumulated experience (Roulac, 1974). There are two fundamental reasons for this; firstly, in the past, the decisions facing property analysts and investors have not been particularly complex, not requiring a great deal of analysis or a detailed consideration of the risk involved. Hiban (1982) reports that the post World War II economic boom was characterised by low interest rates, advantageous tax treatment on real estate investment, high market demand, a "laissez faire" attitude, and relatively stable prices; investment in property was by and large unchallenged by external forces, and enjoyed a state of equanimity. Secondly, the parameters, the evaluation models, the analytic skills and importantly the information base needed for superior analysis has been lacking (Roulac, 1974). Traditionally, because of the difficulties, the dislike and the lack of knowledge on how to deal explicitly with the complexities or uncertainties (risk) that did exist within real estate, most analysts and investors based their decisions on an intuitive analysis of the investment; the four elements of implicit analysis - judgement, hunch, instinct and intuition - made the final decisions (Pyhrr, 1973).

Past Attitudes to Information

Because the "state of the art" accepted decisions based on implicit analysis and intuition, there was no incentive for the development of superior analytic skills and in fact little opportunity to use them (Roulac, 1974). Resulting from the acceptability of this approach to investment decision making, the industry had no perception of, and consequently placed little emphasis on the development of information as a necessary and useful resource; comprehensive market data and information was not seen as a pre-requisite for effective decisions.

1.4.1 A Changing Environment

A great number of articles and books (Toffler 1970, Bonnen 1975, Brabb 1976, Toffler 1980, Toffler 1983) from a wide range of backgrounds and disciplines have, over recent years, identified and outlined major changes which are taking place to the structure, the organisation and the economics of society and its institutions. Much of the literature which has emerged from the property analysis industry over the past decade or so, have identified fundamental structural, organisational, and economic changes which are taking place within real estate, and have outlined the affect these changes are having on the property investment environment (Kaimann and Rasmussen 1973, Roulac 1974, Spivak 1975, Roulac 1977, Hiban and Stalick 1981, Downs 1982, Hiban 1982, Beard 1983, Korpacz and Roth 1983). Because they are likely to have a major impact on the potential and the requirement for information as a productive resource, the following discussion attempts to briefly outline the nature and the likely consequences of the major changes surrounding real estate.

(i) Finance

Barrett and Blair (1981) describe finance as the life-blood of the real estate industry and one of the major links beween real estate and the larger economy; the role of finance is so important that government policies are often designed to affect the real estate market through the financial sector. Epley and Millar (1980) explain the importance of finance to real estate investment in terms of decision making - decisions about the acquisition of funds are often made at the same time as decisions about the selection of investment projects.

Over recent years, a vertual revolution has occured in real estate finance that has immensely affected all aspects of real estate, including property management and investment analysis (Downs, 1982). The role of financiers in investment property has been changing from one of passive participation to one of sharing control and benefits with equity owners (Barrett and Blair, 1981). Inflation is largely responsible for this revolution.

Inflation and Finance

Up until the start of the decade, lenders were prepared to make long term mortgage loans at relatively low rates of interest, in the belief that whenever the rate of inflation went up it would soon fall to a "reasonable" level again. Inflation however, accelerated through the 1970's turning fixed payment loans into falling payment loans in real terms. Even though nominal interest rates rose, the true cost of borrowing declined sharply as inflation accelerated; it became highly profitable to borrow money, buy real estate and let rapidly rising prices build up equity gains that were enormous compared to the initial investment (Downs, 1982). On the other hand, lenders and savers were earning abnormally low real rates of return because of inflation.

The advantage accruing to borrowers from inflation, declined when savers and lenders realised that high inflation wasn't likely to disappear. This realisation stimulated fundamental changes to the structure of traditional financial arrangements (Downs, 1982): firstly lenders began demanding high rates of interest in both nominal and real terms, and recognised that inflation involves uncertainty relative to future rates of price rises. The second change stemmed from this uncertainty - capital suppliers introduced instruments able to vary the size of capital repayments over time to offset inflation; variable interest rate mortgages shifted the risk of inflation from lenders to borrowers. Table 1.1 provides an outline of the average rate of interest charged on new mortgages undertaken within New Zealand for the period 1950 to 1983; these data provide empirical evidence of the transition to higher interest rates.

Table 1.1

Average Mortgage Interest Rate (NZ) : 1950 -1983

(Source : NZ Official Yearbook 1982, page 934,
NZ Official Yearbook 1983, page 788,
Monthly Abstract of Stat., May 1984)

Year	Average Rate	Year	Average Rate	Year	Average Rate
	%		%		%
1950	3.99	1962	5.27	1974	7.86
1951	4.09	1963	5.51	1975	8.25
1952	4.15	1964	5.70	1976	8.61
1953	4.29	1965	5.78	1977	9.85
1954	4.49	1966	6.07	1978	10.30
1955	4.69	1967	6.31	1979	10.86
1956	4.76	1968	6.64	1980	11.38
1957	5.09	1969	6.74	1981	12.89
1958	5.24	1970	6.77	1982	14.30
1959	5.15	1971	6.89	1983	15.16
1960	5.01	1972	7.40		
1961	5.01	1973	7.58		

Equity Participation

Downs (1982) identifies one other major change brought about by the inequitable affect inflation had on lenders. This change revolved around the relationship between real estate financiers and investors - the attractiveness of potential equity gains and the disadvantage of lending at fixed relatively low rates of interest in the presence of high inflation, encoraged equity partnership relationships between the institutions supplying capital and those borrowing for property investment. The impact of the increasingly widespread use of various forms of equity participation by institutional lenders (Kafes and Miller, 1971) is to upset the predictability and the convienience of the foregoing capital structure, increasing the complexity of financial agreements and the financial

environment in general. The changing relationship between debt and equity position will have a continuing effect on real estate practices (Barrett and Blair, 1981).

Impact of Financial Change

Changes to the structure of financial agreements have two major implications to property investment : firstly the real cost of borrowing money to develop or buy real estate is now much higher than it was during most of the 1970's; data presented in Table 1.1 support this suggestion. Secondly, variable interest rate mortgages introduce the risk or the uncertainty of the future cost of borrowed capital once the money is borrowed and committed to the investment.

Capital suppliers have tried to shift all the risks of future inflation to borrowers, and borrowers are trying to avoid all those risks; this conflict has created enormous confusion about what specific forms of mortgage and equity structure are optimal (Downs, 1982).

The fundamental impacts of an increasingly competitive financial environment are firstly to narrow the gap between investment success and failure, and secondly to introduce a great deal of uncertainty with regard to the optimal financial structure for the investment. Cooper and Morrison (1973), have identified that the margin of error with respect to the financial success of property investment has been reduced; the success of investment in real estate, which was by and large assured by the presence of inflation and an increasing demand for property brought about by a rising population, is no longer a foregone conclusion. Stevenson and Jackson (1977), report that major disruptions in real estate investments (such as investment failure, defaults and foreclosures), have occurred in recent years; these are largely due to a lack of ability on behalf of the investment to survive an increasingly competitive financial environment. It becomes apparent that the realities of increased investment risk have been experienced by the property world.

(ii) Organisations and Ownership

Owners of real estate are at the centre of the market and the decision making process (Barrett and Blair, 1981). The growing complexity of real estate together with an increasingly competitive financial environment has

encouraged a reduction in the relative role of the individual entrepreneur and the emergence of more complex organisations involved with property (Roulac 1974).

A number of authors (Roulac 1974, McMahan 1976, Roulac 1977, Downs 1982, Hiban 1982) have identified the emergence of a variety of large institutions with primary and secondary interests in property investment. Real Estate Investment Trusts (REIT's), which have emerged within the American property sector, provide an example.

Real Estate Investment Trusts

As the volume of post war activity expanded in the American real estate sector, and projects became larger and more complex, it was increasingly clear that investors would have to be attracted on a broader scale than in the past if sufficient equity capital was to be raised; the REIT's seemed to offer a panacea for real estate finance (McMahan, 1976). Large numbers of small investors came together and the investment of their cummulative funds enabled each individual to become involved in property investment. The shares of beneficial interests could be traded as easily as common stock, and via REIT's, the tax advantages of real estate could be enjoyed by the smallest of investor. The financial structure of the REIT's suited developers, as funds could be made available on a continuing basis without being at the project-to-project mercy of banks, insurance companies or savings associations (McMahan, 1976).

The New Zealand property sector has experienced a rapid increase in the number of organisations involved in property investment. Keys (1982), reports the rapid emergence, and the increased involvement, of a range of powerful property financier investors including pension funds, fund managers, merchant banks, trusts and public companies.

Changing Investor Roles

Hall (1982) suggests that the emergence and involvement of larger organisations has prompted a change from a relatively passive investor to a far more positive and active role. He relates this transition to other changes which have recently occurred such as the development of very large

property portfolios, rapid advances in technology, and statutory regulations becoming extensive. This increased sophistication generally results in the assets under the institutional ownership falling within a more complex environment.

The major impact, to the investment analysis industry, arising from an increasing involvement of larger and more complex institutions, relates to a change in the nature of investor motivation and objectives, and consequently the requirements placed on the investment. The responsibilities placed on decision makers within these institutions by the individuals they represent, creates the need for a much more thorough and detailed investigation of the merits of potential projects, leading to investment decisions which reflect the degree of risk inherent in the investment. The suitability of potential investments must come under greater scrutiny, the decision process must have the ability to discriminate between potentially suitable and nonsuitable investments.

(iii) Regulation and Intervention

Real estate is heavily regulated by central and local government. Barrett and Blair (1981) suggest that real estate is one of the most thoroughly regulated industries in American society. Property in New Zealand tends to attract a great deal of attention from town planners, statutory bodies and central government (Hall, 1982).

The legal guidelines controlling real estate are evolving rapidly; governments are exerting increasing influence on all aspects of real estate business (Roulac, 1974). Being dependent on the financial returns available from each property, the success of investment in real estate is highly vulnerable to changes in the laws and regulations governing property.

Local government is primarily concerned with land use regulations (Barrett and Blair, 1982); the regulation of land use is becoming more strict. On a more widespread scale, real estate tax laws and interpretation have experienced constant change (Roulac, 1974). With regard to the New Zealand situation, Hoare (1983) identifies that the definition of income in the Income Tax Act has over the last 10 years, eroded further and further into the area of capital gains.

Policy Measures

At the macroeconomic level, central government regulate real estate (as well as other business activities), through monetary policies, fiscal policies and credit controls. Barrett and Blair (1981) have described the property industry as highly sensitive to these measures; macroeconomic policy makers tend to give special attention to real estate activity because it is a leading indicator of what will happen elsewhere in the economy.

The impact of changing regulations, and the potential for future change to the regulations governing property, is to introduce a great deal of uncertainty as to what restrictions and requirements will prevail. Hoare (1983) has suggested that the Income Tax Act (regulating taxation requirements in New Zealand), could well be extended over the next decade to incorporate a proper capital gains tax. The Labour Government currently holding office in New Zealand have made strong indications of major tax reform in the near future; the activities of institutions such as pension funds, which are currently exempt from taxation, could well become taxable. The degree and the measures of future government intervention are uncertain.

It should be noted that this uncertainty is inherent in the basic financial elements of each investment, such as potential rental levels, occupancy/vacancy rates, operating expenses and future prices that may be achieved from the sale of the property. Increasing government intervention, such as an expansion in property taxation, not only erodes the potential returns available from each property, but also adds to the uncertainty of future levels of return.

(iv) Other Changes

The above discussion provides an outline of the major changes which are surrounding real estate. A number of authors (Roulac 1974, Hiban 1982), have identified other changes which are having a less direct affect on investment in property. Changes to the traditional construction process provide an example.

An Evolving Construction Process

Industrialised building technology has enjoyed an enthusiastic reception in the last few years. New materials with better performance standards are replacing traditional products; an increasing portion of the building process is attributable to components or modules manufactured in plants, and to a score of innovative building systems (Roulac, 1974). The structure of building economics is experiencing change, this evidenced by the changing cost of components to create and maintain housing and commercial real estate (Hiban and Stalick, 1981).

The impact of these changes is to introduce new products, new relationships, new participants and an increased sophistication to the production process (Roulac, 1974). The uncertainties of construction, escalation clauses, and extra demands, together with the uncertainties surrounding real estate in general (outlined above), force potential property investors to seriously consider buying established real estate where the price is certain, and the advantages and disadvantages are more clearly displayed (Newland, 1981).

1.4.2 Consequences of Change

It becomes apparent that major and overwhelming changes are occurring to the structure, the organisation, and the economics of the property world. It should be stressed that the combination of these changes have two major implications for individuals and organisations involved in property investment: firstly they narrow the gap between investment success and investment failure, and secondly they combine to create a greater degree of complexity of current decision issues, and introduce a greater degree of uncertainty with respect to future conditions and events influencing the investment.

If individuals and the institutions involved with investment in property are to effectively survive these changes, they will have to revise their approach to investment decision-making (Roulac, 1977). They will have to develop the ability to gain a greater understanding of the complexities and uncertainties inherent in a changing environment, leading to the improved management and control of these aspects of property investment. Because the general quality of real estate economic analysis leaves much to be desired, the potential payoff for superior analysis is high; an

accelerating pace of change, escalating regulatory complexity, and increasing uncertainties of economic outcomes make distinctive investment analysis of even greater worth (Roulac, 1977).

1.4.3 Superior Economic Analysis

The ability to undertake superior economic analysis is reliant on two factors; firstly, the education of individuals with respect to the acquisition and development of superior analytic skills and technical knowledge, and secondly, the development and availability of information as an active resource. These two requirements are closely linked; superior analysis leading to increased precision is reliant on the concurrent achievement of both of these requirements. Data require analysis applied to a specific decision to become information; the ability to use data is related to the analytical capabilities of those who receive the data (Riemenschneider and Bonnen, 1979).

Education

The property based professions have for quite some time, been aware of the need for the education of individuals within each property practice. With respect to the American situation, Evans (1983) reports that a commitment to the education of practitioners was one of the first undertakings of the American Institute of Real Estate Management when it formed in 1933. She identifies a continuing commitment to education during the years since the formation of the Institute, and an overwhelming expansion of education programmes over the last decade.

The requirement for education has been well recognised by the New Zealand property professions. There are now three full time university (Lincoln, Massey and Auckland) courses in property management (Christiansen, 1982); These are generally coupled with a thorough background in valuation theory and methodology. One of the reasons for the formation of the Property Management Institute(NZ), was to provide a professional home for the graduates of these courses (Christiansen, 1982). The Institute itself appears to have a firm commitment to continuing education; Lucas (1983) outlines a number of measures, directed at both national and local level, which are aimed at the continuing education of practitioners.

It appears that the potential for the initial and continued education of practicing individuals, exists; the degree to which this potential is realised is now largely dependent upon the enthusiasm of the new, and the established practitioners to utilise these facilities and develop appropriate analysis skills. Part of the responsibility for improved education must be shouldered by the institutes representing individual practitioners, in the minimum standards they set for individuals entering the professions.

Information

As changing conditions gradually identify the need for more analytical and precise analysis, and as individuals respond by acquiring and developing these skills, superior analysis leading to improved investment decisions becomes reliant on the availability of information basic to each of the factors or issues influencing the decision.

The discussion has previously outlined the nature and the important characteristics of information which lead to its potential as a productive resource. Effective investment decisions in the presence of complex decision issues, and uncertainty with respect to future events and conditions, is reliant on the concurrent availability of information of three types.

(i) Information able to allow the analysis of the complex issues surrounding the investment decision; these issues may in themselves involve an element of uncertainty or may be completely "certain" in nature. An example would be the optimal financial structure of the investment with respect to the level of investor equity to borrowed capital, the duration and terms of any mortgage finance, and the degree of financier participation, ie equity partnership.

(ii) Information reducing the degree of uncertainty and providing an insight into the status of future conditions and the comparative likelihood of future events. Forecasts and projections are examples of this type of information.

(iii) Related to the type of information outlined in (ii) above, the

third requirement revolves around information enabling the decision to reflect the vulnerability of the investment to uncertain future conditions; this type of information is generally provided by a sensitivity study.

Summary

The nature, the magnitude and the consequences of the changes which are taking place within and around the real estate environment have been outlined and stressed above. Economic aspects have become more precise; rapidly rising prices have meant that a far greater amount of money is involved for each property type in both investor equity and borrowed capital; the real estate sector is becoming increasingly sensitive to growing government intervention; an increasingly competitive financial environment has narrowed the margin between investment success and failure; the needs of the new real estate capitalists - the prominant financial institutions - require economic analysis and decisions consistent with the seriousness of their fiduciary responsibilities.

Because of the large sums involved and the increasing risk brought about by the growing complexity of the factors determining the success of investment in property, the cost of uncertainty and subsequent failure are far greater than before. The property environment will no longer support poor investment decisions. Effective decision-making is becoming increasingly reliant on information able to reduce uncertainty and manage the complexity of the factors influencing the performance of investment property, enabling investors to discriminate between potentially viable investments and those more vulnerable to failure. The effective development and management of information as an active resource, offers vast potential to those who have the capability to put the resource to productive use.

CHAPTER TWO

Information Services : Current Status - Future potential

Introduction

Chapter one attempts to outline the potential of information as a productive resource to property investment analysis. The objective of this chapter is to review the existing information services/sources available to practitioners involved in this type of work, and to consider the potential of an information system(s) to the field of real estate investment analysis. The discussion draws on a number of related topics which have an impact on information and the potential of an information system; because the type of analysis carried out by analysts is likely to have a major impact on their information requirements, the discussion adds to that provided by the previous chapter in attempting to review briefly the "state of the art" of real estate investment analysis.

Literature emerging from the New Zealand (NZ) real estate industry has not directed much attention to information and information related matters. In order to obtain data relating to the current status and the future potential of information as a resource to property analysis in NZ, a number of practicing individuals were surveyed (subsequently referred to as the "1984 survey"). The NZ Property Management Institute (PMI) membership was selected as the group of individuals most likely to provide a useful sample of practitioners involved in this type of work. A questionnaire broadly covering computerisation, existing and potential information sources and services, and investment analysis procedures was sent to a number of members of the Institute who were likley to be actively involved in property investment analysis. Appendix 1 provides an outline of the survey procedure and an analysis of results. The following discussion draws on those results in reviewing the current status and the potential of information systems to the field of investment analysis.

2.1 Current Information Requirements

The type of analysis carried out by analysts in the investigation of any particular property investment, will determine the type and the amount of information required to complete the analysis. Roulac (1977) suggested some seven years ago that the "state of the art" of analysis of real estate investments leaves much to be desired. He suggested that one of the reasons for this was that the methodologies relied on by many for measuring investment performance were primitive. Shlaes & Young (1978) drew the same conclusions in suggesting that the simplistic and primitive techniques still canonized in appraisal literature can no longer be justified in an investment environment that has the technological capacity to enable superior analysis.

The introduction to this study suggests that the haphazard development of the property analysis "industry" in NZ has not encoraged the development of a sophisticated analysis methodology. Those who have examined the procedures used by real estate analysts in NZ, indicate that these procedures are, by and large, very limited in scope, not contributing to a comprehensive investigation of the investment (personal communication, W.Penman).

In order to obtain a more specific indication of the nature of investment analysis within the NZ property sector, this topic was included in the survey introduced above. Respondents were asked (1984 survey question 12, refer appendix 1) to indicate from the list outlined in Table 2.1, the factors which they (their firms) actually investigate in the analysis of an income producing property investment. The results are outlined in Table 2.1.

Table 2.1
Factors Investigated in
the Analysis of Investment Property

	% of respondents investigating "this" factor
Capital gain potential	86.5
Cash flow	85.4
Return to overall capital	85.4
Return to equity	58.3
Liquidity (ease of disposal)	55.2
Taxation factors	53.1
Investment internal rate of return	51.0
Computation of the investment value	47.9
Leverage	33.3
Non-monetary objectives of investor	29.2
Discounted cash flow	28.1
Risk/sensitivity analysis	28.1
Ellwood-type analysis	3.1

Note : There appears to be a discrepancy between the percentage of respondents who incorporate a discounted cash flow analysis and the percentage who investigate the internal rate of return and the investment value of the property. Both of these measures require the application of discounting procedures. It is possible that a number of respondents misinterpreted the nature of the internal rate of return and investment value; the interpretation of the above results should take account of this possibility.

It appears the most commonly investigated factors are cash flow, capital gain potential and return on overall capital. The results indicate that approximately half the respondents take account of the return to equity, liquidity and taxation factors. A lower proportion include an

examination of leverage potential, discounted cash flow, risk or sensitivity of the investment, and the non-monetary objectives of the investor.

The difficulty in interpreting the above results is that it is unclear to what degree of depth, or how thoroughly the above factors are investigated. It is not clear for example, whether in computing the return to overall capital, analysts simply examine the annual income for the first operating year over the cost of the property, or whether the computations take account of all the factors which affect the financial return of the property, such as taxation advantages, value appreciation/depreciation realised at sale, changes in market conditions over time with respect to the potential financial return. A recent (November, 1984) seminar held by the Christchurch branch of the PMI outlined an example of the typical approach applied in analysing the potential development of a prime central business site in Christchurch. It was revealed that the measure of investment performance which decided the optimum development for the site was return to overall capital; in computing this measure the analysts, considered to be among the more successful of those currently operating in the Canterbury region, took no account (explicitly) of capital gain potential, taxation factors, changes in market conditions or any other factor which could have an impact on the return generated by the property.

Because a risk/sensitivity analysis implies a more comprehensive investigation of the factors which have an affect on the performance of an investment in property, the above suggested superficial nature of analysis procedures is supported by the fact that only 28.1 % of respondents investigate or consider the risk factor in the investment analysis. It is again difficult to estimate how thoroughly this group take account of investment risk.

One aim of the 1984 survey was to obtain an indication of the current information requirements of practitioners. Respondents were asked (question 3, refer appendix 1) to indicate, from the list outlined in Table 2.2, the types of information they require and currently make an effort to collect in order to carry out their work involved with property management. The results are illustrated in Table 2.2.

Table 2.2

Information Required for Property Management

	% of repondents requiring "this" information
-comparable rentals	86.7
-comparable lease terms and conditions	74.5
-operating expense information	73.5
-construction cost information	65.3
-comparable sales information	63.3
-occupancy/vacancy rates	58.2
-market trend information	56.1
-other	7.1

The low percentage of respondents who indicate that they require and collect "other" information, may suggest that the information types outlined in the above list, broadly comprises the information types required by practitioners.

These results do not provide much in the way of specific indications as it is again difficult to interpret the degree of detail required in each information type. The results generally support the information requirements indicated by the factors investigated by analysts (survey question 12, refer appendix 1).The most commonly required information is comparable rentals, comparable lease terms and conditions and operating expense information; the availability of these types of data are necessary for an analysis of the cash flow generated by the investment.

Although the response to survey question twelve indicates that a large majority (86.5 %) of respondents consider the capital gain potential of the property, a lesser majority (63.3 %) indicate they currently require and collect comparable sale information. Coupling this with the fact that a little more than half the respondents (56.1 %) currently make an effort to collect market trend information tends to support the suggestion that a

comprehensive investigation of the investment is not carried out by the majority of analysts. It is difficult to decide whether these factors are not investigated because of a lack of information, or whether the information is not required because the factors are not investigated.

2.2 Information Sevices : Current Status

The introduction to this study attempts to illustrate that, particularly in NZ, the practice of real estate investment analysis has emerged and developed in a haphazard way. This has resulted in a disjointed analysis industry. Individuals involved in this type of work have not been recognised as an identifiable group of practitioners, rather they are seen as members of other groups involved principally with alternative activities such as property valuation, the legal and accountancy fields, engineering, real estate brokerage, and other professionals who periodically become involved in the analysis of property investments.

Because these people have remained as individuals and have not, in the past, come together as an identifiable group of practitioners, there has been no concentrated demand for the provision of information, and consequently, there have been no information services developed specifically for individuals or groups involved in this type of work.

Because a specialised service(s) has not been available, to obtain necessary data and information, analysts have relied on formal services developed for other groups, and on informal sources seen as able to provide useful information. The following discussion attempts to provide an outline of the nature of the information sources that are currently available to persons involved in real estate investment analysis.

2.2.1 Formal Information Services

The valuation or appraisal professions have, for some considerable time, recognised and acted on the need for the provision of information to practicing valuers. The following discussion draws from the NZ property sector in providing an example of the nature of an information service that has been developed to provide information to the valuation profession. This service provides an illustration of the forces which encorage the

establishment and mould the development of an information sevice to an identifiable group of practitioners.

(a) New Zealand Institute of Valuers' Information Service

(i) Property Sale Information

It had long been realised by the NZ valuation profession that all valuers needed access to information on market sales. This lead the profession in the early 1960's to looking at possible ways of achieving this end. From these investigations and with the government's cooperation, the Valuer General (head of the Valuation Department) agreed to make available to the New Zealand Institute of Valuers (NZIV) copies of the "notice of change" (property sale) form once the necessary department action had been completed. This provided the foundation for the development of the service currently offered by the Institute.

Originally, the Institute enlisted the services of a clerk in each Valuation Dept. office, who recorded the data on A4 sheets. These were sent to the Institute's headquaters in Wellington. Subscribers specified the region in which they required sale information and this was supplied on A4 copy sheets.

This system which continued for quite some time, had inherent disadvantages such as sometimes significant time delays in the delivery of information as well as the cumbersome nature of the information transfer medium (personal communication, T.Marks).

In November 1980, the Valuer General wrote to the Institute advising them that the Valuation Dept. was introducing for its own use a computerised system for recording, analysis and listing sale information which would come into effect on the 1st of January, 1981. The Valuer General stated that with the development of the system, provision had been made for sale information to be supplied in a suitable form to be disclosed to valuers in public practice. This measure was in response to a recognition by the government that it was in the national interest for all registered valuers, both departmental and public, to provide valuation services of the highest standard coupled with optimum economy, and this could only be achieved with accurate up-to-date market information (Cooper, 1981). With the new system, the Valuation Dept. suggested that the

most economical and convenient way to transfer the information would be by magnetic tape once a fortnight, the frequency the Dept. had chosen to compile its own records.

At this stage, the Valuer General considered the Valuers' Registration Board (members appointed by the Minister in charge of the Valuation Dept. under the Valuers' Act, 1948) to be the most appropriate authority to regulate the supply and use of the data. The Board considered the NZIV to be the best agency to continue to compile and distribute the sales lists on behalf of the Board.

The executive committee of the Institute while deciding to accept the package of the Valuer General, decided to introduce microfiche as the means of distributing sales information to subscribers. Cooper (1981) describes microfiche as comprising flat sheets of film measuring 150 mm by 147 mm onto which is etched by a photographic process, text and numerical data or diagrams in very minute form. All material is arranged in normal page format and each microfiche contains 270 separate pages.

The introduction of the microfiche system represented a substantial change in the nature of the existing information service. Firstly, sales information (from July 1st, 1981) was distributed in microfiche form necessitating subscribers to buy, lease or gain access to a microfiche reader (approximately $400 to purchase at that time). Secondly, every subscriber was supplied with details of all sales in NZ rather than by region or district. It was considered cheaper and more efficient for the Institute to provide all sales to every subscriber rather than selecting those from a particular region (Cooper, 1981). The Institute considered the quick indexing that microfiche provides would minimise any inconvienience resulting from the overabundance of data.

The microfiche system was seen to offer a more up-to-date, comprehensive and better indexed system providing a sound base for any latter enhancements in terms of providing additional information services to subscribers; for example noting sales of regional or national importance.

The advantages of the microfiche sales information system have been summarised by Cooper (1981) as :

-more regular supply of information (fortnightly).
-more up-to-date (sales will be no older than three weeks after the date of receipt by the Valuation Dept.).
-information is better sorted and indexed.
-requires no processing when received in the subscribers office.

One disadvantage recognised by the Institute was the non-inclusion of the names of the vendor and purchaser, something that was provided in the rural sales lists and of much value. The legal description of properties is also limited to the first thirty characters as shown on the valuation role.

The cost of the service changed with the medium of data transfer. Under the old system, subscribers paid a charge relating to their demand for information on a volume basis. Under the new system, all subscribers receive identical information and hence face the same subscription. This was estimated to be in the range of $150 at the initiation of the system; the cost of producing microfiche complete with sale details is much cheaper than the old system of individually prepared and printed pages (Cooper, 1981).

The terms under which the sales information system was developed enable the service to be available, broadly, to members of the valuation profession, real estate agents, and individuals or firms involved with the management of property. Subscribers currently receive sales listings twice monthly. The system has been designed so that the two weekly listings be accumulative for a quarter; each listing to the end of each quarter, contain the latest sale information in addition to the information provided on the previous listings for the quarter. The quarterly listing become cummulative for a year. The last listing would contain the sales for the whole of the year, on a January to December basis, and would provide the archival copy for subscribers.

As discussed above, when proposing the computerised information system, the Valuation Dept. suggested that the most efficient way to

transfer the information would be by magnetic tape. The Institute considered however that microfiche was the most suitable medium of data transfer at the time. Since the 1981 proposal by the Valuation Dept., the Institute have examined the feasibility of a computerised information transfer system. Several systems were explored and whilst each had some merit, eg relatively lower cost or earlier onstream date, they also presented technical problems in expandability or compatibility with later developments likely to be required by valuers (Allan, 1982). The system which evolved is one utilizing a centralised bureau computer from which the individual valuer could draw pre-selected data for retention and access on his in-house microcomputer. Via this system, data which is provided on microfiche is available on floppy discs. In the main, the discs are compatible with the ICL 'personal computer' (micro). As for microfiche, floppy discs are supplied once every fortnight. The system has been designed so that a consolidated diskette is provided at the end of each six month period in the same way that the microfiche, at the same time, are a consolidation of the sales for the year to date (personal communication, K.Allan). This system differs from microfiche in that data are supplied by region or area as requested by the subscriber.

In association with the introduction of this computerised service, the Institute developed and made available a specialised computer program (Valpac) which is able to access data provided on the floppy disks. The main advantages of the computerised transfer system over microfiche are seen to be a more efficient and rapid retrieval of specific parcels of information (keyed access), the possibility of hardcopy output in a specified format, potential for data analysis by computer (specialised programs), and broadly, providing a base for future developments such as on-line facilities (personal communication, K.Allan).

Table 2.3 illustrates the data provided by the service. The Institute intend to continue to supply this data in both microfiche and floppy disk form.

The operation of this service represents a major development effort in the area of information systems to the property sector in NZ. Limited to

Table 2.3

NZIV : Individual property data provided by the service.

roll number	assessment number
street number	category
sale date	net sale price
capital value	land value
age improvement	floor area
land area	zone
use	unit
condition	construction
chattels	tenure
sale type	certificate of title
vendor purchase	special rateable values
revision date	description
other value	date included
organisation	comments

comparable sales information, it appears that individuals involved in the analysis of property investments, have access to and are able to utilize the information provided by this service.

(ii) Replacement Cost Information

The replacement cost approach to valuation emerged in response to a difficulty experienced in ascertaining the value of certain types of property. The valuation profession realised at an early stage the need for the provision of information able to assist the application of this approach. There are a number of books and articles (Riley (1972), Jefferies (1978), Frizzell (1979)), covering the application of the cost approach to valuation. The NZIV provide limited replacement cost information; this

takes the form of multiples and modal rates computed to represent the current cost of constructing various types of structures. The Institute derive this information from actual construction projects taking place in the market. Replacement cost information is included in the statistical bulletin which accompanies the Institute's newsletter distributed monthly by post.

(b) Multiple Listing Service

A formal information service available to practitioners involved with real estate brokerage, is provided by multiple listing bureaus. A multiple listing service is a mechanism developed by the real estate community to provide up-to-date, accurate, economical marketplace information to members (Kaimann (1980)). Multiple listing bureaus have formed on a regional basis as cooperatives comprising a number of practicing individuals or firms involved in the purchase and sale of real estate. The objective of this service is to distribute information supplied by one member to all other members of the bureau. The information provided by each bureau includes data on individual properties which are available for sale and properties which have sold in the region.

Multiple listing services (MLS) have been suppling information to practitioners for a considerable time; reporting on the American property industry, Kaimann (1980) suggests that many MLS's are responding to the need to update and modify their systems and services to meet the information needs of practitioners operating in a competitive marketplace.

As an illustration of the nature of the information service provided by the bureaus, the following discussion reviews the development and operation of the Christchurch multi-listing service.

Christchurch Multi-listing Service

The Christchurch bureau came into existence approximately 27 years ago as a result of 16 major real estate firms agreeing to combine together for the purposes of developing a group referral listing service. The Christchurch Multiple Listing Bureau (Incorporated) formed as a non-profit

organisation aimed at distributing information among members. Since that time membership has grown to 95 firms.

Membership is by application only, the applicant (firm) must hold a current real estate agents licence, must have been a member of the Canterbury/Westland division of the Real Estate Institute for not less than four years and must have been based in commercial premises for not less than 12 months. Suitable applicants are granted full membership after satisfactorily completing a probationary term (personal communication, P.Cook).

Because of the relatively small number of sales of commercial and industrial properties in the Chrischurch region, the majority of properties included in the listing service are residential. The transfer of information to the bureau and onto other members is generally as follows : upon receiving notification from an owner wishing to sell his/her property, member agents (firms) usually attempt to maintain sole agency to the property for a period of time. If, after a certain period dependent upon the agent, the property has not sold, the agent passes data to the bureau describing the property and the sale details. The bureau compile this into a "data card" which includes a photograph of the property. This card is supplied to all members. The property is added to the "list" of properties which are available for sale in the region; the list is distributed on a daily basis, by courier, to all members of the bureau.

A feature of the service is that members are not compelled to provide the bureau with every property for which they are acting as agent. Members are able to select the properties they wish to "contribute" to the information "pool". Upon the sale of the property, the listing agent receives one third of the sale commission, the selling agent two thirds, less the expenses charged by the bureau. Members are expected to contribute an equitable share of property information to the bureau for disribution to other members.

Once a listed property is sold, the agent handling the sale provides the bureau with the sale details; sale information, on listed properties, is distributed to members on a daily basis. This information covers

previously listed properties which have sold :

-unconditionally
-conditionally
-finance confirmed on sales which were previously advertised as pending finance
-finance not available
-finance collapsed
-finance not yet available
-properties withdrawn from sale
-property data changes

The bureau attempt to keep members informed as to the status of properties which have been listed. The multiple listing agency is for 60 days only; if after 60 days the property has not sold, the "agency" expires and the property is deleted from the list. The agency, is however able to be renewed allowing the property to be included in the list for a further 60 days. The bureau attempt to keep members informed, where possible, on the status of properties which have expired.

Because delays in the transfer of the information provided by this service are minimal (daily supply), it can be seen as a timely sales information service. The physical property details are provided initially when the property is listed. The financial details of the sale are advertised or updated when the property is sold or the conditions of sale change. The Christchurch bureau recognise the value of the information they are able to provide; a number of the major valuation firms operating in Christchurch, together with the Christchurch division of the Valuation Dept., are provided with the daily property listing and sale information as a courtesy.

The bureau maintain an archival list of all the properties which have been listed. These records are generally for administrative purposes only and are not aimed at providing additional information (personal communication, P.Cook).

Table 2.4 illustrates the data that is recorded and provided on each multi-listed property, by the Christchurch bureau.

Table 2.4

Data provided on Multi-listed

Properties : Christchurch Bureau

-address	-legal description
-suburb	-high pressure water
-multiple list zone	-cooker
-previous listing number	-sewer
-date listed	-paths
-latest listing number	-fencing
-owner	-buses & shops
-private telephone number	-chattels & value
-tenanted (yes/no)	-price of property
-vacant	-freehold/leasehold
-vendor's solicitor	-Govt. capital/land value
-listing firm & telephone number	-rates
-salesman	-land area
-key position	
-structure -type	
-construction	
-roof construction	
-joinery	
-age	
-room size and description	
-code for fittings	
-hot water	
-toilet (inside/outside)	
-garage and outbuildings	

The bureau is currently investigating the possibility of computerised information transfer to the individual member offices (Christchurch MLB (Inc.) Annual Report, 1984). At present, the bureau utilize computer technology for adminisrative purposes only.

(c) General (formal) Information Services

There are a number of formal information services which aim to provide information of a more general nature which is of use to persons involved in the analysis of property. An example of this type of service is provided by the Berl Econometric Resources of NZ (BERNZ).

Berl Econometric Resources Information Service

BERNZ was formed as a joint venture between Business and Economic Research Ltd (BERL) and Econometric Resources NZ Ltd (ERNZ), in 1982. The primary function of BERNZ is to produce independent short-term forecasts of the NZ economy (Berl Econometric Resources NZ, Property Market Forecasts, Nov. 1983). In preparing these forecasts BERNZ consultants draw on the views of a number of individual economists and businessmen who are not members of the BERNZ organisation. BERNZ publishes detailed forecasts of specific sectors of the economy such as the building industry and the property market, as well as aggregate information relating to the entire NZ economy. The following list illustrates the general type of information provided by the service with respect to the property sector.

(i) Outlook for the economy.

-economic activity within the economy
-expected trends in inflation/deflation
-timing and magnitude of any wage order where applicable
-balance of payments and related matters
-total real household disposable income
-employment/unemployment levels

(ii) Money, interest rates and the property market. The information provided within this section attempts to summarise the impact of recent

moves by government with respect to the supply of money and interest rates.

-availability of Housing Corporation finance and the resultant impact on the property sector

-impact on the availability of mortgage finance within the property market

-sources of money within the economy

-the growth in the money supply and governmental policy moves relating to this

(iii) Outlook for the property market.

-expected activity in the property market

-volume of sales

-aggregate property price trends

As indicated, this service provides information of a general nature concerning the state of the economy, and particularly the state of the property market. It attempts to provide a general insight into the likely short term future of the economy and the likely response in the real estate sector.

Comment

It appears that the formal services providing specific data and information to practitioners operating within the property analysis field are oriented towards the provision of comparable sales information. To obtain other types of data necessary for the analysis of any particular property investment, analysts revert to a number of informal information sources.

2.2.2 Informal Information Sources

In-firm data banks are one of the main sources of information available to practitioners. In-firm data banks are comprised of the data representing the portfolios of the properties with which the firm is/has been involved. Typically, mechanical systems of filing have developed where the information is arranged on cards; the practitioner took the

responsibility of maintaining and updating the file as necessary. The data resemble a file of verified case studies.

Shenkel (1976) identifies an advantage with this source of information is that it is readily available and the analyst can be confident that the data are accurate. Because each urban property investment is to a certain degree unique, effective investment decisions require analysts and decision makers to have access to a wide range of data/information; the disadvantage with relying on data held within the firm is that certain required data types may not be available.

There are a number of other sources of information which are able to provide information of assistance to the analysis of property. These take the form of specific publications such as economic/survey reports, property reviews and magazines, radio and television, newspapers, and personal communication with other practitioners and business associates. These are able to provide general information maintaining the analysts' broad knowledge and enabling an intuitive feel for the state of the property sector and the economy in general. They are also able to provide more specific data such as that relating to individual properties or property types. These informal sources are highly suitable to the "one-off" nature of property investment analysis.

2.2.3 Relative Importance of Information Sources

The above discussion attempts to outline the sources of information currently available to property analysts. The 1984 survey was aimed at obtaining an indication from practitioners on whether these sources comprise the full range of those currently seen as offering useful information to analysts. It also attempted to gain an insight into the relative importance of these. Respondents were asked (question 4, refer appendix 1) to rank the information sources outlined in Table 2.5, in order of importance. The results of this ranking are summarised in Table 2.5. Approximately 30 % of respondents indicated that "other" sources of information were not important. The majority of the remaining respondents

Table 2.5
Rank of Information Sources
in Decending Order of Importance

-the portfolios of the properties with which the firm is involved, ie in-firm data.
-formal sources exclusive to the practitioner (firm).
-specific information sources, such as property listing etc.
-informal sources of information.
-other sources.

indicated that "other" sources were the least important. This would suggest that the above list does represent the sources or services currently supplying information to practitioners.

Specifically, these results indicate that data held within the firm are seen as the most important source of information. Formal sources exclusive to the practitioner (practitioners' firm) are seen as more important than specific services which have been developed to provide information to the property analysis industry. Informal sources are seen by the majority of respondents as the least important of the main sources of information.

2.3 Potential for an Information System

The growing complexity of the property sector and the economy in general, is making the intuitive approach to decision-making that has characterised property analysis in the past increasingly difficult : effective decision-making is becoming increasingly reliant on timely and pertinent information. The following discussion examines the factors that determine, or influence the potential for an information system for the investment analysis industry.

2.3.1 Adequacy of Current Information Sources

A question of particular interest to this study, and one to which the 1984 survey is able to provide some insight, is the adequacy of the sources of information available to practitioners. Respondents were asked (question 5, refer appendix 1) to provide an indication as to the adequacy of the sources available to them, with respect to their current and likely future information needs. The response is outlined in Table 2.6.

Table 2.6
Adequacy of Available Information Sources

Currently adequate :	Yes	61.6 %
	No	35.4 %
	Don't know	3.0 %
		100.0 %
Adequate for the foreseeable future :	Yes	39.2 %
	No	52.6 %
	Don't know	8.2 %
		100.0 %

These results would suggest that the majority of respondents recognise an increasing requirement for information. Although a significant proportion (35.4 %) see their current sources as inadequate, the majority (61.6 %) consider these to be adequate for their current information requirements. The majority (52.6 %) consider that these sources will be inadequate for their likely future information needs.

The adequacy of existing sources of information is likely to be related to the extent to which information is required. The response to certain questions included in the 1984 survey were able to be crosstabulated in order to establish the extent of this relationship. Individual responses to question 3 (type of information required, refer appendix 1) were crosstabulated with those of question 5 (adequacy of information sources, refer appendix 1) to obtain an indication of the relationship between the adequacy of information sources and the current information requirements of respondents. The results of this crosstabulation are summarised in Table 2.7.

Table 2.7
Relationship Between Adequacy of Information
Sources and Current Information Requirements

Respondents NOT requiring "these" information types

CURRENT ADEQUACY	Comp. Sales %	Const. Cost %	Comp. Rent. %	Occ/Vac. Rates %	Oper. Exp. %	Comp. Lease %	Mkt Trend %
YES	74.3	72.7	66.7	72.5	60.0	70.8	58.2
NO	25.7	27.3	33.3	27.5	36.0	25.0	38.2
DON'T KNOW	0.	0.	0.	0.	4.0	4.2	3.6

These results indicate the existence of a significantly strong relationship between the adequacy of current information sources and the requirement for information; for each of the above information types, the

majority of those who do not require the information see their sources as adequate. For example, of the respondents who do not require comparable sales information, 74.3 % indicate their current sources are adequate.

In support of the relationship indicated by the above results, individual responses to question 12 (factors investigated in the analysis of investment property, refer appendix 1) were crosstabulated with those of question 5 (adequacy of information sources, refer appendix 1) in order to determine if the adequacy of current information sources is related to the type of analysis carried out by respondents. The results of this crosstabulation are summarised in Table 2.8.

Table 2.8

Relationship Between the Adequacy of

Information Sources and the Type of Analysis Carried Out

Respondents NOT examining "these" factors

CURRENT ADEQUACY	Cash Flow	Disc. Cash	Leverage	Liquidity	Capital Gain	Taxation Factors
	%	%	%	%	%	%
YES	76.9	59.7	68.3	61.9	75.0	63.6
NO	23.1	37.3	30.2	33.3	25.0	34.1
DON'T KNOW	0.	3.0	1.5	4.8	0.	2.3

CURRENT ADEQUACY	Over. Return on Capital	Return to Equity	Ellwood Analysis	Invest. IRR	Invest. Value	Risk/ Sesit. Analysis
	%	%	%	%	%	%
YES	61.5	61.5	61.5	53.3	54.2	55.2
NO	38.5	35.9	35.2	44.4	41.7	40.3
DON'T KNOW	0.	2.6	3.3	2.3	4.1	4.5

It appears that a much higher proportion of those who do not investigate the above factors see their current sources as adequate; for example, of the respondents who do not examine the cash flow generated by the investment, 76.9 % see their current information sources as adequate.

The results of the above two crosstabulations would combine to suggest that the majority of respondents who carry out a more comprehensive analysis of the investment proposal, see their current sources of information as inadequate. The majority of those who do not have a diverse requirement for information and those who do not complete a comprehensive analysis of the property, see their current sources as adequate.

2.3.2 The Risk Factor

A characteristic of real estate investments is that they are often large and tend to tie up a significant portion of the investors funds; the committment tends to be too great for the parties to protect themselves by participating in a large number of projects in the hope that the successful investments will balance the failures. Hence it is important for investors to consider explicitly the risks to which they become exposed when they invest in a project (Stevenson and Jackson, 1977).

The economic outcome of any particular real estate investment is the result of the interaction of a large number of variables; the outcome can be thought of as the result of the interaction of the investment with a number of other economic events or decisions. Because the outcome is dependent upon a wide range of factors, each individually suject to variability, the objective of the analysis must be to focus on the potential variability of the factors, and the potential range of outcomes (Roulac, 1977). Stevenson & Jackson (1977) suggest the analysis of real estate investment performance has in the past, been based on single estimates (or best guesses) as to what the future values of important parameters would be (such as income levels, absorbtion rates, interest rates etc.). They suggest that participants in real estate projects would have been considerably better equiped to deal with new (and discouraging) conditions if they had provided a more thorough analysis of the project at the outset.

Cooper & Morrison (1973) outline the advantages of incorporating a

sensitivity analysis in the investigation of the investment. Here, rather than a single estimate, the important parameters are varied through their likely range in order to examine their impact on the overall performance of the investment. Roulac (1977) also promotes the use of an interval rather than point estimates for important parameters, as well as outlining the need for more comprehensive economic analysis of projects.

In support of the indicated importance of risk, the 1984 survey aimed to obtain from practitioners operating within the market, an indication of the importance of risk with respect to property investment in NZ. The response to question 12 (refer appendix 1) of the survey indicates that 28.1 % of respondents actually examine investment risk in the analysis. It is difficult to estimate to what degree the impact of this factor is investigated. The response to question 13 (refer appendix 1) indicates however, that the majority of respondents view risk to be one of the more important factors to be examined prior to making an investment decision. Respondents were requested (question 14, refer appendix 1) to indicate the likely future importance of investment risk with regard to property. Table 2.9 outlines the response to this question.

Table 2.9

Future Importance of Investment Risk

	% response
-increasing in importance	60.6 %
-steady	33.4 %
-decreasing in importance	3.0 %
-don't know	3.0 %
	100.0 %

It is worth stressing that even though a high portion of respondents do not currently examine risk in the analysis leading to an investment decision, a high portion consider this to be an important factor, and one that is increasing in importance.

Much of the literature examining property investment analysis (Farrell (1969), Pyhrr (1973), Cooper & Morrison (1973), Roulac (1977), Stevenson & Jackson (1977), Martin (1978), Jaffe & Sirman (1981)), have stressed the importance of effectively incorporating the existence of risk in investment decisions. They report that past decisions regarding property investments have not taken adequate account of the risk involved in the project. Roulac (1977) identifies one of the reasons for this to be a lack of information "... techniques for communicating financial data do not provide useful information because existing prohibitions against projections deny the investment community the information fundamental to decision making". In stressing the reliance placed on information he suggests that superior analysis ultimately involves originating viable data and identifing crucial factors and their linkage relationships.

Risk and Information

Of interest to this study is the increasing requirement for data and information that is likely to be associated with a growing awareness of the need to explicitly take account of risk, and to provide a more thorough analysis leading to an investment decision. A more comprehensive analysis is, in part, reliant on the availablity of data and information able to assist the specific areas of investigation; the incorporation of investment risk in the analysis compounds this reliance.

While an increasing requirement for information directly enhances the potential for an information system to real estate investment analysis, the degree to which that potential will be realised is, in part, dependent upon the actual need for a system as seen by the eventual users. The 1984 survey attempted to obtain an indication (survey question 7, refer appendix 1) of the need for an information service to the property management industry. The results are illustrated in Table 2.10; these results clearly

indicate a recognition by responents of a requirement for an information service.

Table 2.10
Current and Future Need for an
Information Service to the Property Management Industry

			% response
Current need for a service	:	Yes	82.8 %
		No	12.1 %
		Don't know	5.1 %
Need in the forseeable future	:	Yes	91.8 %
		No	4.7 %
		Don't know	3.5 %

A large majority of respondents (82.8 %) see a current requirement for the development of a service, an even greater percentage consider the industry will require an information service at some time in the forseeable future. Only (4.7 %) of respondents are certain that the industry will not require a service in the forseeable future.

In support of the potential for a service, the survey results were able to provide an indication of the need for a service as this relates to the type of analysis carried out by practitioners. The response to question 12 (factors investigated in the analysis of investment property, refer appendix 1) were crosstabulated with those of question 7 (need for an information system, refer appendix 1). The results of this crosstabulation are illustrated in Table 2.11.

Table 2.11

Relationship Between Requirement

for an Information Service and the Type of Analysis Carried Out

NEED FOR INFORMATION SERVICE	Respondents examining "these" factors					
	Cash Flow	Disc. Cash	Leverage	Liquidity	Capital Gain	Taxation Factors
CURRENT	%	%	%	%	%	%
YES	82.3	85.2	72.4	86.0	82.5	84.0
NO	12.7	11.1	24.2	8.0	15.0	16.0
DON'T KNOW	5.0	3.7	3.4	6.0	2.5	0.

	Over. Return on Capital	Return to Equity	Ellwood Analysis	Invest. IRR	Invest. Value	Risk/ Sensit. Analysis
CURRENT	%	%	%	%	%	%
YES	82.3	79.6	66.7	81.6	88.9	77.8
NO	11.4	18.5	33.3	14.3	8.9	14.8
DON'T KNOW	6.3	1.9	0.	4.1	2.2	7.4

Table 2.11 continued

Respondents examining "these" factors

	Cash Flow	Disc. Cash	Leverage	Liquidity	Capital Gain	Taxation Factors
FUTURE	%	%	%	%	%	%
YES	93.0	92.0	85.2	93.6	93.2	93.2
NO	4.2	4.0	11.1	2.1	5.4	6.8
DON'T KNOW	2.8	4.0	3.7	4.3	1.4	0.

	Over. Return on Capital	Return to Equity	Ellwood Analysis	Invest. IRR	Invest. Value	Risk/ Sensit. Analysis
FUTURE	%	%	%	%	%	%
YES	90.2	91.5	100.	95.5	92.7	92.6
NO	5.6	4.2	0.	2.3	4.9	3.7
DON'T KNOW	4.2	4.3	0.	2.2	2.4	3.7

It appears that a significantly high portion of those who include an investigation of the above listed factors, ie provide a more comprehensive analysis, see a need for the provision of a service. Again practitioners providing a more comprehensive analysis are likely to have a greater and more diverse requirement for information.

2.3.3 Potential Service Response

The overall potential of any service that might be developed for the investment analysis/property management field, must take account of the potential utilization or uptake of the service. The 1984 survey attempted to provide an insight to this question. The results of question 4 (refer appendix 1) indicate that specific information sources (such as property

listing etc.), are not amongst the most important of the existing information sources. This may be due to the fact that none of these (specific) sources are directly aimed at providing information to the property management/investment analysis field. This suggestion is supported by the fact that less than half (48 %) of respondents currently utilize the service offered by the NZIV (refer question 6, appendix 1); the information provided by this service (comparable sales) is of limited value to the property management industry. The service offered by the multiple listing bureaus enjoys a much greater utilization; of the 105 real estate licensees currently operating in the Christchurch area for example, 95 subscribe to the service offered by the Christchurch multiple listing bureau (personal communication, P.Cook); the information provided by this service is fundamental to real estate brokerage and it is likely that this fact explains the high use made of this service.

The 1984 survey (question 8, refer appendix 1) gave respondents a general idea of the type of information that might be provided by an operative information service developed specifically for the property management/investment analysis industry. The types of information were briefly : comparable sales, construction cost, comparable rentals, occupancy rates, operating expenses, comparable lease terms and conditions, and market trend information, together with any other type of information specified by the respondent in the reply to this question. The response to question 8 (refer appendix 1) provides an indication of the type of information that respondents consider should be provided by such a service. With this in mind, respondents were asked (question 9, refer appendix 1) to indicate whether they (their firm) would subscribe to such a service if it became available. Table 2.12 provides an outline of the results obtained. It would appear that the development of an operative system would receive a favorable response. A large majority (68.4 %) would currently utilize the service, an even greater majority of respondents indicating they would subscribe to the service in the forseeable future. It is interesting to

note, that only 3.6 % indicate that they are certain they would not utilize the service at some time in the forseeable future.

Table 2.12
Potential Utilization of an Information Service
Developed for the Property Management/Investment Analysis Industry

		% response
Currently subscribe :	Yes	68.4 %
	No	10.5 %
	Don't know	21.1 %
Subscribe in the forseeable future :	Yes	73.5 %
	No	3.6 %
	Don't know	22.9 %

2.3.4 Technology and Information

The potential contribution computer and related technology has to offer management organisations in today's society has been outlined and stressed by a wide variety of authors from a wide variety of backgrounds (Glassman (1970), Shenkel (1971), Levine (1972), Roulac (1974), Spivack (1975), Shenkel (1976), Jaffe (1976), Maxwell (1979), Hampson (1981), Hiban & Stalick (1981), Beard (1983)). The coming of operations research marked the turning point between the view of management as an art as opposed to a science. The theory of business organisations moved from the static and deterministic to the dynamic and probalistic; parallelling such developments has been a growth in systems theory, with its stress on the whole rather than the parts. With the emergence of scientific management has come the development of a scientific methodology incorporating the use of a wide range of techniques, including such mathematical models as linear, quadratic and dynamic programming coupled with the more

statistically oriented ones such as regression and factor analysis. Barnard (1979) considers that such a methodology is reliant on two factors : the techniques often require relatively large amounts of detailed data to be handled if their full potential is to be realised and, secondly, access to computer technology is necessary to deal with the computational burden they impose; both these requirements have been met by the concurrent development of computerised information systems. In the transition to information, data require analysis and interpretation in a process which places them in a decision or problem solving context (Riemenschneider & Bonnen, (1979)).

At its simplist, Barnard (1979) views an information system as consisting of three basic elements :

Input --> Processor --> Output

(Raw Data --> Process --> Information)

Couger & Mcfadden (1975) describe the major functions performed by a computer system also to be input, processing and output. Brabb (1976) equates the electronic digital computer to a data processing system whereby raw data are internally processed into output information. It would appear that the functions or elements of the computer are synonomous with those of an information system; any computer application involves input, process and output, the three functions of the information system.

The computer is the means by which new horizons in data processing have emerged (Blackie & Dent, 1979). Since data processing is at the technical heart of information systems, technological developments have a major role to play in the development of effective information systems. Barnard (1979) identifies advances in technology to be one of the major reasons the potential of information systems have become, in many instances, a practical reality. Much of the literature (Couger & Mcfadden (1975), Thierauf (1975), Llewellyn (1976), Brabb (1976), Sprowls (1979)), have identified the potential role of computer technology within data base management and information systems. In stressing the link such systems have with computer and related technology, Barnard (1979) provides a useful review of the technical developments taking place in computerised information systems. He suggests that computerised information systems can

be broken down into three basic elements :

(i) A means of transmitting, communicating and receiving messages and information. Terminal devices are necessary to permit users to make their requirements known to the central processor and to receive back information. One common type consists of a small console with a keyboard for initiating instructions on specific processes. The same unit receives back information for display. Other forms of output include line printers, graphical devices and cathode ray displays (specially adapted television sets).

(ii) A central facility (processor) for storing, receiving and manipulating data. The central processing facility is the core of the information system in which the computer plays a key role, both in terms of servicing the individuals needs for various forms of data processing, and in ensuring the smooth functioning of the whole system.

In reviewing information systems within agriculture, Pugh (1979) reports that computer processing units have traditionally tended to be concentrated into computer centres, where a central installation is operated by specialists and organised to process a large volume of work; the underlying reason for this has been the high cost of computer installations. He identifies recent developments in computer technology to be a move towards systems that allow regular and direct interaction between the decision-maker and the information system. "On-site" and interactive computer processing can be achieved in, broadly, two ways :

1. Terminal. This is essentially a keyboard and a printer with means to link it via a telephone line to a centrally sited computer. The user dials the computer and, once connected, is able to interact with the computer system very much as if he was at the central site.

2. Micro-computer. The complete computing facility is available to the user with no links to any other centre whatsoever. An additional facility might be a 'modem' which allows the micro-computer to be used as a terminal , and linked by telephone to a central computer site. Pugh (1979)

reports that technological advancements have reduced, in real terms, the cost of microcomputer facilities and peripherals to a level affordable by an increasing number of individuals and firms.

(iii) The final element in a computerised information system consists of programs containing instructions, first for controlling the functioning of the different parts of the system, and secondly for executing user's specific requirements; functions such as updating files, retrieving and displaying data, performing statistical analyses and mathematical programming etc. Large central processing centres typically develop their own software; suppliers would typically provide any micro-computer installation with sufficient "system" software to control all the peripherals. Specific (user-required) programs are commercially available or are developed by the actual user where viable.

The link between computer technology and information systems is apparent and appears to be a strengthening one. The potential of information systems to real estate analysis is therefore, in part, reliant on the acceptance and utilization of technological advancements by the industry.

Computerisation Within the Industry

It is difficult to obtain an accurate indication of the extent of computerisation within the property analysis industry. Hiban & Stalick (1981) provide a brief review of the history of computers within property management.

Computers first had an impact on property management in the late 1960's when they lent themselves well to accounting functions. Other computer applications were developed to cope with the physical security problems caused by the increased crime rates of the 1960's and 1970's. Initially the computer applications of most property management firms were handled through service bureaus rather than in-house hardware, the use of bureaus being more feasible both financially and technically. Many of the early systems were based on punched cards, a medium that holds up to 80

characters of information, and could be read, sorted and tabulated by electronic machines. Following this came the batch systems which also relied on punched cards; however a series of instructions enabled the computer to read the data, store the data and derive calculations to be printed in a report.

The increased attention given computers around this time lead to the development of on-line systems. In this case, the machine was able to take instructions from a terminal operator and immediately produce results either output to the terminal or an appropriate printout. By this time, technological advancements had significantly reduced the cost of computer systems, in real terms, and this resulted in a shift from bureau to in-house computer services.

A number of surveys (Wiley (1976), IREM Research Report (1982), Page (1983)), conducted within the American real estate analysis industry indicate a trend toward the increased use of computer systems in property management. The results of the 1982 IREM Research Study provide some insight to the extent of computerisation within the industry. The report initially documents the types and arrangement of systems currently in use, as follows :

Service Bureau - a company that sells its computer services (access to hardware and software) to companies, firms or individuals who do not have their own equipment or data processing staff.

Time-sharing - a company leases space on and access to its computer(s) and frequently to its software as well, to other firms who do not own a computer. The user purchases or leases an in-house terminal, which is connected to the central computer via telephone line communication.

In-house Computer - the user buys or leases a computer for installation in the user's office(s). The equipment generally includes a central processing unit (CPU), one or more access terminals, a printer, and auxillary storage units, ie tape or disk drives that allow the user to read and store data on tape or disks.

The hardware systems are frequently described or classified as follows:

Mainframe (or "large" computers) - developed for large applications, these systems require specially designed facilities, a large computer operations and technical staff, and can handle the greatest range of applications and quantities of data.

Mini-computers - although smaller than a mainframe, a mini-computer still involves a substantial investment in equipment. It generally requires at least one staff member skilled in computer operations and maintenance, and can be used simultaneously by a large number of people.

Micro-computers, Micro-processors, Personal Computers - the capacity of these machines is limited in comparison to larger machines, many require no more space than a desk top. Technological advancements are constantly increasing their capacity.

Table 2.13 outlines the results of the IREM study, with regard to the uptake of computer technology by the industry. These figures indicate that a high portion of the American industry currently utilize computer systems, and that the industry is experiencing an increase in the adoption of computer technology, the majority opting for in-house systems.

Past surveys of the NZ property industry indicate that the NZ real estate sector have been slow to adopt technological developments. Reporting on the valuation profession, Hargreaves (1984) identifies that until quite recently computer applications in NZ have been confined to the mass appraisal operations of the Valuation Dept.. In 1982 a computer useage survey of NZ valuers was carried out : responses were received from 190 valuation organisations - 14 firms were using computers and 73 firms were intending to use computers (Hargreaves, 1982).

The 1984 (NZ) survey aimed to obtain an indication of the current and likely future uptake of computers within the NZ property analysis industry. Question 1 (refer appendix 1) provides an outline of the specific questions respondents were requested to answer. The results (refer question 1,

appendix 1) are surprising in the degree to which they indicate computers are currently being used by the industry; 71.6 % of respondents are

Table 2.13

IREM Survey Results : Uptake of Computer Technology by the American Property Management Industry

(Source : IREM Research Report (1982))

Overall sample survey 1555 firms, effective response rate 40 %.

	1974	1977	1982	
	%	%	%	
Percentage of all firms using computers	39.5	46.0	58.8	
	Percentage of firms with computerised accounting			
Type of System	%			
Service bureau	58.	52.	27.	
Time sharing	6.	9.	15.	
In-house	31.	37.	55.	(40 % micro. 15 % mini. computers)
Other	5.	2.	3.	
	100.	100.	100.	

currently using computer technology of some sort, the vast majority of these using in-house systems. Of those not currently using computers, only 13.8 % indicated that they were not intending to utilize computers in the forseeable future.

The real estate analysis industry has, for some considerable time, been aware of the potential contribution computer technology has to offer

real estate management and analysis. Much of the literature (Glassman (1970), Shenkel (1971), Levine (1972), Spivack (1975), Shenkel (1976), Jaffe (1976), Maxwell (1979), Hampson (1981), Hiban & Stalick (1981), Kaimann & Rasmussen (1973)), stress this potential in outlining the advantages and the pitfalls surrounding the use of computers. A number of articles (Roulac (1974), Beard (1983)), have reported a recognition on behalf of practitioners of the need to keep abreast of, and to make good use of the advantages offered by such technology. A comparison of the results of the surveys outlined above (Wiley (1976), IREM Research Report (1982), Page (1983), Hargreaves (1984), 1984 Survey) support the existence of this recognition. Those involved with the development and operation of existing data services to the industry, such as multi-listing and the services offered by such institutuions as the NZIV, appear to be well advanced in the utilization of available technology. Kaimann (1980) reports that many multi-listing bureaus are replacing their original product, loose sheets containing photos and data on each listed property, with terminal networks that use a computer to improve speed, accuracy and economy of service. The computerised information service recently introduced by the NZIV (outlined above) illustrates a recognition by the Institute of the need to keep up-to-date with any technological advances that are likely to offer advantages (personal communication, K.Allan).

In summation, it would appear that certain sectors of the property analysis industry have been slow, if not divorced from the uptake of higher technology. This may be, in part, attributable to the fact that the industry is comprised of a large number of individuals and small firms who have not seen the need to commit the necessary financial and manpower resources to adopting technological developments. This is changing as advances in technology reduce, in real terms, the cost and increase the capabilities of computer systems. There appears to be an increasing awareness of the advantages offered by such systems and of the need to keep abreast and to utilize any technological developments that are made.

This would suggest, from a technical point of view, that the industry have an increasing capacity to link to, and to utilize advanced information systems, reliant as they are on computer technology.

2.3.5 Availablility of Data

The development and continuation of an operative information system is, in part, dependent upon the availability of the data and information which the system aims to distribute.

A number of articles (Stigler (1961), Eisgruber (1967), Hirshleifer (1971), Eisgruber (1973), Bonnen (1975)), have stessed the potential of information as a productive resource, and the advantage held over competitors by those who have exclusive use of information. A noteable characteristic of the resource is that this advantage declines as the information is utilized and thus directly or indirectly dispersed to other users. In this light, information is a resource which is difficult to control; it must be exploited, yet in doing so its value to the user diminishes as a result of competitor education.

This fact has been realised by a large number of individuals and organisations within the property world, who appear to be reluctant to make public any data or information which they are not legally compelled to disclose.

The property analysis industry is comprised of a large number of individuals and small firms. Each of these maintain in-house data, and through their work, are in constant contact with different types of data and information; the data available from these sources may not, in themselves be of great value to the industry, however if contributed to a central data/information pool would be of tremendous value. The above suggested reluctance to disclose data could well hamper the effective development and operation of an information system. There are however, two reasons why this limitation may be minimal :

Public Data

Firstly, certain types of data are required by law to be disclosed. In NZ for example, the system of land registration (Torrens System) requires every land transaction to be registered with the Land Transfer Office. Wide use is made of these sales data; the Valuation Dept. for example, use the data extensively; the information service offered by the NZIV, and utilized by a wide variety of practitioners, is based on the availability of these data; a number of Departments, such as the Statistics Dept., are reliant on

the availability of these records. Certain types of data will therefore be available for distribution irrespective of the attitude of individual practitioners with respect to making the information they control, public.

Private Data

The second reason, and one that greatly adds to the potential of an information system to property analysis, is that practitioners appear to be willing to disclose data if they see an overall advantage in doing so. Multi-listing services provide an example. Real estate brokers are willing to surrender the advantage of sole agency and contribute property data (properties available for sale) to a central pool in the hope that the aggregate information available from the pool will prove of greater advantage to them, than the loss of exclusive use of the information they contribute.

If a large number of potential system users recognise the advantages offered by an operative service providing information fundamental to their needs, a sufficient majority may, over time, be willing to contribute to a central data pool. In considering the future of the property management industry, Beard (1983) suggests that it is not unrealistic to expect data on income-producing properties to be collected in data-banks on regional, national and international levels.

It would appear that, although there may initially be a general reluctance on behalf of practitioners to disclose privately controlled data and information, the availability of public data, and the fact that an increasing number of practitioners may, over time, be willing to contribute to a central data base, indicates that it is probable that sufficient data would be available to maintain an operative information system.

2.3.6 Analytical Ability and Information

The potential of information as a resource must be, in part, dependent upon the users ability to put the resource to good use. The previous dicussion suggests that the "state of the art" of property investment analysis leaves much to be desired. Roulac (1977) suggests that very few of those providing real estate economic analysis services have sufficient

breadth of background and expertise essential to superior economic analysis. Pyhrr (1973) considers that one reason it is not common for investment risk to be explicitly included in the analysis, is a lack of knowledge on behalf of analysts and investors.

In August 1984, an investment analysis seminar took place at Lincoln College, Canterbury (NZ). A large number of practitioners from around the country attended the course which aimed to provide an introduction to discounting techniques and related investment performance measures. While the high attendance indicates a lack of knowledge of these techniques, which in themselves could be considered as quite basic, it also indicates an awareness on behalf of practitioners of the need to develop appropriate analysis skills.

A number of articles and books (Messner & Findlay (1975), Epley & Millar (1980), Martin (1982), Fleming & Salvestrini (1982), Korpacz & Roth (1983), Lane (1983)), have been written on the discounted cash flow method and its applicability to real estate analysis. This method underlies many of the measures able to provide an indication of the performance of investment property. A number of reasonably recent articles emerging from the NZ industry (Glew (1982), Stewart (1983)), support the suggestion that discounting procedures are not widely understood or utilized by NZ practitioners involved in real estate analysis. The 1984 survey (NZ) indicated (question 12, refer appendix 1) that only 28.1 % of respondents currently utilize the discounted cash flow method to aid investment decisions.

The American industry appear to be considerably more advanced in terms of an analysis methodology. Wiley (1976) drew the following conclusions from his study conducted some eight years ago :

-most large real estate investors analyse their investment proposals with the 'mortgage-equity' approach.
-the most widely used relative return measures involve cash flows, as contrasted to gross income, net income, or other accounting measures. A large majority of investors are concerned with depreciation and other tax related features attending ownership of real estate investment properties.
-a significant portion of large scale investors use some form of

after-tax discounted cash flow model; the internal rate of return being the most popular.

From his findings, he concluded that the so-called "sophisticated" techniques were in wide use among actual real estate investors - at least the large institutional investors. Page's (1983) recent study indicates that the methodology employed by American property analysts is considerably more advanced than the procedures employed in NZ. His findings indicate that the methodology identified by Wiley (1976) has become more widespread.

The discussion has previously outlined a recognition by the industry of the need for a more comprehensive investigation of the merits of the investment, incorporating the risk factor, prior to finalising an investment decision. This recognition, coupled with an increasing acceptance and utilization of computer technology, has resulted in the adoption of more advanced techniques such as computer modelling. A number of articles (Farrell (1969), Wendt (1972), Pyhrr (1973), Cooper & Morrison (1973), Stevenson & Jackson (1977), Janssen (1977), Martin (1978)), report the potential of this technique and review specific models which have been developed to aid real estate analysis. A high portion of these models have been developed to enable analysts to investigate the impact of risk on the performance of the investment.

Pyhrr (1973) reported some eleven years ago, that risk analysis through simulation is rapidly becoming an established technique in American industry. While he identifies that models are being used by numerous universities and real estate development firms, and available through a variety of computer service organisations, he suggests that a considerable orientation period will be necessary before widespread confidence in simulation models will evolve in real estate. He proposes that, with the considerable cost of developing and testing an operational model and the substantial level of knowledge, expertise and manpower necessary for its development - the application may initially be feasible only at the institutional level where the necessary resources are available.

The NZ industry does not appear to possess the necessary skills to firstly develop, and secondly to utilize computer simulation modelling as an analysis technique; a number of articles (Stevenson (1975), Hargreaves

(1981)), have outlined the application of computer assisted techniques, such as regression, to property analysis, however computer simulation modelling has received only passing attention from the literature.

In summation, while much of the literature condem the simplistic nature of the analysis methodology adopted by many practitioners, the industry as a whole is becoming aware of the requirement for superior analysis and is moving towards achieving this. Roulac (1974) suggests that real estate decisions can be made with the precision that characterises the decisions made in other business sectors. Firstly, there is a wider awareness of the application of modern financial measures of investment performance to real estate. Secondly, a growing proportion of those in decision-making roles are becoming familiar with these performance parameters. Thirdly, and most importantly, is the potential offered by computer technology. The continued development of these factors is likely to ensure that the industry experience a growing ability to put information as a resource, to good use.

Conclusions

The individualistic nature of the practice of property investment analysis has not encoraged the development of specific information services to this sector of the property world. Analysts have had to rely on fórmal services developed for other sectors, such as the service provided by the NZIV, and on informal sources seen as able to provide useful information.

The industry is recognising a growing requirement to examine more closely, the feasibility of potential property investments; an investigation of the impact of risk on the performance of the investment is increasing in importance. As a result of these factors, analysts and investors are experiencing an expanding requirement for data and information; many see their current sources of information as inadequate.

The development and effective utilization of advanced information systems appears to be closely linked to computer technology. The property world has been, for some considerable time, aware of the potential contribution advanced technology has to offer the field of management and analysis. Individuals involved with property investment appear to be aware

of the advantages offered by computer systems and of the need to make productive use of technological advances in this area. A significant number of practitioners have utilized this potential. From a technical point of view, the industry have an increasing capacity to link to and to effectively utilize advanced information systems, reliant as they are on computer technology.

The development of a comprehensive information service to the industry may initially experience difficulties in obtaining data and information. An awareness of the advantages offered by such a service is likely to encorage an increasing number of practitioners to disclose privately held data and information. This, coupled with the availability of public data, ensures that it is probable that sufficient data would be available to maintain an operative information system.

One limitation to the full realisation of the potential of any system that might be developed to provide information to the industry, may be a lack, on behalf of analysts, of an advanced ability to put the information to good use. Past investment analysis procedures have been identified as primitive and simplistic. This limitation is declining; practitioners are becoming aware of the need for superior analysis and there is an increasing ability to achieve this goal. The American industry are setting an example.

These factors lead to the conclusion that an increasing requirement for information, coupled with the inadequacy of current information sources creates the potential for the development and utilization of an information system by the real estate investment analysis industry. Advances in computer technology, which have been widely recognised and utilized by practitioners within the industry, coupled with the likely availability of a central data base, and an increasing ability on behalf of analysts to put the resource to productive use, suggests the industry are capable of achieving this potential.

CHAPTER THREE

A Information System Conceptualised

Chapter one attempts to outline the potential of information as a productive resource to the real estate investment analysis industry. Chapter two identifies the potential for the development of an information system to practitioners involved in this type of work. The objective of this chapter is to combine a number of these ideas, in conceptualising an information system that could be developed within the industry. Because the concepts and relationships introduced below are a forecast of future events, the discussion tends to be more general than specific.

The previous discussion has suggested that one of reasons for the lack of suitable information services within the industry, is that practicing individuals and firms have not had the time or the man-power resources to put to the development of information systems. This is unlikely to change, and although the stimulus and support for the creation of an information system must come from practitioners as a unified group, these individuals are unlikely to be prepared to become heavily involved in the practical side of developing and operating an information system. The success of any comprehensive information system will be measured largely by the pertinence, and the efficiency of the system. To achieve these features, even if developed by stages, the system in its entirety must be fully conceived, conceptualised and planned, prior to its design and development. These factors suggest that the task of developing and operating the system is likely to be placed in the hands of a select group of individuals, possessing (or co-ordinating) the motivation, the skills, and the resources necessary for the task. The organisation(s) representing the practitioners for whom the system will be developed, appear to be the most likely "agency" to undertake the task of developing and operating the system.

3.1 Overview

The system that is most likely to develop could be broadly described as a comprehensive computerised information system (Barnard, 1979); all

components of the system will be computer based, or would, where possible, be developed to make use of computer related technology. In its entirety, the system can firstly be conceived as a comprehensive supply service, providing a regular supply of data and information to a wide range of individuals and user organisations (outlined below) with varying relationships and contact with the main system. Secondly, one of the main functions of the system is likely to be catering for ad hoc inquiries (Sprowls, 1979) of individual users, such as for specific types of data and information, or specific types of processing. Close contact between the main system and individual users, and ready access to the facilities and services offered, are likely to be features of the system. A number of user organisations are likely for example, to interact with, and make use of the system on a daily basis, using equipment located in their own offices (Pugh,1979); certain users may only make use of the data processing capabilities of the system; other subscribers may simply require a straighforward supply of data and information.

The scattered location of potential system users, and the focus on a select body co-ordinating and operating the service, implies a system structure consisting of a central core and an extensive delivery and communications system. Figure 3.1 provides an illustration of the basic components and component relationships comprising the structure of the system.

The central core would function as the heart of the system and would comprise the main data base (discussed below), perform the majority of data processing and analysis, and control the organisation and operation (Barnard, 1979) of the system. This would be linked to individual users by an extensive communication and delivery system. It is important to identify at the outset that the flow of communication within the system will be circular; the delivery network would enable two way communication between the central core and individual system users. It is likely to incorporate a number of communication levels to cater for the different needs and facilities of individual system users.

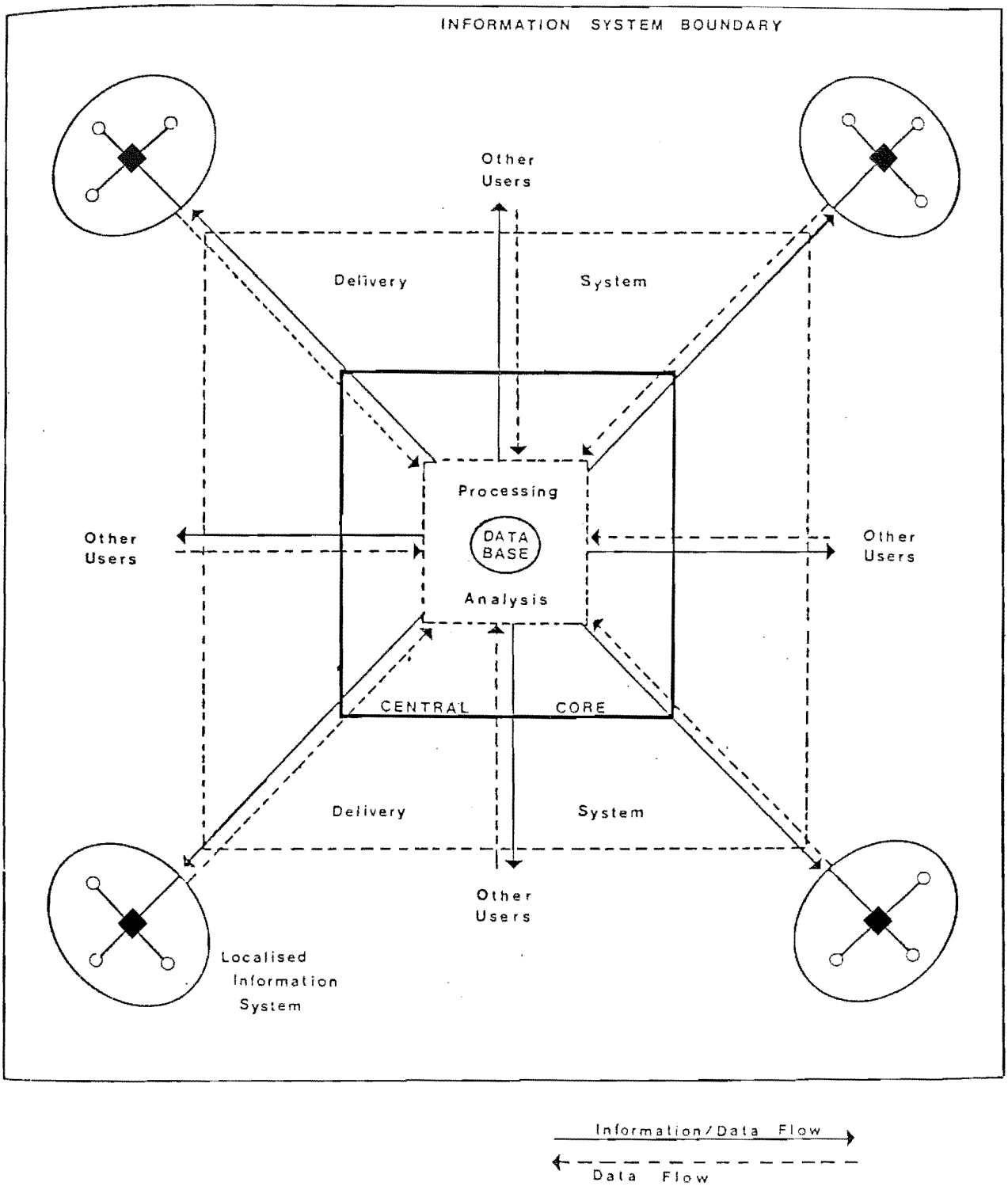


Figure 3.1 Information System Structure

While the central core and delivery system create a comprehensive supply service, specific information needs of individual user organisations, the availability of an extended (central) data base, improving capabilities of in-house computer facilities (Pugh, 1979), and the privacy of certain data types (Sprowls, 1979), would encorage the development (at the users end) of "localised" information systems (Thompson, 1979). These are likely to develop as sub-systems linked to and utilizing the data, the information, and the facilities provided by the central core. Figure 3.2 provides an outline of the general structure of localised information systems. These are likely to evolve as a series of lower order systems (refer section 3.5), each developed in response to a specific requirement for information. Figure 3.3 illustrates an example of the hierarchial nature of the system that is likely to develop. The comprehensive information system can be conceived as a system of sub-systems.

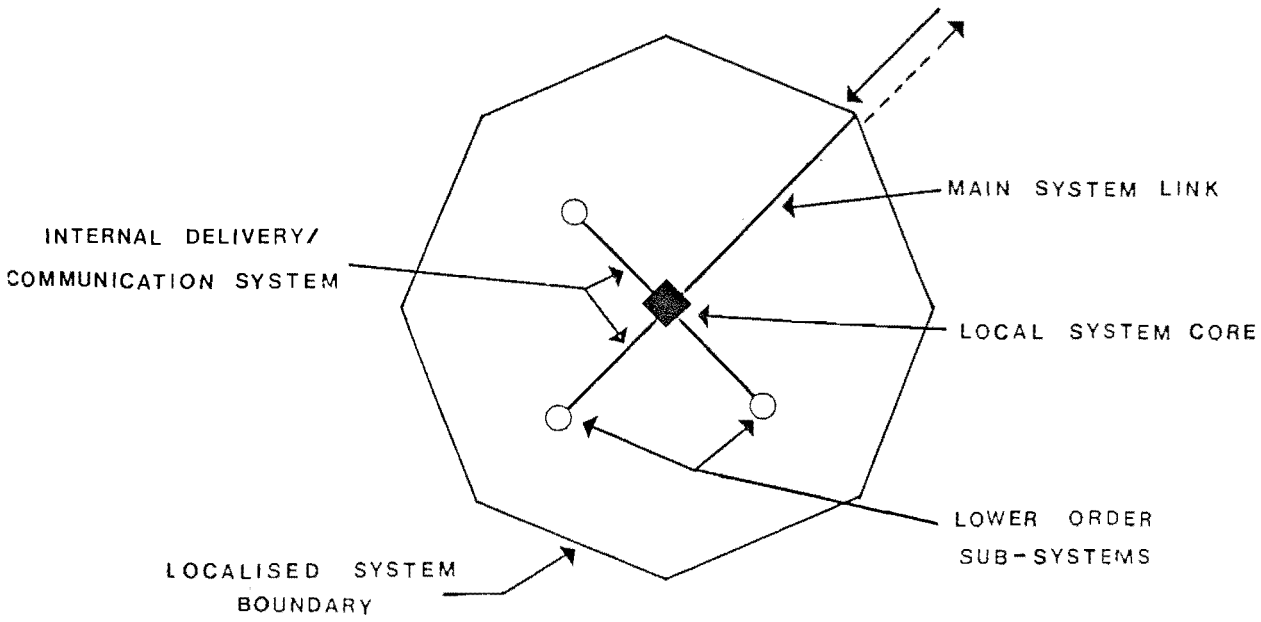


Figure 3.2 Localised System Structure

3.2 System Users

Although developed specifically for organisations and individuals involved in the analysis of investment property, the wide range of property based data and property related information available from such a system would encourage a large number of individuals and organisations to make use of the service. Potential users would be central government departments; local, regional and ad hoc authorities; firms with interests in land and land related matters, such as real estate agents, legal firms, property developers, property management organisations and large institutional investors; and educational institutions including universities. Professionals likely to have an interest in such a system, in addition to property investment analysts, include valuers, architects, lawyers, engineers, surveyors, planners, and land adminisrators.

The structure of the system proposed above would involve a substantial level of overhead costs - spreading the service, and hence the costs, over a greater range of individuals and organisations would reduce individual user charges and thus enhance the potential utilization of the service. A greater range of system users implies a greater range of data contributors. The availability of the service and the use that is made of the data and information held within the central core, would have to be tempered with data security considerations (discussed below). The following discussion attempts to examine the major components of the system in greater detail.

3.3 Central Core

The central core would act as the focus, and provide the expertise and the co-ordination, for the entire system. It would act as the central base in housing the administration and the physical components such as the central computer and archive data base. It would develop as the heart of the system having the functions of ensuring the smooth functioning of the entire system, receiving, regulating and processing data, and distributing information according to user requirements (Barnard, 1979).

The central core would provide the expertise necessary for the operation of the system itself, and also the servicing of the requests and

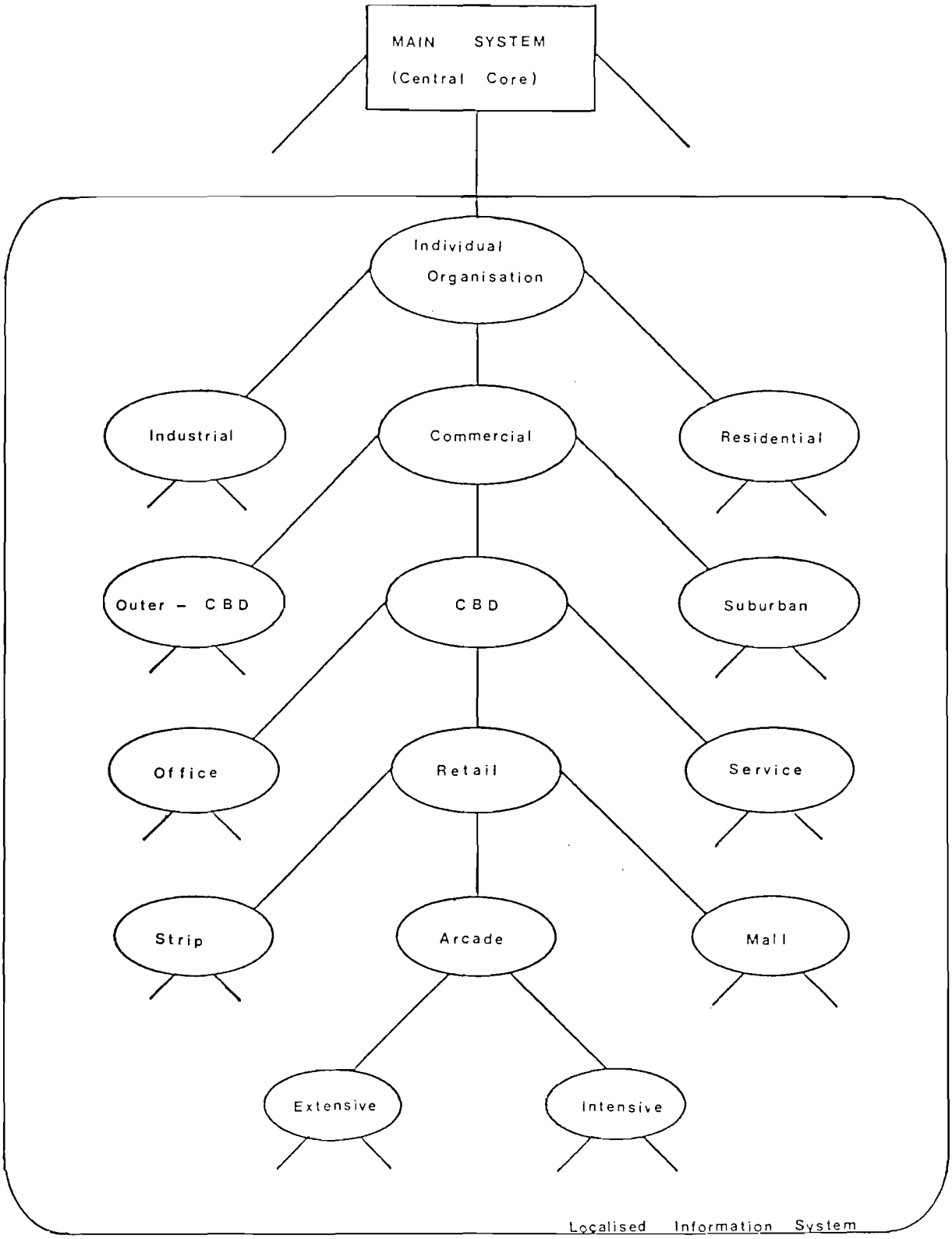


Figure 3.3 Hierarchial Structure of a Comprehensive System

requirements for advice from individual users. The central core is likely, for example, to provide where applicable, individual users with technical advice as to the most suitable computer and related equipment for their particular needs, in addition to other advice such as aspects concerning localised data base management.

An important function of the central core will be to monitor the effectiveness of the system with respect to current and likely future user requirements. The efficiency of the communication system (outlined below) will enable close contact between the central core and individual users; interactive communication is likely, for example, to be a feature of the system. Facilities enabling response and feedback from individual users will enable the central core to identify, and respond to evolving user requirements. One possibility would be a "suggestions facility" that enables users to comment on current issues concerning the service, and inform the central core as to current or anticipated requirements of the system.

A further function would be to keep abreast of, and introduce to the system, any technological advances that might enhance the service offered (Barnard, 1979). Advances in the capacity and efficiency of telecommunications for example, have the potential to improve the overall delivery system, and should be monitored and utilized by the system. The following discussion considers the important components of the central core.

(a) Data Base

An integral part of the computerised system, the main data base would be located and maintained at the central facility. Data held within the central core is likely to comprise the full range of urban investment property types. It is likely to be both aggregate (representing general aspects of the property sector, such as the amount of industrial development under construction at some point in time, average value levels for specific property types etc), to specific data on individual properties. Data held on residential properties for example, may range from aggregate data relating to the number of individual investment properties by type, location, value or age etc, to specific data held on individual

properties such as the number of rental units, rental levels, lease arrangements, current occupancy, standard of accommodation, other improvements, investment history etc.

Because certain data decline in value over time (Bonnen, 1975), and because of storage limitations, the data base would comprise internal and external (or archive) storage.

(i) Internal - internal storage is likely to be divided into primary (main memory) and secondary (auxillary) storage (Couger and Mcfadden, 1975). Primary storage is contained in the central processing unit and consists of the data immediately being processed by the computer. Secondary or auxillary storage contain data (and programs) not being processed by the computer; this type of storage is typically of very large capacity, and is simply an extension of primary storage. Internal storage would comprise data typically processed on a day to day basis.

(ii) External - external storage would be used principally for storing data where high speed access is not important. The medium of storage may consist of punched cards (becoming obsolete), magnetic tape, and documents encoded with magnetic ink characters or optical characters (Couger and Mcfadden, 1975). The external storage medium would allow data stored in archive form to be readily re-entered into the central computer system. Data not required on a day to day basis, or data considered to be out of date would be stored externally.

The development and maintenance of a property based data bank of the size and nature that would be required for the system outlined above, would be dependent upon the availability of both public and privately held data.

Examples of public data that would be of use to the system would be the data held by a number of central or local government departments, such as the Valuation Department and Lands and Survey Department of New Zealand. The majority of these departments are transferring their data banks to computer based data systems. The ability to attain public data on computer based transfer medium enables it, where available, to be efficiently incorporated into the data base maintained at the central core. A further facility may be a direct access link to data banks held within other

organisations, such as multiple listing bureaus.

Many of the data that would be needed by the system would have to be obtained from private sources. Individual users are likely to supply certain types of data at periodic intervals. A property management organisation may for example, be required to provide a wide range of data drawn from the portfolios of the properties with which they are involved. The key to the development and maintenance of the data base is likley to be convincing potential contributors that the overall benefit from the aggregation of data from all contributors, will be of greater benefit, than the loss of privacy of the data contributed. An important consideration will be data security.

Data Security

The property investment environment is competitive and much of the data held by individuals operating within that environment is considered to be strictly private. To encorage individuals to contribute data, some system of data security is likely to be maintained. Data may for example, be coded according to the requirement for security (Sprowls, 1979), and released only to individuals or organisations considered to qualify for access to the data. Rental data relating to a specific group of properties for example, may only be available to a specific group of individuals or organisations. The aggregation of data should, where applicable, be such that no link can be made between the contributor and the data provided. The fact that certain data are likley to remain strictly private, is likley to encorage the development of localised information systems.

(b) Data Processing

A dependence on large scale computer capacity and a proximity to the main data base, implies the majority of data processing would be carried out at the central core (Barnard, 1979). Access to an extended (central) data base would enable both regular and specific processing of data.

Regular Data Processing

Although any particular parcel of information may be specific to a given problem or the analysis of a particular property, a large portion of

the information required by property analysts on an ongoing basis, is of a similar type, such as comparable sales information, available rental space or market absorbtion rates.

Once the initial requirement for information needed on an ongoing basis has been identified, regular processing of aggregate data to provide this information would be carried out at the central core. An example would be the development of market trend information : delineated on a property type (or perhaps location) basis, this type of information could be produced and distributed from the central core at regular intervals.

Specific Data Processing

The unique nature of each investment property suggests that in addition to an ongoing requirement for certain types of information, users are likely to have, at different times, a need for specific information. The range of information of this type is extremely wide; examples would be the amount of vacant industrial space in a particular locality, the average time delay (or range of times delays) between a particular type of property being placed on the market and confirmation of sale, or the number of residential sections available in a certain locality. The processing of data to produce "one-off" type information is fundamental to real time information systems (Thierauf, 1975) such as the one outlined above.

Data processing is likely to be executed by two types of programs. Because they determine the type of information supplied, it is important to distinguish between these:

(i) Packages - widely available commercially developed programs designed to perform pre-defined tasks such as statistical analysis, mathematical programming and a host of analyses for which the procedures are widely known and generally accepted.

An example of this type of processing would be the development of general sales information such as average sale prices, the range and standard deviation of prices paid for particular types of property, the most frequently paid price, and other statistical measures typically provided by packages such as SPSS (Statistical Package for the Social Sciences).

A technique made widely accessible through the availability of computer packages is known as regression analysis. This technique enables the relationship between a single and a number of other variables to be quantified. Regression offers considerable potential to real estate analysis, and the processing section of any comprehensive information system is likely to make wide use of this method of analysing data. The assessment of rental income for any particular investment property, for example, is dependent upon a number of factors, such as locality, quality of the property and the space offered, current vacancy levels within the market, lease terms and conditions etc. These factors can be quantified in various ways, and rental estimates derived from a regression of these factors. It is not unrealistic to expect users to request the central core to carry out this type of analysis and provide this type of information on a regular, and on a request basis.

(ii) Specific "user-prompted" programs - the design and development of these programs would be in response to a specific (ongoing) user requirement for information of a particular type. These programs would be tailored to satisfy specific requirements placed on the system.

The analysis programs outlined above are likely to be used within the system in a variety of ways : firstly, depending upon the computer facilities of individual users, they are likely to be located and maintained at both the central core and at the users end (localised systems). Secondly, they are likely to be able to be utilized as programs independent of any data base (central or localised), or as programs linked to and utilizing the central data bank, or where maintained at the users end, the localised data bank. The investment model developed within this study provides an example of the type of specialized program that would be developed to enable specific types of analysis to be carried out within the system. The following discussion draws on this model to outline a number of attributes, and a number of advantages inherent in the development and availability of specialised analysis programs.

Investment Analysis Model

The investment analysis model described in chapter four can be seen as an information system of two dimensions. Firstly, the model can be viewed as an independent information system complete and adequate in itself. Secondly, the model can be seen as a small component, or a sub-system, of the comprehensive information system outlined above.

(a) Investment Model as an Independent System

The model is able to fully and adequately perform in isolation, with no link to any other system or data base whatsoever. In this situation, the model is reliant on data developed outside the system and input by the model user; the independent use of the model is reliant upon the users ability to provide the fundamental input data necessary for the analysis to be completed. It is not unrealistic to expect for example, users to be able to access, via the communication system, specialised programs (such as the investment model) maintained at the central core, submit the necessary input data, and receive the output information, all in interactive mode. Where analysis programs are used as independent systems, either at the central core or at the users end, the value of the output is wholly dependent upon the "value" or acceptability of the input.

(b) Investment Model as a Sub-system

Programs such as the investment analysis model are able to be located and maintained within the central core, and provide information as a finished product, or incorporated as a complete "localised" information system, or as a component of a localised system, developed and/or maintained at the users end for more specific applications.

Incorporating and utilizing the model as a sub-system of the main system is likely to improve the efficiency of application and enhance the value of the model as an information system. Linking the model to an extended (central) data base which could be accessed, manipulated and analysed (by specialised programs and techniques such as regression) to provide the fundamental input data required by the model, would enable the user-input (data) requirement to decline. This improves the efficiency of application. Because the model analysis and results are based on current and more comprehensive market data, and because any bias that might be

introduced (via the input data) by the user is minimised, the value of the output is improved.

In the analysis of a potential industrial development for example, a number of the basic investment input parameters, such as the initial cost of land, initial rental level and anticipated rate(s) of rental growth, occupancy/vacancy rate(s), operating expense ratio(s) and potential sale prices, could be derived from the data base, submitted to the program user for approval or change (where desirable) and then submitted to the investment model.

3.4 Communication - Delivery System

The demands placed on the communication system are likely to differ in the type and level of communication between the central core and individual users (and between users themselves), the frequency of communication and delivery of information, and the nature of the medium of supply. The key to the success of the system lies in its ability to cater for individual user requirements. An effective delivery system would involve a number of communication levels, enabling two way communication between the central core and individual users, and where possible, between users themselves. Figure 3.4 provides an illustration of the flow of communication within the system.

Advances in computer technology have enabled a comprehensive delivery system to be both technically and financially feasible (Pugh, 1979). The following discussion provides an outline of the components of a delivery system that could be developed to cater for the different requirements of users. Figure 3.5 provides a diagramatic representation of these components and the likely levels of communication within the system.

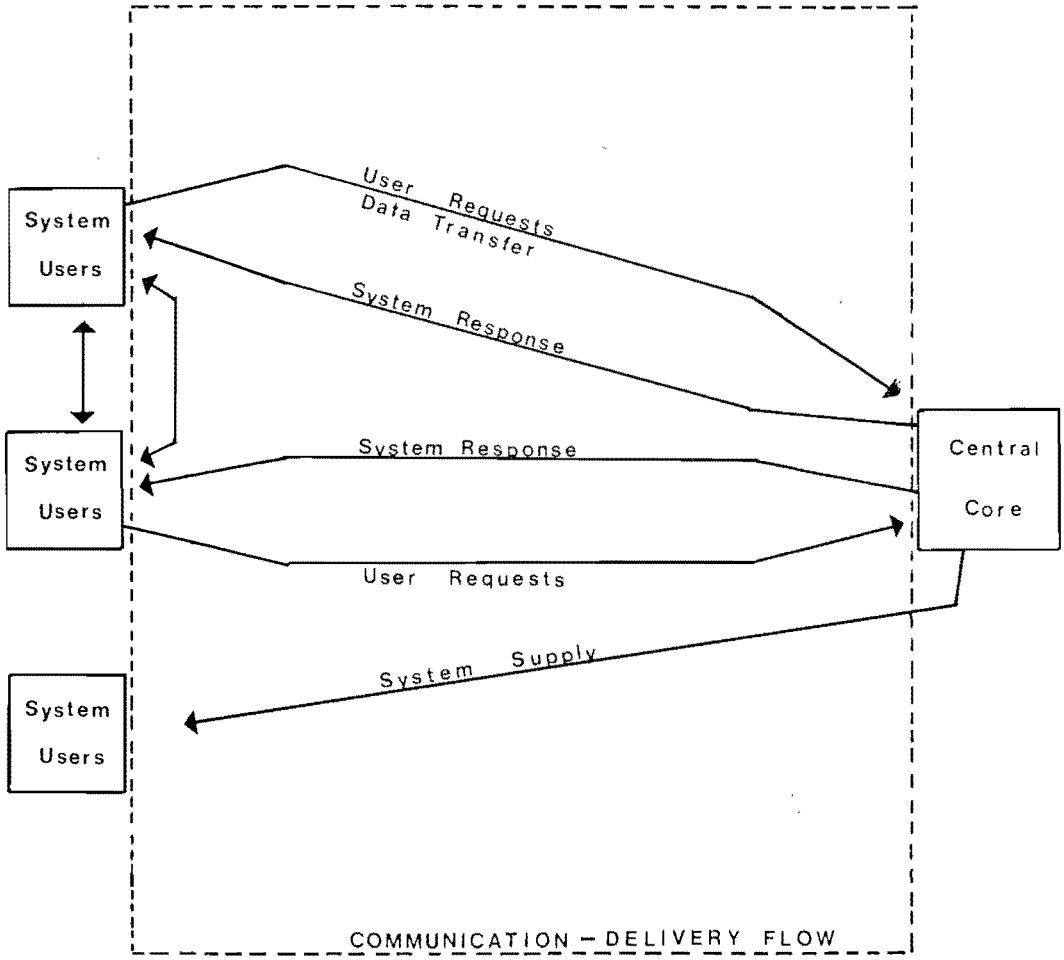


Figure 3.4 Communication/Delivery Flow
Within the Information System

(a) On-line facilities for users with the requirement and resources for continuous/semi-continuous enquiry access. On-site and interactive systems would be achieved in three ways :

(i) main-frame/mini computers held by large organisations or government departments with the requirement to link to and utilize the system.

(ii) terminals - users would have access to a terminal with a keyboard (for entering instructions) and a printer with means to link it via a telephone line (telecommunication) to the central computer; continuous interaction of request and response with the central computer is possible.

(iii) microcomputer - microcomputers with their limited, however increasing data base and processing capabilities are likely to be an important component of comprehensive information systems (Pugh, 1979). An important component of any microcomputer installation will be a 'modem' which enables the micrcomputer to be used as a terminal and linked by telephone to the central computer; this will enable access to centrally stored data, centrally held programs, and processed information.

Access to a localised self-contained microcomputer enables on-site and interactive computing leading to the development of localised information systems. Figure 3.6 provides an illustration of a typical microcomputer installation.

(b) Remote data/information capture at "receiver stations" for lower level system enquiries. Remote capture of information would be achieved by:

-terminal systems functioning largely as receivers only.

-adapted television receivers able to capture information directed via satelite or via telecommunication network.

Examples of the type of users utilizing this type of delivery mode would be firms such as small real estate agencies who do not have the

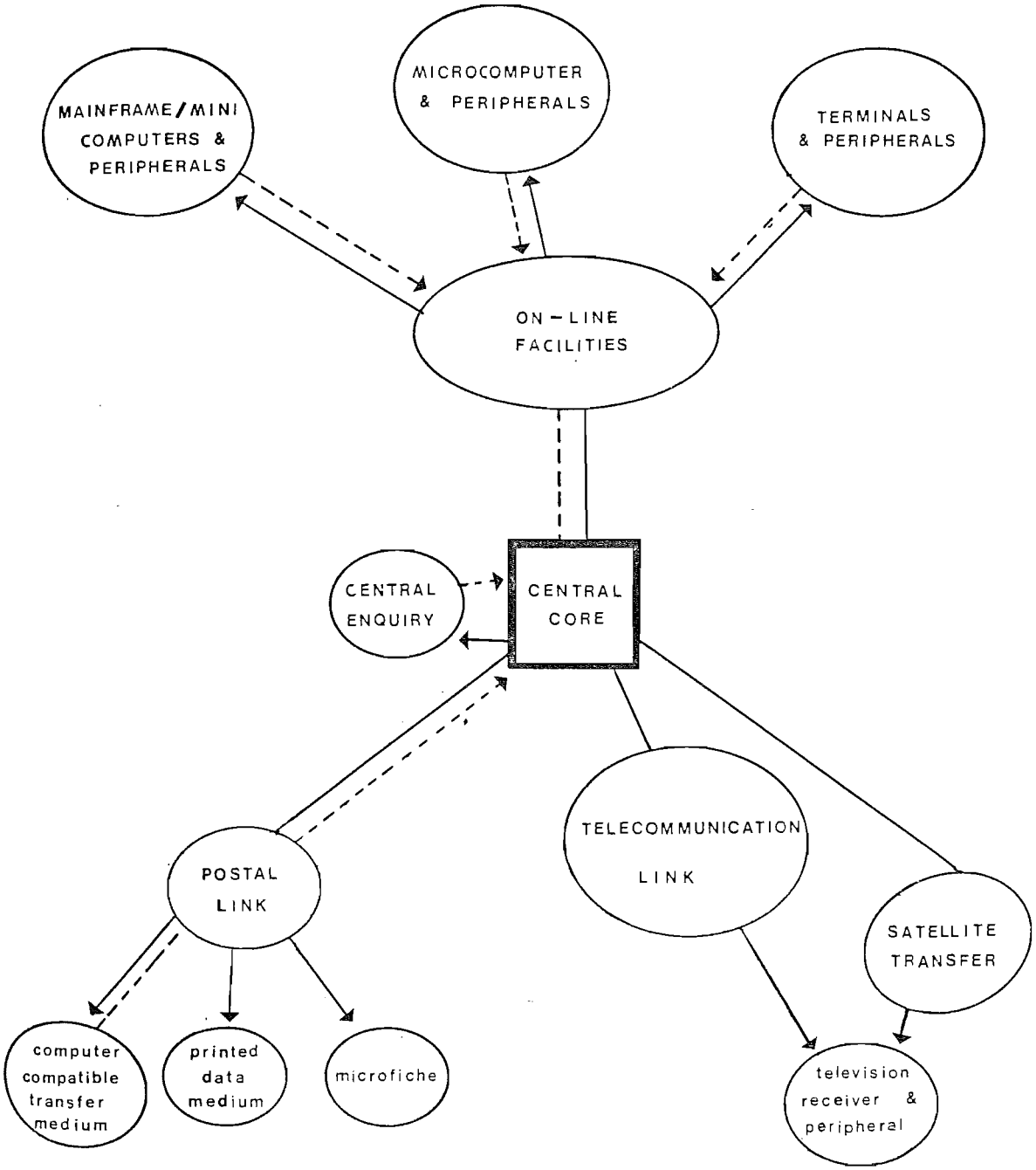


Figure 3.5 Comprehensive Delivery System

requirement for continuous or semi-continuous access to the system, however have an ongoing need for information relating to property. Peripherals such as printers enhance the potential of remote capture links.

(c) Lower level communication facilities, such as postal services, providing regular and "on-request" data and information transfer between the central core and system users. Data and information are likely to be transferred in the following forms :

- computerised storage medium (such as floppy disc) compatible with individual user facilities.
- printed medium for low level user requirements not justifying the investment in receiving equipment.
- other storage medium such as microfiche or microfilm.

It is likely that higher level users would make use of these lower level facilities.

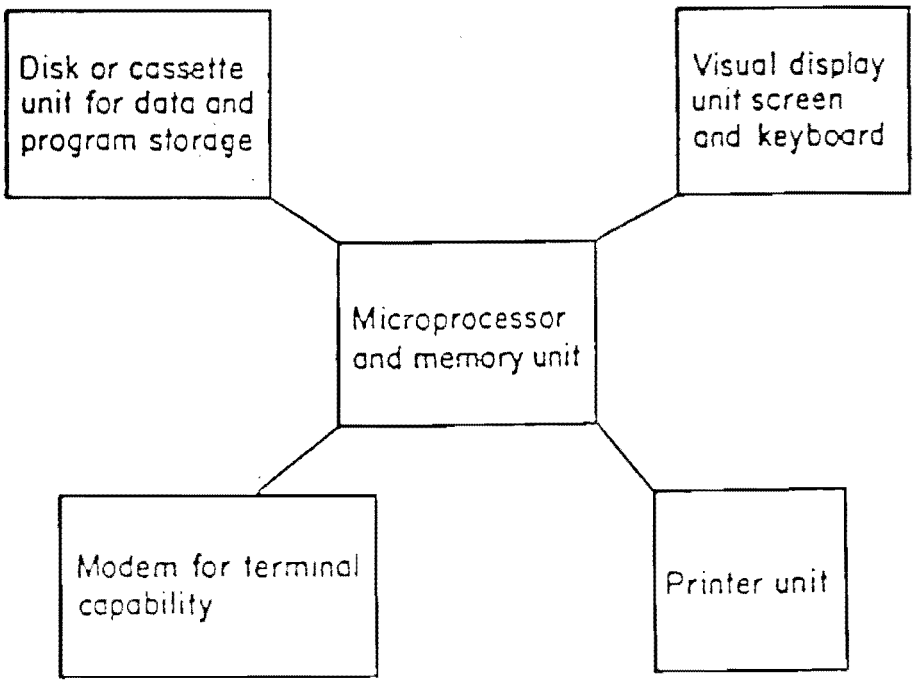


Figure 3.6 Typical Microcomputer Installation
(Source : Pugh, 1979 - page 116)

Data Contribution

The effectiveness of the system is, in part, dependent upon maintaining a current and comprehensive data base. New data will be added and existing data modified in a very controlled environment to ensure the accuracy and integrity of the data (Bonnen, 1975).

In addition to catering for the intake of public data (outlined above), the delivery system would enable the periodic transfer of data from individual users to the central core. Where users have the necessary computing facilities, the most efficient method of data transfer is likely to be interactively through the system itself (Thompson, 1979). The transfer of data on computerised data storage medium, such as floppy discs or magnetic tape, is likely to be widely used by individuals and firms with less extensive computer facilities.

Postal transfer of data from individual users to the central data base would be restricted by the need to establish the data on machine compatible storage and access medium (Thompson, 1979); the economics of transfering printed data into the central computer may not enable hardcopy to be used as a data transfer medium, from the users end.

3.5 Localised Information Systems

Localised information systems (or sub-systems) are likely to develop as users identify and attempt to satisfy specific information requirements that may not be adequately (or efficiently) catered for by the main system (central processing). Ready access to an extended (central) data base made possible through the delivery system (Pugh, 1979), coupled with the availability of in-house computer facilities at the users end, enhances the potential of information sub-systems; localised information systems are likely to make use of both types of programs outlined above. Figure 3.2 provides an illustration of the likely structure of a typical localised system.

As indicated in Figure 3.3, localised information systems are likely to be developed as a series of lower order systems (Barnard, 1979). Within the localised system developed by any particular property related organisation for example, there may be a sub-system developed to cater for the information requirements relating to commercial properties. This

commercial sub-system may be developed by segments, each relating to a particular type of property or location, such as central city, retail or service. Each of these segments may in turn, be comprised of a number of sections, each relating to a particular type of property or location. In this way, the localised systems are likely to develop and expand in stages, each in direct response to a requirement for information of a particular type.

Summary

The above brief forecast into the nature of the system that could develop within the industry, poses some interesting questions and encourages the consideration of a number of exciting possibilities with regard to the development and operation of comprehensive information systems.

The discussion has purposely avoided certain questions that would require detailed consideration, such as the structure of the decision-making process and the hierarchy of authority within the system. Other important aspects such as user charges, user priority, and user access would also require detailed investigation. At this stage it may be safe to briefly note the possibility of the development of facilities enabling the provision of more than objective information. Subjective and intuitive information is of use to individuals involved in the analysis of investment property. The development and provision of this type of information would require detailed investigation.

Many components and facilities of the system are likely to be novel to the majority of users. The introduction of the service is likely to include considerable user education programs in an attempt to inform users on requirements, and importantly, the capabilites and potential of the system.

The discussion introduces the investment analysis model developed within this study, within the context of the main information system. The model's ability to adequately perform in isolation as a complete information system in itself, encorages its widespread use by both main system users and practitioners with no connection to the central information system. Its ability to be incorporated within, and to operate

as a sub-system of the main system, adds to the potential of both systems; the efficiency of application and value of output is improved, and this, by definition, improves the overall potential of the central system.

The key to the success of the system lies in its ability to cater for the full range of user requirements, and in doing so foster a commitment to the system on behalf of individual users. Because its survival is dependent upon the continued support of users, it is likely to develop very much as a users system, with all components and facilities specifically designed and directed towards satisfying individual requirements. It is apparent from the above discussion that the system in its entirety is ambitious. The development and operation of such a system is likely to meet with considerable obstacles. It is hoped that the problems encountered can be overcome, and that such an idealised system be realised.

CHAPTER FOUR

INVESTMENT ANALYSIS MODEL

4.1 OBJECTIVES OF THE INVESTMENT MODEL

The first step in simulation modelling is to formulate the problem. It is critical at the outset for the model-builder to determine the exact nature of the problem (Shannon, 1975); this is particularly important in simulation studies where the model-builder may not be the ultimate user of the model (Blackie and Dent, 1979b). This study involves the development of a simulation model which will, in general, be used by persons with little or no knowledge of the techniques used in simulation modelling. The aim of the model is to provide decision support information on the financial feasibility of a specific predefined investment in urban real estate. The analysis provided by the model is based on data developed outside the model and input by the model user. The components of the analysis (outlined below) are compatible with the statutory regulations and requirements governing real estate investments in New Zealand.

4.2 MODEL DESIGN CRITERIA

The first creative stage in the development of the model, involves a conceptualisation of the "system" being studied. Diagramatic representation can be useful. The general idea of this procedure is to promote systematic and clear thinking about the system under study, and to set the component parts in appropriate juxtaposition (Blackie and Dent, 1979b). Figures 4.1 and 4.2 attempt to provide a representation of the main components of the investment analysis system as well as the interrelationships between these components.

Figure 4.1

Components of the Investment Analysis System for Property Development Investments.

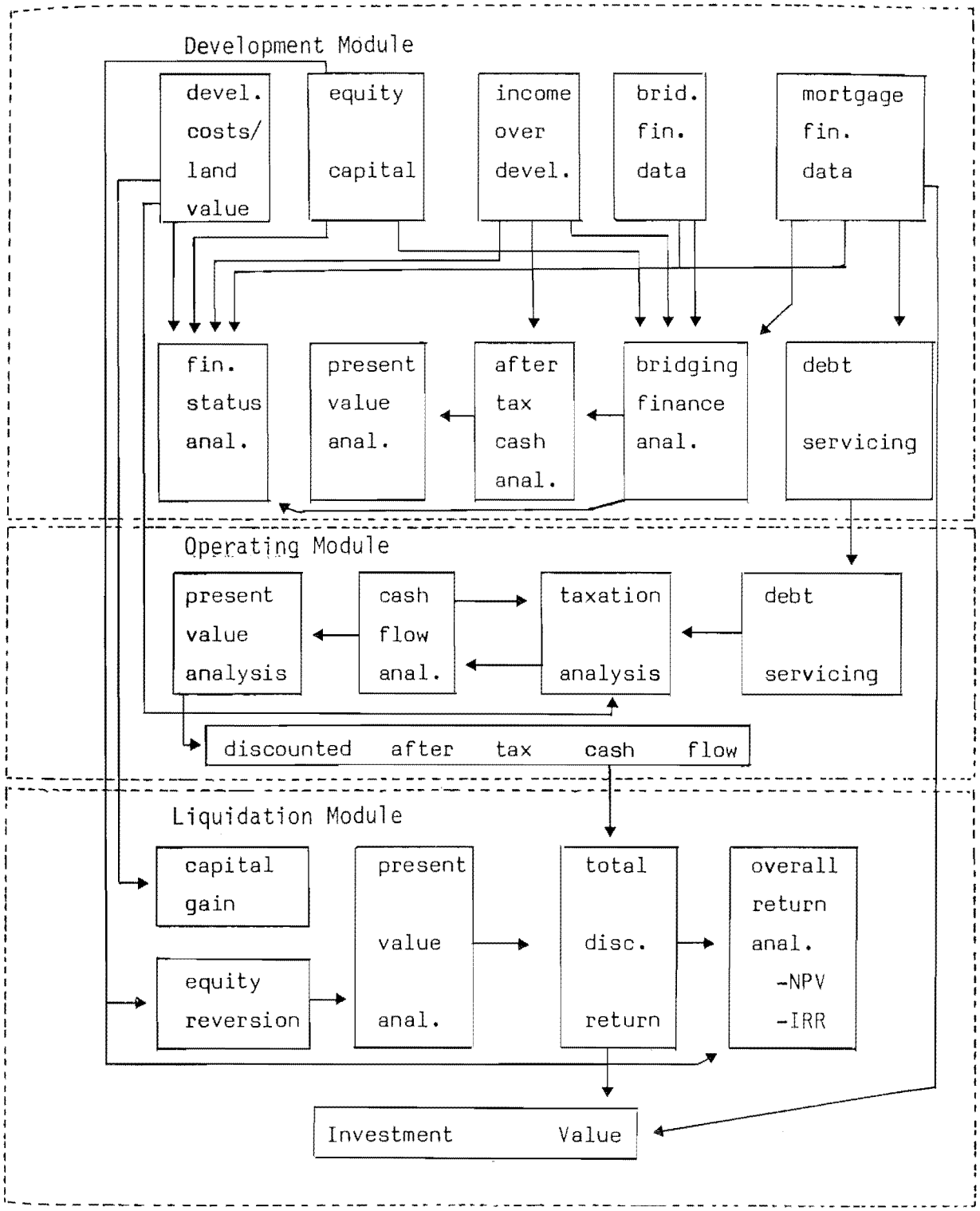
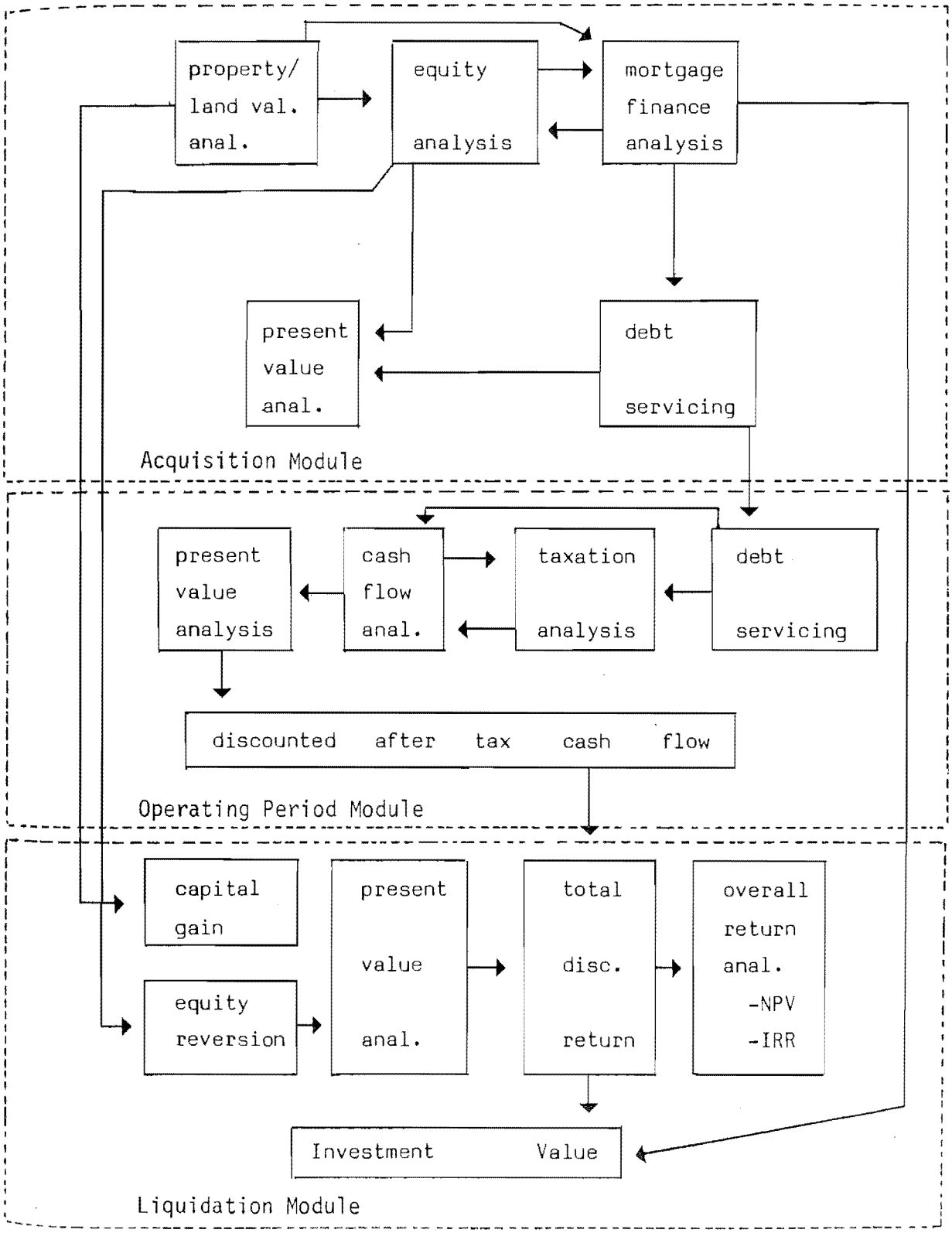


Figure 4.2

Components of the Investment Analysis System for Property Purchase Investments.



It is necessary to design the computer model in detail prior to actually constructing the computer program of the model; computer coding should be a straightforward representation of the symbolic model (Blackie & Dent, 1979b).

Modular Top-down Approach

A modular design has been selected as the most appropriate structure of the computer program for this study. The model has been designed as a series of high level modules which in turn are composed of a series of submodules. This procedure enables a systematic approach to programming, allowing identifiable portions of the system to be conceptualised and developed into the overall structure of the model. A strict modular top-down approach to programming will produce a model which can be adapted and expanded as needed.

4.2.1 Model Design Objectives

The underlying design objective was to maximise the flexibilty of the model with respect to its potential application. The basic design considerations were firstly to ensure the model is able to be applied to any type of urban property. Secondly, to ensure the model is able to cater for the likely range of basic investment parameters that might be experienced in real estate investment situations. Examples of these are loan/value ratios, the number, type, repayment and refinance terms of any mortgage finance, variations in bridging finance, operating expense levels, depreciation allowances, taxation and investor discount factors, together with the basic cash flow and investment liquidation data.

A further consideration was to ensure, as far as possible, the analysis provided by model can accommodate any likely changes in governmental or local authority legislation.

The model is written in standard Fortran 77. It is designed to be used interactively at the terminal, providing both terminal display output and output in hardcopy form. Appendix 2 provides a listing of the computer program of the model.

4.3 MODEL OVERVIEW

The main structure of the model comprises four main modules:

- development term module (applicable to investments involving the development of investment property).
- acquistion module (investments involving the purchase of existing real estate).
- operating period module.
- liquidation module.

Depending upon the nature of the investment, either the development or the acquistion module combines with the operating and liquidation modules to provide the overall analysis of the investment proposal. Both the operating and liqidation modules are reliant on data items developed by the preceeding sections of the model. Figure 4.3 illustrates the relationship between the basic modules comprising the model.

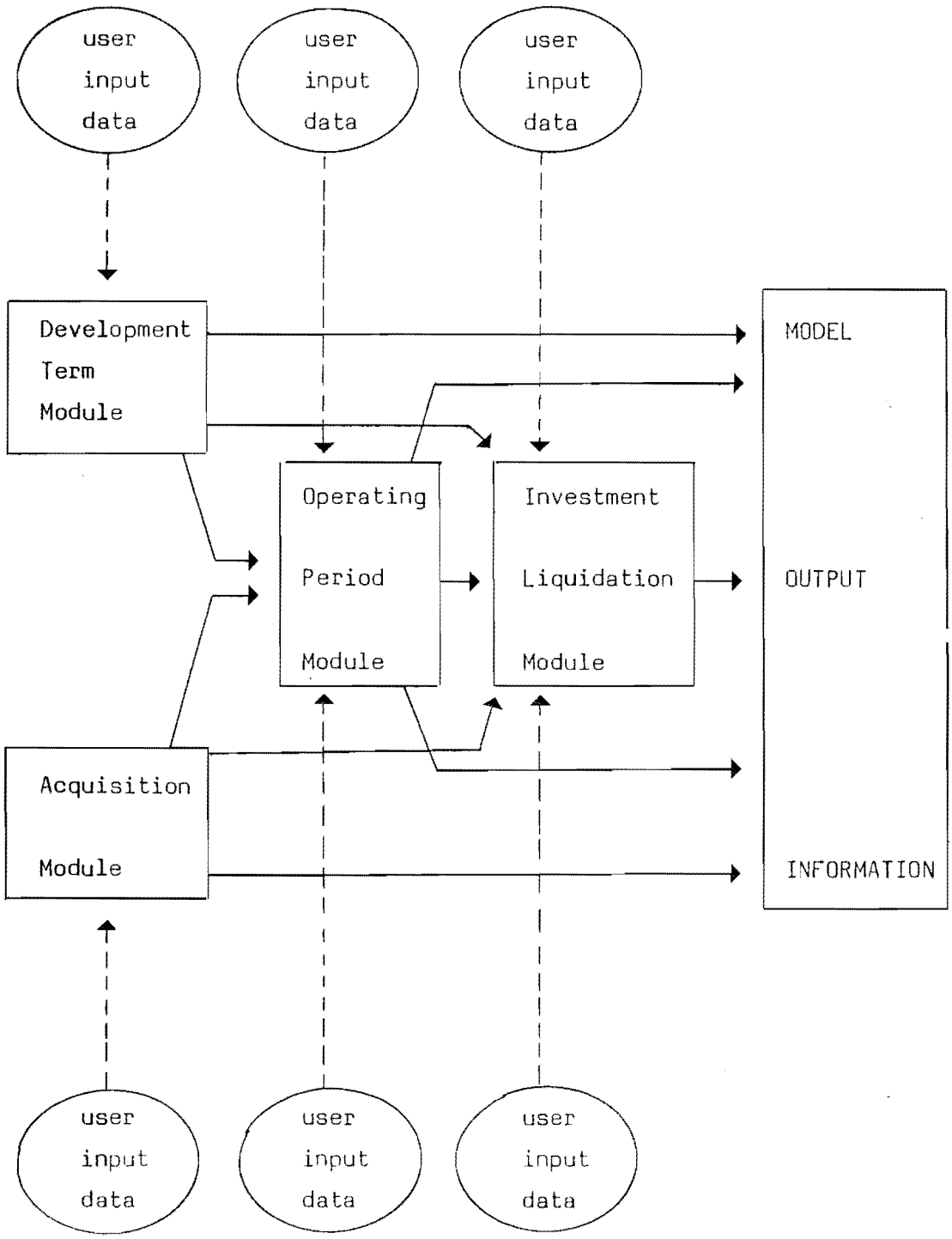
The following discussion briefly introduces the objectives of each module.

4.3.1 Development Module The development module is applicable to investments involving the development of an urban property. The aim of this module is to accept, and where applicable, generate subsequent cash flow items incurred over the development of the property. The model combines the cash flow items to provide information assisting an analysis of the cash position of the "investment" at regular (per period) intervals over the development term. Where applicable, cash flow items are carried over to the operating and liquidation modules. The information provided by the model includes a detailed summation of the output from the development analysis.

4.3.2 Acquisition Module For investment situations involving the purchase of urban real estate, the acquisition module accepts the basic property purchase data and where applicable, generates subsequent cash flow items. These are carried over to the operating and liquidation modules where applicable.

Figure 4.3

High Level Modules



4.3.3 Operating Period Module The objective of this portion of the model is to complete a comprehensive, after tax, discounted cash flow analysis on an annual basis. The duration (number of years) of the operating period must be specified by the model user. The analysis is based on both user input data and data developed by the preceeding modules. This module provides a substantial portion of the information developed by the model.

4.3.4 Liquidation Module This section of the model aims to complete, for each year of the operating period, an examination of the overall financial feasibility of the investment under the assumption that the property is sold at the completion of each operating year;it combines the cash flow analysis with an assumed property sale to provide financial return information under the different investment holding periods available to the investor. The analysis is based on user input property disposal data and data items provided by the preceeding sections of the model.

The model examines, for investments involving a property development, the financial feasibility of disposing of the property at the completion of development, ie a develop and sell option.

This section of the model incorporates the analysis output provided by the predeeding modules to provide the fundamental decision support information with respect to the financial feasibility of the investment.

The following discussion attempts to describe the model in detail. It concentrates on each module individually reviewing each item and the relationship of each to the rest of the model.

4.4 MODEL REPRESENTATION

4.4.1 DEVELOPMENT MODULE

The analysis of an investment involving the development of an urban property, initially concentrates on the financial aspects of the development itself. The following items comprise the components of this analysis.

4.4.1.1 Time Horizon The analyst is required to set the time horizon upon which the development analysis is based. This involves specifying the duration of the development term and the number of periods this term is to be divided into for analysis purposes;the analyst is required to specify the number of periods over development and the number of these periods per annum, ie the duration of each period.

Examples :A two year development term for which a monthly analysis is required, the analyst would specify 24 periods, 12 per annum.

:A three year development for which a quarterly analysis is required would comprise 12 periods, four per annum.

These data are fundamental to the development module as it sets the limit on the timing of subsequent user input data and internally computed cash flow items; these must be compatible with the number and duration of development periods initially set by the analyst. The factors which will determine the optimum time horizon are outlined on page 116.

4.4.1.2 Investors Required Rate of Return This rate reflects the investor's perspective of prevailing market conditions as well as his minimum acceptable rate of return on capital invested in the project. It is the rate at which cash flow and liquidation items are discounted.

The analyst or model user is required to enter the investors required rate of return in percentage (decimal) form. Both annual (operating period) and periodic (development term) discount factors are derived as follows:

Annual factor =(1./(1.+i)**N)

Periodic factor=(1./((1.+i)**(1./NPA))**N1)

where i=investors required rate of return.
N=number of years the cash item is to be discounted.
NPA=number of development periods per annum.
N1=number of development periods over which the cash item is to be discounted.

4.4.1.3 Cost of Development Cash items representing the cost of development reflect the magnitude and the timing of the payment of the direct costs of developing the property inclusive of the cost of any land. The cost of mortgage (section 4.4.1.8) and/or bridging finance (section 4.4.1.7) is catered for separately and is not to be included as a direct cost of development.

Development cost items are able to be input as a single cost ($) input for each period over the development term, beginning at period zero.

The timing of the payment of the costs of development will be a major factor influencing the time horizon selected by the analyst for the development term. Payments are assumed to be made at the end of each period. This assumption will influence the time horizon decision.

4.4.1.4 Land Value This lump sum ($) input comprises the actual or estimated cost of the land at the time of land purchase. In situations where the investor already owns the land, the estimated land value (as at the beginning of development) should be input to enable the investment results to reflect the opportunity cost of the land. The land value is essential for the computation of items such as the book value of the structure, depreciation and capital gains.

4.4.1.5 Equity Capital Invested Where applicable, equity inputs to the investment over the development term are able to be included in the analysis in two ways:

(i) Direct equity inputs are able to be entered as a single ($) input for each period over development, beginning at development period zero. Direct equity inputs are assumed to occur at the end of each period. This is compatible with the timing of the direct costs of development.

(ii) Equity inputs resulting from the refinance of mortgage capital. In situations involving the refinance of standard flat mortgages (section 4.4.1.8) over the development term, where refinance takes place at a sum less than the original principal, the difference is taken as an equity input to the investment. Equity is also able to be invested in the project in the form of equity financed capital improvements (section 4.4.3.11) made to the property over the operating period.

4.4.1.6 Income Over Development The analyst is able to include, where applicable, any income generated by the project over the development term. Income items are to be net of any expenses incurred in generating that income.

Net income over development is able to be input as a single ($) input for each or any period beginning at development period zero. To maintain compatibility with other cash flow items, income is assumed to be earned at the period end. This assumption must be considered by the analyst when determining the development term time horizon.

The model completes an analysis producing the after tax cash flow available to the investor over the development period. In situations where income generated over development is low or nonexistant, this item will reflect the magnitude of any tax shelter provided by the development term cash flows. This analysis is outlined under the develop and sell option (section 4.4.5).

4.4.1.7 Bridging Finance Facility to incorporate bridging finance is assumed to be available during the development term at any time prior to the time mortgage finance is borrowed. For developments which involve bridging finance the analyst is required to specify:

- the period the bridging finance is available.
- the maximum ($) sum that is able to be borrowed.
- the annual interest rate.
- the period that the bridging finance is to be repaid.

The bridging finance schedule is computed internally, based on the above data and the following procedure : a cash balance, based on the physical receipts and payments for each period over development, is computed at each period end, as :

cash balance closing = cash balance opening (start of period)
+ equity input for the period
+ income for the period
- development cost for the period

Bridging finance "maybe" borrowed if all the following apply,

- the period coincides with or follows the period bridging finance is available.
- the cummulative bridging finance borrowed to date is less than the maximum ($) sum available.
- the closing cash position for the period reflects a deficit position.

The amount of bridging finance borrowed is equal to either:

- the cash deficit if the cummulative finance borrowed plus the deficit does not exceed the maximum sum available, or
- the remaining sum available to be borrowed.

This procedure ensures that for each period, only the sum required to cover the deficit for the period is borrowed. In this way the closing cash position inclusive of bridging finance is zero.

In line with the timing of the flows comprising the cash balance, bridging finance is assumed to be borrowed at the period end. The first interest will therefore begin to accrue over the following period. The annual interest rate is converted to a periodic rate based on the number of development periods per annum. Interest is computed on a compound basis, ie interest computed for the current period is added to the principal for subsequent periods. Cummulative principal and interest is repaid as a single lump sum at the end of the period the bridging finance is to be repaid.

Interest on bridging finance involved in property developments is typically computed on a daily basis (personal communication, D.Newman). The magnitude and duration of this type of finance within a development project will influence the initial time horizon decision for the development term analysis. The analyst faces a tradeoff in selecting the optimum time horizon for the development term analysis. Minimising the duration of the individual periods which form the basis for the analysis will improve the accuracy of the total interest charged on bridging finance. The periods will however, have to be of sufficient duration to ensure that the timing of the other cash flows which occur over development can be accurately represented; for each period over development, an individual period duration of one day may ensure the interest computed on bridging finance truly reflects the real life situation. However it may not be possible to identify on a daily basis the timing of other cash flow items such as development costs, equity inputs and any income that may be generated over development.

4.4.1.8 Mortgage Finance Flexibility was the key objective in the design of the mortgage finance section of the development module. For investments involving mortgage finance:

-up to three separate mortgages are able to be included at any time (ie any period) over the development term. Mortgages are able to be of the standard table or standard flat type.
-mortgages which extend past the development term are carried over to the operating period of the investment.
-standard flat mortgages are able to be refinanced at any time over the development term or the operating period.

(i) Initial Mortgage Finance. For each mortgage, the analyst is required to specify:

-the period the finance is available.
-the type of mortgage (table/flat).
-the principal ($) sum, loan term and annual interest rate.
-the number of repayments per annum - the model caters for any number of annual repayments, for each mortgage.

Loan repayment schedules are computed internally based on this data and the following standard assumptions:

-finance is available (borrowed) at the beginning of the period specified.
-interest and principal payments are made at the period end, ie in arrears.

Table Mortgages The payment to amortise a standard table mortgage is computed internally using standard formula (Jefferies, 1978). The loan repayment schedule together with the interest and principal portions of each payment are computed on a period basis for each table mortgage.

Flat Mortgages The periodic interest payment is computed as:

payment = i*principal

where i = periodic interest rate

Principal is repaid as a single lump sum at the termination of the loan.

(ii) Mortgages Carrying Over to the Operating Period. The model caters for mortgage finance involving more than one repayment per annum. Although the operating period analysis is on an annual basis, in situations involving mortgages which carry over to the operating period, it is necessary to ensure that the correct interest and principal portions of the total annual debt service are computed for each operating year, for each mortgage;table mortgages involving more than one repayment per annum will contribute a smaller interest portion to the total annual debt service than the same mortgage with a single annual repayment. The number of annual repayments on flat mortgages will not affect the interest portion of the total annual debt service provided by those mortgages.

Accurate interest and principal portions are necessary to ensure the validity of subsequent totals dependent upon these items. For example, annual tax deductible interest, equity buildup via principal repayment, outstanding mortgage balance and, in turn, subsequent totals dependent upon these figures.

For each mortgage carrying over to the operating period, the repayment schedule is continued on a period basis (as for the development term) over the entire duration of the operating period or the remaining term of the loan; ie on a period rather than an annual basis. The interest and principal payments applicable to each individual year of the operating period are then summed and recorded. These totals comprise the interest and principal portions of the total annual debt service for each mortgage for each year of the operating period.

(iii) Mortgage Refinance Standard flat mortgages are able to be refinanced at any time during the development term or operating period. Refinance is able to take place at a sum greater than, equal to or less than the original principal. For mortgages which are to be refinanced the analyst is required to specify:

-the period (development term) or the year (operating period) in which the refinance is to take place.
-the principal ($) sum, and annual interest rate.
-the refinanced loan term.
-the number of repayments per annum.

Repayment schedules are based on these data and the following standard assumptions:

-refinance takes place at the beginning of the period/year.
-interest payments are made in arrears.

The computation of the loan schedules for refinanced mortgages follows the same procedure as for initial mortgage finance (ref. part (i) above); ie the refinanced mortgage is essentially treated as replacing the original loan. As indicated, in situations involving the refinance of a mortgage at a sum less than the original principal, the difference is taken as a direct equity input to the project. In situations involving a greater refinanced principal, the difference is simply treated as additional borrowed capital.

It should be noted that the model relies on the analyst to ensure the compatibility of the input data. The timing of the "items" comprising the development must be compatible; for example, in an analysis involving six periods per annum, it is illogical to attempt to include mortgage finance requiring 12 repayments per annum. The time horizon decision will be

influenced by the following factors:

-the frequency and the timing of the payments of the direct costs of developing the property.
-the magnitude and the timing of any bridging finance.
-the timing of mortgage finance, both incoming principal and repayment requirements.
-the frequency and timing of any income or equity capital applicable to the project.
-the assumption that cash flow items occur at the period end.

The model displays a schedule of each individual cash flow item on a period and a summation or total basis. The loan repayment schedule for each mortgage is displayed on a period basis.

The model computes an overall cash position for each period over development, as follows:

cash position closing = cash position opening (start of period)
+ equity input (direct plus via refinance)
+ income for period
+ bridging finance borrowed for the period
+ incoming mortgage principal (initial and refinanced) where applicable

- period development cost
- final bridging finance repayment where applicable
- period debt service (interest and principal including principal repayment via refinance)

An investigation of the closing cash position for each period will provide the investor with an indication as to the compatibility or acceptability of the components of the investment. A deficit closing cash position indicates the total payments made over the period exceed the funds

available for the period. This situation indicates that more finance is required; if the investment is to be undertaken, the timing of incoming funds will have to be rescheduled to cover any potential deficit situation (period). The closing cash position is particularly useful in providing an indication of the efficiency of the allocation of investment funds. A substantially high (positive) cash position for any period(s), would indicate that funds scheduled for investment in the project at some time (period) in the future, are currently idle.

The above items comprise the components of the development term analysis. Figure 4.1 provides an illustration of the relationship of these items to the rest of the model.

4.4.2 ACQUISITION MODULE

The acquisition module is applicable to investments involving the purchase of a parcel of real estate. The following discussion outlines the components of this module.

4.4.2.1 Estimated Acquisition Price This data input represents the actual or estimated asking price of the property under investigation.It includes both the land and improvements.

4.4.2.2 Estimated Land Value This input represents the estimate of the land value at the time of property purchase. It is essential to the computation of such items as the book value of the structure, annual depreciation and capital gains.

4.4.2.3 Equity Input In property purchase situations, equity inputs are able to arise in three ways:

(i) Direct equity input. The analyst is able to specify the investors initial equity input to the investment. This is taken as a single lump ($) sum invested at the time of property purchase.

(ii) Via mortgage refinance. As for development investments, where mortgages are refinanced at a sum less than the original principal (refer section 4.4.2.5) the difference is taken as a direct equity input to the investment.

(iii) Equity capital is able to be invested in the project in the form of equity financed improvements (refer section 4.4.3.11) made to the property.

4.4.2.4 Investors Required Rate of Return This input is fully discussed in section 4.4.1.2.

4.4.2.5 Mortgage Finance The design and objectives of the mortgage finance section of the acquisition module do not differ greatly from that

of the development module (outlined in section 4.4.1.8). The following points should be noted:

-up to three separate mortgages, of the standard table or standard flat type, are able to be included as part of the capital involved in property purchase. Mortgage finance is assumed to be borrowed at the time of purchase.

-standard flat mortgages are able to be refinanced (at any principal sum) during any year of the operating period. Refinance is assumed to take place at the beginning of the year specified.

-the analyst is required to specify the following data for each mortgage.

Initial mortgage finance:

- -type of mortgage(table/flat).
- -principal, loan term, annual interest rate.
- -number of repayments per annum.

Mortgage refinance:

- -year mortgage refinanced.
- -refinanced principal sum, loan term, annual interest rate.
- -number of repayments per annum.

Loan repayment schedules are initially computed on a period (rather than an annual) basis, depending upon the number of repayments per annum. Interest and principal payments applicable to each year of the operating period are then summed and recorded. As discussed in section 4.4.1.8, this procedure ensures the computation of accurate interest and principal portions of the total annual debt service for each year of the operating period.

The above items illustrate the components of the acquisition module. Where applicable, these are carried over to the operating and liquidation modules.

4.4.3 OPERATING PERIOD MODULE

The objective of this module is to complete, for each year of the operating period, a comprehensive after tax discounted cash flow analysis. In such an analysis, investors are typically interested in output figures from an investment feasibility and a liquidity or cash flow point of view. For this reason the model provides, where applicable, the analysis and output of cash items in discounted or present value terms and in nominal or actual dollar value terms. The following discussion examines the module in detail.

4.4.3.1 Year The model is able to provide an annual analysis for a maximum operating period of 50 years.

4.4.3.2 Discount Factor Factors for both periodic and annual discounting are computed internally based on the investors required rate of return (section 4.4.1.2). In investment situations involving the development of an urban property, the discount factor is applied to provide a present value indication for cash items occurring over the investment, as at the beginning of the development term. The discount factor for property purchase investments provides the present value of cash items as at the time of purchase or the beginning of the operating period.

4.4.3.3 Gross Income This figure represents the maximum potential income that is able to be earned by the property during each operating year. It is the basis upon which subsequent cash items are computed.

The gross income figure is able to be changed from year to year to reflect increases or decreases in nominal rentals or changing market conditions. Changes in potential gross income need not necessarily be annual. The model caters for rent reviews of any duration. The rent review interval is able to vary over the operating period of the investment.

An important component of the overall analysis is the discounting or the derivation of the present value of investment cash flow items. Discounting is based on the assumption that the ($) sum is to be discounted from the period/year end, ie the sum is available to the investor at the period/year end.

Typically, real estate lease arrangements would specify that rental installments must be paid in advance, and that more than one installment per annum is required.

Because rental income does not typically accrue as a single lump sum at the end of each operating year, a straight discounting of the ($) sum would not reflect the true present value of that income. The model employs the following procedure to overcome this problem:

- the yearly gross income figure is converted to an "equivalent year end" ($) figure by compounding the individual installments comprising the annual income figure. The compounding procedure is based on:
  - the number of installments comprising the annual gross income.
  - the assumption that rental is paid at the start of each installment period, e.g. six installments would indicate rental being paid two monthly in advance.
  - the investors required rate of return.

EXAMPLE : Nominal gross income for the year equals $27500 paid monthly in advance. The equivalent year end figure for discounting purposes relating to an investors discount/compound rate of 17 % would be :

- monthly compound factor = ((1.17)**(1./12))**N

= (1.0131696)**N

where N = number of months compound

- monthly rental = $ 27500/12

= $ 2292

MONTH	NOMINAL RENTAL	COMPOUND FACTOR	YEAR END EQUIV.
1	2292	1.169998	2682
2	2292	1.154791	2647
3	2292	1.139781	2612
4	2292	1.124965	2578
5	2292	1.110343	2545
6	2292	1.095910	2512
7	2292	1.081665	2479
8	2292	1.067605	2447
9	2292	1.053728	2415
10	2292	1.040031	2384
11	2292	1.026512	2353
12	2292	1.013169	2322
	NOMINAL $ 27500		YEAR END EQUIV. $ 29976

The present value of the annual gross income is able to be derived by discounting the equivalent year end sum.

It should be noted that the analysis is not directly concerned with the present value of the gross income figure itself. However, this procedure enables subsequent cash items, derived from it, to be discounted with validity.

The model provides output of the potential gross income figure in both nominal dollars and year end equivalent dollar terms.

4.4.3.4 Occupancy Rate This figure is supplied by the analyst and reflects the average level of occupancy of the property over the operating year. It should be based on prevailing occupancy rates in the local market area and where applicable should take account of the historical level of occupancy of the subject property. The occupancy rate is able to be reduced to take account of any bad debt that may be necessary.

Although this rate remains constant over the operating period, changes in effective gross income (refer section 4.4.3.5) are able to be catered for by varying the potential gross income figure.

4.4.3.5 Effective Gross Income Effective gross income reflects for each year of the operating period the actual income earned by the property. It is computed by applying the annual occupancy rate to the potential gross income for each year.

As for gross income, to ensure the validity of the discounting procedure, the model computes and records effective gross income in both nominal dollar and year end equivalent dollar terms.

4.4.3.6 Annual Operating Expenses This item reflects the annual expenses incurred in operating the property for the purposes of generating the annual income. It represents the expenses that are paid by the investor. It includes :

- -fixed expenses such as real property rates, land tax, insurance premiums etc.
- -variable expenses dependent upon the level of occupancy.
- -repairs and maintenance to the property.
- -replacement of short lived items such as carpets, appliances etc.

Annual operating expenses should be derived from a market analysis that includes a comparison of the operating expenses of similar type properties. From this, operating expenses may be estimated to be a constant percentage of effective gross income; effective gross income (rather than potential gross income) is used as the basis for computing operating expenses, as it is able to reflect both fixed costs and the expenses which are likely to vary with the level of occupancy.

To maintain flexibility, operating expenses may be entered by the analyst in two ways :

(i) as a constant percentage of effective gross income.
(ii) as a lump sum ($) input for each operating year or series of operating years.

This latter method caters for situations where operating expenses may not be a constant percentage of effective gross income over the entire operating period of the investment.

It is unlikely that operating expenses will be paid as a single lump sum at the end of each operating year. For discounting purposes, the model computes an equivalent year end operating expense figure based on :

- -the number of installments (or payments) comprising the annual nominal expense figure.
- -the assumption that the payment is made at the end of each installment period, ie in arrears rather than in advance.
- -the investors required rate of return.

The compounding procedure (outlined in section 4.4.3.3) is used to compute the year end equivalent figure, catering for payments in arrears rather than in advance, e.g. for monthly installments, income in month three would be compounded by ten months (as income payments are made in advance) whereas operating expenses for month three would be compounded for nine months (operating expenses being typically paid in arrears) in order to compute an equivalent year end figure.

4.4.3.7 Net Operating Income Net operating income is internally computed for each year of the operating period by deducting the operating expenses from effective gross income.

For discounting purposes, net operating income is computed in nominal dollars and as a year end equivalent ($) sum.

4.4.3.8 Cash Throw Off to Equity Cash "throw off" to equity represents the before tax cash balance remaining from income, after all expenses and the annual debt service have been paid. It is computed by deducting the total principal and interest payments on all mortgage finance, from the net operating income for each year of the operating period.

As outlined in sections 4.4.1.8 and 4.4.2.5, any mortgages existing over the operating period are able to incorporate more than one annual repayment. The annual debt service for such mortgages will obviously comprise a series of payments at regular intervals over the year. For discounting purposes these payments are converted to an equivalent year end debt service figure based on :

- -the timing of individual interest and principal payments for each mortgage over the year.
- -the assumption that mortgage payments are made in arrears.
- -the investors compound rate (converted to a periodic rate).

The procedure used replicates that applied to annual operating expenses (section 4.4.3.6).

The analyst is not directly interested in the present value of the total annual debt service. However, the discounting procedure is applied to subsequent totals dependent upon the debt service figure.

The model computes the cash "throw off" to equity figure as year end equivalent, and nominal dollar items.

4.4.3.9 Cummulative Principal Payment The cummulative principal payment is computed internally to represent the cummulative or total principal repaid on all mortgages to the end of each operating year. It is calculated in nominal dollars and provides as indication to the investor as to the equity buildup in the investment resulting from the repayment of mortgage principal.

4.4.3.10 Unpaid Mortgage Balance The unpaid balance represents the sum of all principal outstanding on all mortgages at the end of each operating year. It represents, in nominal dollars, the finance outstanding after the principal repayments have been made for the "current" year.

4.4.3.11 Capital Improvements The investment analysis takes account of any capital improvements that may be made to the structure of the property at any time over the operating period. These are likely to take the form of additions or alterations, a refurbish or renovation of the structure. Improvements are assumed to take place at the beginning of the year in which they are made.

Capital improvements are included in the analysis as a lump sum ($) figure(s) input by the model user. The analyst is required to specify the method of financing the improvement; improvements are able to be financed by equity capital or by mortgage finance.

Where improvements are financed by mortgage capital, the analyst must ensure sufficient finance has been allocated; for example, an improvement in the range of $ 33500 at the beginning of year five, may well be "covered" by the refinance of an existing mortgage in year five, at a principal sum increased by $ 33500. It should be noted that both refinance and capital improvements are assumed to take place at the beginning of the operating year.

Capital improvements increase the book value of the structure in the year in which the improvement was made, by the ($) value of the improvement. Such improvements therefore generate tax deductible depreciation (section 4.4.3.13) for that and all subsequent years.

4.4.3.12 Book Value Building (Open) The book value of the structure is computed as at the beginning of each operating year.

For property development investments the book value of the structure at the completion of the development term is the sum of the direct costs of creating the structure. For property purchase investments, the book value is computed by deducting the estimated land value from the total acquisition price of the property. The book value declines in each year by the amount of depreciation claimed for the year (refer section 4.4.3.13).

4.4.3.13 Depreciation Allowance An annual tax deductible depreciation allowance is available on assets used in the production of assessable income. In the case of buildings, depreciation is designed to cover the loss in value brought about by fair wear and tear. Annual depreciation is not to include any allowance for obsolescence (New Zealand(NZ) Master Tax Guide, 1984 para. 1301). The two most common methods of depreciation are the cost price and the diminishing value basis.

(i) Cost Price Method. The annual allowance for depreciation is calculated at a flat percentage of the historical cost of the asset. This method applies mainly to buildings, the annual allowance remaining constant over the operating period, unless improvements are made to the structure of the property.

(ii) Diminishing Value Method. The basis for depreciation under this method is the declining book value of the asset, ie the flat depreciation rate is applied to the declining book value. This results in a reducing depreciation allowance for subsequent years over the operating period.

Although the cost price basis is typically the method applied in the assessment of depreciation for buildings, the model caters for the application of both methods outlined above.

The form tax deductible depreciation takes is dependent upon the type of property and the age of the structure.

Ordinary Depreciation The analyst is required to specify the method of depreciation and the rate that is able to be claimed. The Inland Revenue Department(IRD) of New Zealand advertise the general rates that are able to be claimed. These are displayed (ie terminal display) by the model. The analyst is not restricted to the displayed rates.

First Year Depreciation Certain building types are able to claim a first year depreciation allowance. This must be claimed in the first year the asset is used in the production of assessable income (NZ Master Tax Guide, 1984 para. 1352). The IRD advertise the building types that qualify for first year depreciation, and the rates that are able to be claimed, as follows :

-approved new tourist accomodation	22 %
-private facilities for licenced hotels	22 %
-new hotels and motels	10 %

These rates are displayed by the model.

The analyst is able to specify where applicable the rate of first year depreciation that is able to be claimed. This is applied to the cost price of the structure. Ordinary depreciation is resumed for the second and subsequent years.

Accelerated Depreciation An accelerated depreciation allowance is available for the first five years a newly constructed house is used exclusively for rental purposes. The allowance does not apply to :

-accomodation provided for the travelling public.
-boarding houses.
-accomodation provided by employers for employees.

(NZ Master Tax Guide, 1984 para. 1366)

The model displays the rates of accelerated depreciation that are able to be claimed, as advertised by the IRD. The analyst is required to specify the method and the rate to be used. Ordinary depreciation is resumed at the completion of the five year term.

No depreciation allowance is able to be claimed in the year a building is sold, irrespective of whether or not a profit is made on the sale (NZ Master Tax Guide, 1984 para. 1325; personal communication Inland Revenue Dept.). The method of including depreciation as a tax deductible item is outlined below (section 4.4.3.14).

4.4.3.14 Sum Tax Deductible Items The provisions of section 104 of the Income Tax Act 1976, constitute the general authority for deducting from assessable income any expenditure or loss incurred in producing that income (Income Tax Act, 1976). The sum of the tax deductible items represent the total tax deductible expenses that are able to be claimed against any income produced, for each operating year.

The analysis has previously taken account of normal operating expenses (section 4.4.3.6) in deriving the net operating income for each year.The sum of the tax deductible items are therefore able to include:

-any interest paid on mortgage finance.

-the annual depreciation allowance.

(i) Interest Interest paid on borrowed finance may be treated as a tax deductible item as long as it is payable on capital employed in the production of assessable income (NZ Master Tax Guide, 1984 para. 1012).

Current legislation includes provision however, for the recovery for tax purposes, of interest that has been claimed where land is sold within ten years of acquisition by the taxpayer. For recovery purposes "interest" is considered to be the interest which has been paid on the land, since its acquisition on :

-mortgage money used to acquire the land.

-mortgage money used to make improvements of a capital nature to the land.

(NZ Master Tax Guide, 1984 para. 1013)

Certain circumstances exempt, in whole or in part, particular properties from the interest recovery provisions. The IRD will assess the merits of each case. The model caters for the possible variation in the applicability of this clause as follows :

-interest must be either claimed in total or not at all.

-where interest is claimed, the model assumes the property is exempt from the recovery provisions, ie interest claimed is not reassessed for tax purposes where the property is sold within ten years.
-the recovery provisions obviously do not apply where interest is not claimed.

(ii) Depreciation Provision is made under section 117 of the Income Tax Act 1976, for the recovery of depreciation where a depreciated asset is sold for more than its book value within ten years of acquisition (Income Tax Act, 1976).

However, with respect to the sale of buildings, the recovery provisions do not apply to :

-ordinary depreciation.
-accelerated depreciation.
(NZ Master Tax Guide 1984, para. 1325).

The recovery provisions therefore apply only to buildings which have claimed a first year depreciation allowance. The IRD will again however, assess the merits of each case.

The model caters for the possible reassessment of first year depreciation in a similar way to the interest recovery provisions :

-the analyst is required, where permitted, to either claim first year depreciation or to disregard the first year allowance.
-if claimed, the model assumes the property is exempt from the recovery provisions.
-the provisions obviously do not apply where no claim is made.

The analysis provides for depreciation to be claimed as a tax deductible expense as follows :

- based on the provisions outlined in section 4.4.3.13 above, the method(s) and rate(s) applicable is initially set by the analyst.
- the optimum holding period will obviously involve only a single sale of the property, ie the liquidation analysis for previous years will be of no interest. For this reason, although depreciation cannot be claimed in the year in which the property is sold, annual depreciation is included in the cash flow analysis for each year. It is not included as a tax deductible item in the liquidation analysis for each year, ie the cash flow analysis for each year incorporates annual depreciation however the actual cash advantage accruing from depreciation (depreciation * tax rate) is deducted from the cummulative discounted after tax cash flow carried over to the liquidation analysis. In this way cummulative cash items of interest to subsequent operating years reflect the depreciation allowance able to be legally claimed in previous years. The overall return provided by the liquidation analysis validly disreguards depreciation for the "current" year.

4.4.3.15 Taxable Income This item represents the income upon which tax is assessed for each operating year.

In the assessment of the tax liability, the IRD are concerned with nominal or actual dollars only. Taxable income is computed in nominal dollars by deducting the sum of the tax deductible items from net operating income.

Where the dollar value of tax deductible items is high, real estate investments are able to operate at a loss for taxation purposes. Taxable income is therefore able to be positive or negative. In addition, gross income often increases in nominal dollars over the life of the investment, while tax deductible interest (table mortgage) and depreciation (declining balance method) often decline. Taxable income is often initially negative however becomes positive over time.

4.4.3.16 Income Tax/Tax Shelter These items represent in nominal dollars the annual tax liability for each operating year.

Income Tax The investment is liable for income tax in the years in which the taxable income is positive. The tax liability is computed by applying the investors marginal tax rate to taxable income.

Tax Shelter Tax shelter arises where losses incurred in the operation of the property are able to be offset against income from sources outside the project.

The leasing of property for the purposes of deriving rental income is considered to be a "specified activity" for the purposes of assessing income tax. The loss offset provisions for income derived from a specified activity are as follows (NZ Master Tax Guide, 1984 para. 1112) :

- there is no limit to the loss amount that can be offset against income from another specified activity.
- a loss offset limit of $ 10000 applies to losses offset in the same year against income from sources other than a specified activity. The balance of the loss is able to be carried over to subsequent years. This may be offset against income from the project or from other sources if taxable income is again negative.

In years in which operating losses are incurred, the model assumes that no limit is to apply, ie the total loss is able to be offset against income derived from other sources in the year in which the loss is incurred. This assumes the investor has sufficient alternative income available; a maximum of $ 10000 from a non specified activity, the balance covered by income from an alternative specified activity. This assumption is more realistic than assuming an unknown cutoff point for losses able to be offset in the current year, the balance carrying over to the following year(s).

The amount of tax shelter generated by the project in any operating year is derived by applying the investors marginal tax rate to the loss that is able to be offset against other income. Tax shelter is treated as a positive cash flow generated by the investment.

Both income tax and tax shelter are assessed as at the end of each operating year. For discounting purposes, they require no conversion to equivalent year end figures.

It is recognised that the method of assessing taxation within the model may be inappropriate for many investment situations. A provisional taxation system may apply where investors are forced to meet provisional taxation payments and face terminal tax assessment at the completion of each financial year. Assessing the annual tax liability as a single lump sum takes no account of provisional requirements and assumes that the beginning of the operating "year" coincides with the beginning of the investors financial (tax) year. A time constraint with respect to the development of the computer program of the model prohibited the inclusion within the model, of the provisional method of tax assessment. It is recognised that the assessment of taxation is one aspect of the model with potential for further development.

4.4.3.17 After Tax Cash Flow This item represents the disposable cash available to the investor at the end of each operating year. It is computed by combining cash throw off to equity with income tax/tax shelter. It is computed in both nominal dollar and year end equivalent dollar terms.

4.4.3.18 Discounted After Tax Cash Flow The discounted or present value of the after tax cash available to the investor from the operation of the property is computed at the completion of each operating year.

4.4.3.19 Discounted After Tax Cash Flow/Present Value Equity This percentage figure represents the rate of return on equity capital invested in the project, yielded by the annual discounted after tax cash flow.

Because equity capital is able to be invested at different times over the investment, the discounted or present value of equity capital is used. This provides a measure of the return taking account of the timing of

equity inputs and the resultant income/expense flows. The present value of equity capital is derived as follows :

-equity inputs which occur at the beginning of the period or year, are converted to an equivalent period/year end figure, by compounding.

-the present value of equity capital is derived by discounting the year end equivalent equity items and nominal equity capital where this is invested at the period/year end.

It should be noted that this measure of return is based on total equity capital invested in the project to the end of the "current" operating year. The measure takes no account of equity that is scheduled to be invested in subsequent years.

4.4.3.20 Cummulative Discounted After Tax Cash Flow The cummulative discounted after tax cash flow (Cumm. Disc. A.T.C.F.) represents the sum of the discounted after tax cash flow totals generated by the project for each year up to and including the "current" year.

This is an informational figure providing the investor with an indication of the present value of the total net disposable cash generated by the operation of the property at various times over the life of the investment.

For property development investments, this item includes the discounted after tax cash flow generated by the project over the development term. This is discussed under the develop an sell option (section 4.4.5).

Figure 4.4 provides an illustration of the relationships which exist between the components of the operating period module.

Figure 4.4

Relationship Between the
Components of the Operating Period Module

```
   Gross Income                    (nominal & year end equiv.)
*    Occ. Rate
   ------------
   Eff. Gross Income               (nominal & year end equiv.)
-  Operating Expenses              (nominal & year end equiv.)
                        Eff. Gross Income
                      * Op. Exp. Ratio
                        ----------------
                        Operating Expenses
   ------------
   Net Op. Income                  (nominal & year end equiv.)
-  Ann. Int. Payment               (nominal & year end equiv.)
-  Ann. Prin. Payment              (nominal & year end equiv.)
   ------------
   Cash T.O. Equity                (nominal & year end equiv.)
                    Net Op. Income          (nominal)
                  - Sum Tax Ded. Items      (nominal)
                            Depreciation Allow.
                            Ann. Int. Payment
                            ----------------
                            Sum Tax Ded. Items
                    --------------
                    Taxable Income          (nominal)
                  * Tax Rate
                    --------------
                    Income Tax/Tax Shelter  (nominal)
-/+ Income Tax/Tax Shelter
   -----------
   After Tax Cash Flow             (nominal & year end equiv.)
*  Discount Rate
   -----------
   Disc. A.T.C.F  =>  Cumm.Disc.A.T.C.F.
```

4.4.4 INVESTMENT LIQUIDATION MODULE

The investment liquidation module provides an investigation of the overall financial feaibility of the investment under the different holding periods available to the investor. The following items comprise the components of the analysis.

4.4.4.1 Estimated Sale Price The analyst is required to specify the estimated sale price of the property, as at the end of each year of the operating period. The estimate should be generated from an analysis of historical rates of appreciation/depreciation in the local market. It should also reflect a qualitative relationship to the levels and changes in rental income able to be generated by the property. The model caters for annual price appreciation/depreciation or any combination of price changes that may be experienced over successive years.

4.4.4.2 Selling Expenses Depending upon the nature of the investor and the investment, certain expenses may be incurred in the sale of the property. These mainly involve legal fees and/or the commission charged by real estate agents.

These expenses are typically charged on a sliding scale as a percentage of the consideration paid for the property. The model displays the current scale of charges as advertised by the societies representing the legal and real estate practices (ref. Real Estate Institute Diary, 1984).

The analyst has the option of selecting the sale expense allowance to be included as a percentage of the price paid for the property, for legal fees and/or real estate agent's commission. Where a percentage is to be applied, the model employs the sliding scale to compute the expense figures. Alternatively, sale expenses are able to be input as a lump ($) sum for each year. The model caters for situations where no expenses are incurred upon the sale of the property.

4.4.4.3 Repayment Penalty The liquidation analysis assumes that any mortgage finance outstanding at the time of sale will be repaid from the property sale proceeds.

The early repayment of borrowed funds may incur an early repayment penalty (personal communication, Trustee Bank Canterbury). Where applicable, the standard penalty is three months interest charge. The model incorporates an early repayment penalty as follows :

- -where related to interest, the analyst is required to specify the number of months comprising the charge.
- -where not related to interest, the analyst is able to input a single lump ($) sum for each operating year.
- -the model caters for the early repayment of borrowed funds where no repayment penalty is incurred.

It should be noted that where related to interest, the model computes the repayment penalty on interest scheduled to be paid over the following year. It disreguards any refinance that was due to take place over that year. In this way the procedure takes account of any principal repayments (table mortgages) that are made in the year the property is sold.

4.4.4.4 Amount Realised on Sale This item represents the dollar value of the amount realised on the sale of the property. It is computed by deducting any sale expenses and/or repayment penalty from the estimated sale price of the property.

4.4.4.5 Book Value Property The book value of the property is computed, as at the end of each operating year, by adding the book value of the structure (as at the year end; ie year start less annual depreciation) to the land value. This item is necessary for the computation of capital gains (refer below).

4.4.4.6 Capital Gain Capital gains result when the amount realised on the sale exceeds the book value of the property. The IRD refer to capital gain as "profit" for the purposes of tax assessment. As indicated, this item is derived by deducting the book value of the property from the amount realised on the sale.

The model has previously catered for items that may be recoverable for tax purposes if the property is sold at a profit (section 4.4.3.14). The measure of capital gain is included as an informational figure only.

4.4.4.7 Unpaid Mortgage Balance As outlined in section 4.4.3.10, this item represents the total outstanding mortgage balance that must be repaid from the proceeds of the sale of the property.

4.4.4.8 Equity Reversion The amount of equity that will revert to the investor upon the sale of the property is computed by deducting the unpaid mortgage balance from the amount realised on the sale.

It is comprised of :

- -direct equity inputs.
- -indirect equity inputs e.g.mortgage refinance at reduced principal.
- -cummulative principal repayments.
- -any increase in the value of the property since purchase/development.

4.4.4.9 Discounted Equity Reversion This represents the present value of the sum reverting to the investor upon the sale of the property. Because the sale takes place at the year end, the discounting procedure can be directly applied to the equity reversion figure in computing this item.

4.4.4.10 Total Discounted Return This figure provides the investor with an indication as to the present value of the total dollar return that can be expected from the investment. It is comprised of the cummulative discounted after tax cash flow (less that contributed by the annual depreciation allowance; refer section 4.4.3.14), and the discounted equity reversion.

The importance of this figure stems from its ability to indicate the net spendable cash available from the operation and disposal of the property. It is comprised of all the cash flow items that are typically generated by urban real estate.

4.4.4.11 Percentage Return to Equity This represents in precentage terms the total discounted return to the present value of equity invested in the project, to the end of the "current" operating year. Under the property sale assumption, this measure takes no account of equity inputs to the project, scheduled for subsequent years.

4.4.4.12 Net Present Value The net present value (NPV) of the investment is computed for each operating year. It provides a measure of the difference between the present value of the costs incurred by, and the present value of the benefits resulting from, the project.

The NPV is an informational figure indicating whether the investment is providing the required level of return on funds invested. A positive (negative) NPV indicates that the benefits available from the project are sufficient (insufficient) to meet the return requirements, taking account of the timing of cash flows and the required rate (discount) of return.

The model computes the NPV by discounting and summing individual costs and benefits occurring over the term of the investment, at the investors discount rate. A similar approach to that applied in computing the internal rate of return (refer below) is used, however the investors discount rate is applied in deriving the present value of cash items.

4.4.4.13 Internal Rate of Return An important component of the investment liquidation analysis is the computation of the internal rate of return (IRR) for the project. The model does this for each year of the operating period based on the assumed year end property sale.

The IRR is the rate of return or rate of discount which equates the present value of the costs incurred in the investment, with the discounted or present value of the receipts generated by the investment. It can be considered the percentage rate of return generated on capital invested in the property.

The model employs the following procedure in computing the IRR for each year. A basic "net cash balance" figure is computed for each operating year. This represents the difference between the annual benefits and costs as follows :

Benefits :effective gross income + tax shelter + incoming principal (initial only : if refinanced principal were added, this would effectively "double-count", as typically incoming principal via refinance increases the sale price of the property (structural improvement) and is therefore automatically added to the "net cash balance"; refer below).

Costs :operating expenses + income tax + interest payments + principal repayments (including reduced principal via refinance).

Note : because the IRR routine is based on the discounting procedure, year end equivalent figures are used for the above items.

An annual net cash balance is computed for discounting purposes, as this is more efficient than discounting individual cost and income items.

In order for the IRR computed for each year to reflect the merits of disposing of the property in that year, the "current" year's net balance is increased by the net proceeds or equity reverting to the investor from the sale. Following the computation of the IRR the net sale proceeds are deducted from the cash balance for the "current" year. This ensures that the cash position for each year reflects a true operating balance for the

computation of the IRR for subsequent years, ie the inclusion of the sale proceeds in the net cash balance of previous operating years would distort the IRR computed for subsequent years.

Development Investments For projects involving the development of an urban investment property, the IRR computation is based on the benefits and costs occuring over both the development term and the operating period. A net cash balance is computed for each period over the development term as follows (refer to section 4.4.5 for an outline of the inclusion of taxation over the development term):

Benefits : income + incoming principal (as discussed above) + bridging finance borrowed + tax shelter (for 'year end' periods).

Costs : development costs + interest payment + principal payment (including refinance) + bridging finance repayment + income tax (for 'year end' periods).

The investors required rate of return (this being the best guess as to the likely IRR) is converted to an equivalent periodic rate based on the number of development periods per annum. The trial period discount factor is derived from this rate. The operating period is transformed to a time horizon of similar base to the development term; for example, a development term of 12 periods consisting of 12 of these periods per annum (ie one year development) and an operating period of two years, would transform to:

- periods 1-12 would cover the actual development term and the cash balance for each would represent the actual net cash balance for each period over development.
- periods 13-24 would cover the first operating year, periods 13-23 would reflect a net balance of zero while period 24 would represent the net balance of operating year one.
- periods 25-36 would cover the second operating year, periods 25-35 having a net balance of zero with period 36 reflecting the balance for operating year two.

Trial period discount factors are applied to the net balance for each of the above "periods". The discount factor which produces a NPV of zero is converted back to an equivalent annual rate of return. This rate is taken as the IRR for the current year.

Acquisition Investments The IRR is computed for property purchase investments as follows :

- the acquisition cost (incoming principal previously included as a positive cash flow) is included as a negative cash flow in the net cash balance for operating year zero. It should be noted that the difference between the purchase price and initial mortgage finance will be equal to the investors initial equity investment in the property. Thus the net cash balance for year zero reflects the initial equity investment as a cost.
- for each year of the operating period various annual rates of discount are applied to the annual cash balance figures for each year up to and including the current year. The rate which provides a NPV of zero is taken as the IRR for the year.

Multiple Roots Problem One problem faced by the IRR routine is that of multiple solutions. Multiple roots occur when more than one rate of discount results in a NPV of zero. This situation is likely to occur when the net balance figures for consecutive periods/years change from positive to negative to positive and/or visa-versa. Because mortgage finance is treated as a positive cash flow for the net balance calculations, this situation is common in real estate investment situations which incorporate borrowed finance.

The model caters for this problem by checking the likelihood of multiple solutions for the internal rates of return. The routine checks for a single or series of positive/negative changes in the periodic/yearly cash balance figures. If multiple roots are likely to be a problem, the model displays a warning message to that effect. Because the IRR generated by a property investment could be expected to at least approximate the general level of return required by the investor, beginning with a trial IRR or rate of discount equivalent to the investors required rate will often enable the model to produce, where multiple solutions are possible, an accurate estimate of the true IRR for each year.

4.4.4.14 Investment Value The investment value of the property is of prime importance to the investor. This figure represents the maximum amount in discounted or present value terms, that is able to be paid for the property, enabling the investor to receive the required rate of return on invested capital. The investment value indicates the maximum that is able to be paid either as the cost of developing a property or the total price paid for a property, in discounted dollar terms.

The investment value is computed for each operating year by adding the present value of the total mortgage finance invested to the end of the current year, to the total discounted return (section 4.4.4.10) for the year.

The present value of mortgage finance invested in the property is derived by discounting the nominal ($) principal for each mortgage; because mortgage finance is assumed to be borrowed at the start of the period or year, the principal is transformed to an equivalent period/year end figure, prior to discounting. The investment value computed for each operating year, takes no account of mortgage finance scheduled to be invested in the property in subsequent years.

The above items comprise the components of the liquidation analysis applied to each year of the operating period. Figure 4.5 illustrates the relationship between each of these elements. Figures 4.1 and 4.2 provide a more comprehensive illustration of the interaction between these items and the rest of the model.

Figure 4.5

Relationship Between the
Components of the Liquidation Module

```
  Estimated Sale Price
-   Selling Expenses
-   Repayment Penalty
  ------------------
  Amount Real. on Sale
-   Book Value Property
  ------------------
    Capital Gain
- Unpaid Mortgage Bal.
  ------------------
  Equity Reversion
*   Discount Factor
  ------------------
  Disc. Equity Reversion
+   Cumm. Disc. A.T.C.F (from operating period anal.)
  ------------------
  Total Disc. Return
+ P.V. Mortgage Finance
  ------------------
  Investment Value


Other Items : Net Present Value

            : Internal Rate of Return

  ====================
```

For investments involving the development of an urban property, the model completes an analysis for an option involving the development and immediate sale of the property, as follows.

4.4.5 Develop and Sell Option

This investigation is concerned with the feasibility of selling the property at the completion of development. The procedure involves cash flow totals over development and is not directly concerned with individual cash items. The model completes the analysis in both nominal dollar and present value dollar terms. The following items are included in the analysis.

4.4.5.1 Net Income Any income generated over development by the project is treated as a positive cash flow. This item is net of any expenses incurred in generating that income (section 4.4.1.6). The model output includes the present value and the nominal or actual dollar value of this item.

4.4.5.2 Debt Servicing The total debt service over development is comprised of bridging finance and/or mortgage finance repayments. Bridging finance is usually repaid from incoming mortgage principal or equity capital. It is not typically repaid from income earned by the project. For this reason the repayment of bridging finance (principal and accumulated interest) is not included as part of the total debt service for the computation of the cash throw to equity (refer section 4.4.5.3).

For the purposes of computing the cash throw to equity, the model computes the total interest and the total principal repaid on all mortgage finance over the development term. These figures are computed in nominal and present value dollar terms.

4.4.5.3 Cash Throw Off to Equity As outlined in section 4.4.3.8, this item is derived by deducting the total debt service over development from the net income figure. The model computes the cash throw to equity for the development term in nominal and discounted or present value dollar terms.

4.4.5.4 Income Tax/Tax Shelter Depending upon the magnitude of any income generated and any tax deductible items that are able to be claimed, the project may be liable for income tax, or may provide tax shelter over the development term.

The analysis investigates the taxation liability on an annual basis, ie for each year over the development term as follows :

-the total income generated over each year of the development is computed and recorded. As previously indicated, this item is net of expenses.

-any tax deductible items able to be claimed for each year are computed. This item is able to comprise for each year, the total yearly interest payment (if interest is to be claimed) plus any other ($) sum specified by the analyst. It should be noted that interest paid on bridging finance is able to be claimed as a valid tax deductible expense (NZ Master Tax Guide, 1984 para. 1012).

-taxable income for each year over development is computed by deducting the yearly tax deductible items from the yearly income figure.
The investors marginal tax rate is applied to taxable income to compute the tax liability or shelter for each year.

The income tax/tax shelter assessed for each year is summed to establish the total tax liability/tax shelter over development in both nominal dollar and present value terms.

Note : The development term time horizon may be such that the total number of periods over development will not exactly coincide with or replicate a yearly analysis; the development term may span for example, two thirds of a year, or two and one half years.

In this situation, in reality the tax liability for the final "year" may be assessed some time after the completion of development. Where this occurs, the income tax/shelter figure is discounted from the time it would actually be assessed, ie from the end of the year in which the development term ends rather than the time the development term actually ends. This ensures the accurate computation of the final "year's" income tax liability.

4.4.5.5 After Tax Cash Flow The after tax cash flow generated by the project over development is computed as present value and nominal dollar items. They are internally calculated by combining the cash throw to equity with the income tax/tax shelter assessed for the entire development term.

4.4.5.6 Estimated Selling Price The analyst is required to input the estimated sale price of the property as at the end of development. This should be derived from an analysis of similar types of property in the local market area, and should reflect the likely rental levels that are able to be obtained by the property.

4.4.5.7 Selling Expenses/Repayment Penalty These items are outlined in sections 4.4.4.2 and 4.4.4.3.

4.4.5.8 Amount Realised on Sale This item is computed internally by deducting any expenses and/or repayment penalty incurred in the sale of the property, from the estimated sale price.

4.4.5.9 Unpaid Mortgage Balance The unpaid mortgage balance represents the sum of all mortgage finance outstanding at the time of sale. The analysis assumes this sum is to be repaid from the sale proceeds.

4.4.5.10 Equity Reversion The equity reverting to the investor at the time of sale is computed by reducing the amount realised on sale by the unpaid mortgage balance.

4.4.5.11 Discounted Equity Reversion The equity reversion is discounted over the duration of the development term to derive the value of the amount reverting to the investor as at the beginning of the investment.

4.4.5.12 Total Discounted Return This represents the present value of the total return available to the investor under the develop and sell option. It is derived by adding the discounted equity reversion to the discounted after tax cash flow for the development term.

4.4.5.13 Total Discounted Return/Present Value Equity Invested This item represents the total discounted return as a percentage of the present value of equity capital invested in the project over the development term. It takes no account of equity scheduled to be invested after the completion of development.

4.4.5.14 Net Present Value As outlined in section 4.4.4.12, this item represents the difference between the discounted costs and discounted benefits. It is based on the cash flows occuring over the development term inclusive of the property sale proceeds.

4.4.5.15 Internal Rate of Return As oulined in section 4.4.4.13, this percentage figure can be considered the rate of return generated on capital invested in the project under the develop and sell option. Section 4.4.4.13 outlines the method applied in computing the internal rate of return.

The above items are computed to provide an indication of the financial feasibility of disposing of the property at the completion of development. Figure 4.6 illustrates the relationships between the components of the analysis.

Figure 4.6

Relationship Between the
Components of the Develop and Sell Analysis

```
   Net Income                          (nominal & present val.)
 - Total Int. Payment                  (nominal & present val.)
 - Total Prin. Payment                 (nominal & present val.)
   ---------
   Cash T.O. Equity                    (nominal & present val.)
-/+ Tot. Tax/Tax Shelter
                     Ann. Net Income       (nominal)
                   - Ann. Tax Ded. Items   (nominal)
                     ---------------
                     Ann. Tax/Tax Shelter
   ---------
   After Tax Cash Flow                 (nominal & present val.)
   Disc. A.T.C.F.
   ==========
   Est. Selling Price
 - Selling Expenses
 - Repayment Penalty
   ----------------
   Amount Realised on Sale
 - Unpaid Mortgage Bal.
   ----------------
   Equity Reversion
 * Discount Rate
   ----------------
   Disc. Equity Rev.
 + Disc. After Tax Cash Flow
   ----------------
   Total Disc. Return
 + P.V. Mortgage Finance
   ----------------
   Investment Value
   Other Items : Net Present Value
               : Internal Rate of Return
```

4.5 MODEL EVALUATION

In developing a model, an attempt is made to mimic the behavioural patterns or characteristics of the process or system being studied. Once that model has reached a stage where it can generate apparently useful information, the modellor needs to develop an acceptable level of confidence that inferences drawn from the performance of the model are correct and applicable to the real world system being studied (Shannon, 1975). Model evaluation can be described as the process in which this confidence is built up.

In general, a simulation model may be considered as a theory describing the structure and interrelationships of a system. Since all models contain both simplification and abstraction of the real world system, no model can be exactly correct in the sense of a one to one correspondence between itself and real life. Much of the literature (Popper (1959), Carnap (1963), Naylor and Finger (1967), Van Horn (1971), Shannon (1975)), identify the concept of model evaluation as one of degree rather than a binary notion. Mckinney (1967) poses the question of model success as : does the model fulfill its purpose of insight, play or test? He suggests that a simulation model is developed until it has adequate acceptance for its purpose.

The evaluation procedure is a vital component of the overall development of the model and generally involves the processes of verification and validation.

Verification

Mirham (1972), defined verification as "that stage of the model's development during which the model's responses are compared with those which would be anticipated to appear if indeed the model's structure were programmed as intended". Blackie and Dent (1979b) support this definition and for the purposes of this study, verification is interpreted as the process of examining the model for logical and mathematical correctness.

Validation

Validation, on the other hand, must be seen in relation to the purpose for which the model was built (Shannon, 1975). If we accept that a functional model is an approximation to the real system, then the problem is to determine whether the model that has been constructed is an adequate representation for our purposes. Validation then, can be broadly described as the test of agreement between the behaviour of the model and that of the real world system (Fishman & Kiviat, 1967).

An issue complicating model evaluation is the fact that in many instances the behaviour of the real system is less than certain. The validation proceedure involves comparing the performance of the model against data representing the real world system (Blackie and Dent, 1979b); an attempt is made to interpret the behaviour of the real system from an analysis of the data representing that system. Data representing the real system usually comprise a single or a series of samples from the overall data "population", these samples may or may not be representative of the overall population. Therefore, while the evaluation procedure attempts to examine the validity of the model as an approximation to our concepts of the system we are attempting to model, those very concepts may often be an approximation to the system that exists in reality.

In contrast to this, simulation modelling occassionally attempts to replicate a system or procedure which is fully understood; the level of knowledge or insight into the components and behaviour of the system is complete for the purposes of the modelling exercise. In this situation, the evaluation procedure is not concerned with how adequately the modeller has conceptualised the system, it is concerned with how adequately those concepts have been replicated in the model.

The investment model developed within this study falls into this category. The component items and interrelationships underlying the model aim to mimic those which are "known" to exist in the real world system. The existence and interaction of these components is not open to question. The relationships, for example, between the cash items that combine to transform a potential gross income figure into a specification of the after tax cash flow are definite. There is no margin for interpretation or misconception in the interaction between these items.

Because the "system" the model is attempting to mimic is clear and precise, the evaluation procedure itself becomes more precise. It encompasses model verification, the aim in evaluating the model being to develop confidence that the model has been programmed and is performing as intended; the evaluation procedure is concerned with an examination of the model for internal consistency.

4.5.1 Evaluation Procedure

Shannon (1975) suggests that there is no such thing as a single "test" for validity or acceptability of the model. Rather, model evaluation is a continuing process throughout the development of the model during which confidence in the performance of the model steadily increases. It is an ongoing series of assessments which begin in the early stages of development and continue into the commissioning stage of the model's life.

Antibugging

There are a number of techniques which are of use in evaluating a simulation model. One technique, known as "anti-bugging" (Blackie and Dent, 1979b), has its application in the design stage of the development of the computer program of the model.

A program with a "bug" is one which fails to behave in a consistent manner. It results from some flaw in the program; the detection and elimination of such bugs is one of the major costs in simulation modelling. Anti-bugging is the term given to the prevention of bugs; this technique simply comprises a common sense and systematic approach to computer modelling (Blackie and Dent, 1979b). The advantages of this technique have been incorporated in this study by concentrating on the following aspects during the design stage of the development of the computer program of the model.

(a) Data handling was treated as an important consideration in the design of the model; incorrect data are one of the most common causes of bugs in simulation modelling.

(b) Multiple switches and program branches were, as far as possible, avoided. These are a potential source of bugs.

(c) Program documentation was maintained throughout the construction of the program.

(d) A top-down approach to program design was employed; this involved starting with a large section or module of the program, breaking this up into smaller submodules, and continuing dividing each submodule into smaller sections until each is in a manageable form, function and size.

The modular structure aided in the overall program design and in isolating areas for evaluation.

The objective of concentrating on the above listed design aspects was to minimise the potential source of bugs in the computer program.

Debugging

A major part of the evaluation procedure employed in this study, involved the application of a technique known as debugging; this technique can be described as the process of tracing the cause of and eliminating bugs in the computer program of the model.

The application of this technique involved a number of tests based on the input of test data to the model, and the checking of the computations and output provided by the model against manually computed results derived from the same input data. The following procedures were adopted.

(a) At each stage during the development of the computer program of the model, the program was made to print out the status of the important parameters developed by "that" section of the model. These were checked against manually computed parameters. The development of the program proceeded to the next section only when the preceeding sections were verified as working correctly.

(b) At the completion of the overall program a number of "complete" sets of input data (each representing a hypothetical property investment) were run through the model. Each set of data comprised a different combination of input parameters. The output provided by each run of the model was checked against manually computed results derived from the same data. Corrections were made to the program where inconsistencies were found. This procedure continued until the output developed by the model conformed to the results computed manually for each of the differing data sets.

(c) By way of a final check on specific sections of the model (specifically the routine computing the internal rate of return), input data relating to a hypothetical property investment were run through the model. The same data (transformed and summarised into an appropriate form; ie period/year end "net cash balances") were submitted to a verified package available on the Lincoln College mainframe computer (Vax - VMS version 3.7). The output from the model was checked against that provided by the verified package. The two sets of output provided the same results.

The above stages of investigation were carried out at different times during the development of the computer program. They involved a series of trials and corrections until the performance of the model could be relied on as consistent and accurate. The successful completion of the above stages of evaluation, ensured that a high level of confidence could be placed in the performance of the operational model which had been developed.

Appendix 3 provides an illustration of the procedure employed in evaluating the results developed by the model for two hypothetical property investments (stage (b) above). It illustrates a comparison of the performance of the model, ie model output, against results computed manually for two separate property investment examples. Example one concentrates on a property purchase investment, example two illustrates an evaluation of results for an investment involving the development of an urban property.

CHAPTER FIVE

Investment Model : Example Application

Introduction

The preceeding chapter attempts to provide a detailed coverage of the investment analysis model developed within this study. The objective of this chapter is to provide an example application of the model.

Data used in the following example has been derived from a comprehensive market analysis of industrial properties in the Christchurch region; data reflect current market conditions as at October, 1984. It should be stressed that the accuracy of the data is not of critical importance to this exercise. The industrial developments used for example purposes are however, based on realistic development options; the sites are actually available and all data reflect the actual costs and returns available from this type of investment.

5.1 Overview

The aim of the analysis is to provide decision-support information leading to the selection of the optimum of two mutually exclusive potential industrial developments in the Christchurch region. It is assumed that the investors have defined in specific terms the nature of the building they wish to construct. The same structure will be constructed irrespective of the site chosen; the structure is outlined below. A full market analysis has been carried out incorporating an examination of the availability of industrial sites, together with the likely demand for industrial rental space and a comprehensive investigation of the financial aspects of the two investment options. From these investigations, and the requirements and constraints faced by the investor, two potential sites have been identified as suitable. The primary objective of this exercise is to complete a financial analysis leading to the selection of the optimum site.

Investors Brief

It is assumed that the brief provided by the investors specified the following requests :

(Note : it is assumed the investors have specified a 20 % required rate rate of return on equity invested in the project).

Request One : A full financial analysis of the two alternative investment options leading to the selection of the optimum site.

Request Two : An analysis of the comparative financial feasibility of disposing of the property at the completion of each year of a potential holding period of ten years.

Request Three : An analysis of the feasibility of disposing of the property at the completion of development.

Request Four : The maximum that is able to be paid for the land (of the optimum site) and still enable the investment to earn the required rate of return.

Request Five : A full sensitivity study providing an indication as to the risk of the investment with respect to the required rate of return, and whether changing market conditions are likely to affect the comparative feasibility of the two options, ie change the optimum site.

Type of Investor

The investor is assumed to be a large provident fund with substantial financial backing. The total cost of development is intended to be financed by equity capital; no borrowed funds are involved. Provident funds are currently exempt from taxation.

Proposed Building

The design of the building will be the same irrespective of the site chosen. It is assumed the investors have specified an industrial warehouse building with a total area of 2787 square metres, consisting of 402 sq. m. office area and 2385 sq. m. of open warehouse. The construction consists of portal frame with tilt slab, concrete reinforced floor slab and long run roofing. The building has nine electrically operated roller doors and is built to comply with NZS 623. The parking area and associated turning and operating space is to be constructed of asphalt and is assumed to provide facilities for 42 car parks, with a total area of 1052 sq. m.. Security fencing will be provided, and an array of trees and shrubs are proposed to comply with town planning reqirements.

5.2 Development Options

Option One (Site One)

This industrial site consists of a level corner section 6458 sq. m. in size (yielding a site coverage of 43.1 %), situated within a slowly developing industrial area on the rural outskirts of Christchurch.

Option Two (Site Two)

This site consists of a level industrial section 5872 sq. m. in size (providing a site coverage of 47.4 %), situated in a moderate size industrial subdivision on the outskirts of Christchurch.

A comparison of the prevailing land values and rental levels of properties located in the above two industrial areas, indicates that option (site) two is situated in a more desirable industrial location than option (site) one, ie land values and rental levels per unit, are higher for properties in proximity to site two, than for those in proximity to site one. In option two, the investors are faced with paying a significantly higher price for the site (estimated to be in the range of $117400 verses an estimated $55000 for site one), however they are likely to be able to obtain much higher rental levels and can expect a higher rate of capital growth. Option one would involve a lower land cost however is likely to achieve lower rentals and capital growth.

5.3 Proposed Lease

An analysis of the lease agreements of comparable properties indicates that the most likely lease arrangement for the above investment(s) would consist of :

- -five year lease term.
- -rent reviews at 2.5 year intervals.
- -an option for right of renewal available at the expiry of the lease.

It is recommended that the lease specifies rental to be paid in advance, and that all expenses, such as operating expenses, rates and repairs and maintenance, be paid by the tenants. The analysis carried out in this exercise is based on the assumption that this recommended lease aggreement is adopted.

5.4 Financial Details

The following discussion provides an outline of the estimated cash flows representing the two investment options outlined above.

General Development Costs

The total construction contract value including all fees, insurance, and an allowance for inflation and contingencies amounts to $ 740273. The cost of land, rates over development and other expenses incurred by each development option are incorporated below.

The period from commencement to completion of development has been estimated to be six months. Table 5.1 provides an outline of the development payment schedule faced by both investment options. For illustrative purposes it is assumed that the land is purchased at the end of December 1984, and the initial development costs (fees etc.) and stamp duty are also paid at this time. Construction is assumed to begin at the start of January 1985.

Table 5.1

General Development Payment Schedule

	Development Payments	
	$	
Dec. 1984	29627	+ Land + Stamp Duty
Jan. 1985	78506	+ Rates
Feb.	96680	
Mar.	133865	
Apr.	141302	
May	141302	
Jun.	118991	
Total $	740273	

5.4.1 Option One (Site One)

(i) Development Costs

Table 5.2 provides an outline of the development payment schedule for option one. This schedule is inclusive of the estimated cost of land, rates over development and stamp duty. The total cost of this industrial development amounts to $ 797163.

Table 5.2

Development Payment Shedule : Option One

Development Cost	$ 740273	(as above)
Estimated Land	55000	(paid Dec. 1984)
Total	$ 795273	
Rates over development	1065	(paid Jan. 1985)
Stamp duty	825	(paid Dec. 1984)

Adjusted development payments :

	Payment
	$
Dec. 1984	85452
Jan. 1985	79571
Feb.	96680
Mar.	133865
Apr.	141302
May	141302
Jun.	118991
Total $	797163

(ii) Rental Income

The property is able to be occupied at the completion of development, ie at the beginning of July 1985. No vacancy or bad debt is anticipated. An analysis of comparable market rentals (particularly industrial rental properties in proximity to site one), indicates that the initial rental for option one is likely to be in the vicinity of $ 86148 p.a., with an expected rental appreciation rate of 9 % compound p.a.. This rate yields a compound factor of 1.2404128 (1.09 ** 2.5) over the 2.5 year rent review period. As stated in the recommended lease aggreement, rental is paid monthly in advance. Table 5.3 provides an outline of the rental schedule for option one, based on the expected initial rental level and the anticipated rate of rental appreciation over the ten year analysis period.

Table 5.3

Expected Rental Schedule : Option One

$ 86148/12 = 7179 per month

(rental appreciation factor = 1.2404128)

Year	Month	Monthly Rental	Annual Rental
		$	$
1	1-12	7179	86148
2	13-24	7179	86148
3	25-30	7179	
	31-36	8905	96504
4	37-48	8905	106860
5	49-60	8905	106860
6	61-72	11046	132552
7	73-84	11046	132552
8	85-90	11046	
	91-96	13702	148488
9	97-108	13702	164424
10	109-120	13702	164424

(iii) Operating Expenses

In accordance with the recommended lease aggreement, all operating expenses are paid by the tenants. This arrangement is typical of current lease aggreements operative for comparable rental properties.

(iv) Estimated Sale Price.

The investment analysis model aims to provide information able to assist a comparison of the financial feasibility of the different possible holding periods. In computing the price they are able to pay for a property, for years (end) between rental reviews, buyers typically disregard the actual rental being earned by the property, and capitalise the current "market" rental, or the rental that would be achieved if the review was to take place at the time of sale; they deduct from this figure, either the nominal value or the discounted value (depending upon their competence with discounting procedures) of the difference between the current "market" rental and the current actual rental for the remaining period till review.

The objective of this analysis exercise is not accuracy of data, and for ease of illustration, the estimated sale price for each year end will be computed by simply capitalising the estimated "market" rental as at each year end. This procedure will be adopted throughout the exercise where sale price estimates are required to be computed.

An analysis of comparable rental properties which have recently sold in the Chrischurch area, and specifically properties of a similar nature to investment option one, yielded an indicated capitalisation rate of 11.2 %. This rate is estimated to remain constant over the ten year analysis period. Table 5.4 illustrates the procedure adopted in computing the estimated sale price for each year end, and outlines the sale price estimates produced.

Table 5.4

Estimated Year End Sale Price : Option One

Estimated initial rental $ 86148

Estimated annual rental compound rate 9 % p.a.

Anticipated capitalisation rate 11.2 %

Year	"Market" Rental		Capitalisation Rate			Est. Sale Price
0	86148	/	.112	=	769178	769000
	* 1.09					
	93900					
1	93900	/	.112	=	838393	838400
2	102348	/	.112	=	913821	913800
3	111564	/	.112	=	996100	996100
4	121608	/	.112	=	1085786	1085800
5	132552	/	.112	=	1183500	1183500
6	144480	/	.112	=	1290000	1290000
7	157488	/	.112	=	1406143	1406100
8	171660	/	.112	=	1532679	1532700
9	187104	/	.112	=	1670571	1670600
10	203940	/	.112	=	1820893	1820900

(v) Selling Expenses

The (assumed) sale of the property at each year end, incurs a conveyancing fee calculated at normal scale rates, as outlined in chapter 4. The investors are assumed to be able to act as their own selling agents, and no other selling expenses are incurred.

5.4.2 Option Two (Site Two)

(i) Development Costs

Table 5.5 provides an outline of the development payment schedule for investment option two (site two). This schedule is inclusive of the cost of land, rates over development and stamp duty. The total cost of this industrial development amounts to $ 861794.

Table 5.5
Development Payment Shedule : Option Two

Development Cost		$ 740273	(as above)
Estimated	Land	117400	(paid Dec. 1984)
	Total	$ 857673	
Rates over development		2273	(paid Jan. 1985)
Stamp duty		1848	(paid Dec. 1984)

Adjusted Development payments :

	Payment
	$
Dec. 1984	148875
Jan. 1985	80779
Feb.	96680
Mar.	133865
Apr.	141302
May	141302
Jun.	118991
Total $	861794

(ii) Rental Income

An analysis of current rental levels for comparable industrial properties located in proximity to site two, indicates a potential initial rental income in the vicinity of $ 91080 p.a. can be expected, and an anticipated rental appreciation rate of 12 % compound p.a.; this rate yields an appreciation compound factor of 1.3275322 (1.12 ** 2.5) for the 2.5 year rent review period. Rental is assumed to be paid monthly in advance. Table 5.6 provides an outline of the expected rental schedule for investment option two, based on these rental data.

Table 5.6

Expected Rental Schedule : Option Two.

$ 91080/12 = 7590 per month

Rental appreciation factor = 1.3275322

Year	Month	Monthly Rental	Annual Rental
		$	$
1	1-12	7590	91080
2	13-24	7590	91080
3	25-30	7590	
	31-36	10076	105996
4	37-48	10076	120912
5	49-60	10076	120912
6	61-72	13376	160512
7	73-84	13376	160512
8	85-90	13376	
	91-96	17757	186798
9	97-108	17757	213084
10	109-120	17757	213084

(iii) Operating Expenses

As for option one, the recommended lease specifies all operating expenses to be paid by the tenants. Operating expenses are therefore excluded from this analysis.

(iv) Estimated Sale Price

The market analysis yielded an indicated capitalisation rate for investment property two of 10.5 %. Comparable properties which had recently sold in proximity to site two, in general indicated lower capitalisation rates than those comparable to, and in closer proximity to, site one. This difference is likely to be attributable to the different level of risk associated with the two industrial areas. As indicated, site two is situated in a more favorable industrial location and the expected levels of rental and capital growth are probably more secure than those of option one. Table 5.7 provides an outline of the computations providing the estimated sale price of option two for each year end.

Table 5.7

Estimated Sale Price : Option Two

Estimated initial rental $ 91080

Estimated annual rental compound rate 12 % p.a.

Anticipated capitalisation rate 10.5 %

Year	"Market" Rental		Capitalisation Rate			Est. Sale Price
0	91080	/	.105	=	867428	867400
	* 1.12					
	102009					
1	102009	/	.105	=	971514	971500
2	114250	/	.105	=	1088104	1088100
3	127961	/	.105	=	1218666	1218700
4	143316	/	.105	=	1364917	1364900
5	160514	/	.105	=	1528705	1528700
6	179776	/	.105	=	1712152	1712200
7	201349	/	.105	=	1917610	1917600
8	225511	/	.105	=	2147723	2147700
9	252572	/	.105	=	2405447	2405400
10	282880	/	.105	=	2694101	2694100

(v) Selling Expenses

The (assumed) sale of the property, for each year end, incurs a conveyancing fee at scale rates, as outlined in chapter four. No other selling expenses are incurred.

5.5 Analysis Results

It should be noted that because of the nature of the assumed investor (provident fund), taxation and mortgage finance are excluded from this analysis, ie provident funds are currently exempt from taxation and typically finance investment projects with 100 % equity capital.

5.5.1 Traditional Investment Appraisal

Traditional appraisal methods are sometimes referred to as non-discount investment criteria and are very simplistic in their application (Hawkins and Pearce, 1971). The approach that would traditionally be applied in deciding upon the optimum of the two investment options would involve investigating the potential operating income generated by the alternative investments; operating income would be computed as a rate of return against the capital invested in each project, ie annual income for the first operating year over the total cost of the project. Typically, no account would be taken of factors such as taxation advantages offered by the alternative investments, the optimum level of leveraging for the property (although these two factors are not applicable in this example exercise), changes in rental income or operating expenses over time, or capital gains potential. The traditional approach would yield the following results.

	Option One	Option Two
Operating income year one	86148	91080
Total capital invested	797163	861794
	= .1080	= .1056
Rate of return on capital	10.80 %	10.56 %

The simplicity of this approach makes it difficult to differentiate between the two options; the above results indicate option one is slightly superior in terms of overall investment performance. If no further

investigations are carried out, as is often the case, the traditional approach would select option one (site one) as the optimum investment.

5.5.2 Investment Model Analysis

5.5.2.1 Expected Level of Investment Cash Flows

Data representing the two investment options (outlined above) were submitted to the investment model. For each investment option, the performance parameters developed by the model which are of interest to this exercise, are outlined below. (Note : Percentage figures reflect annual rates).

Decision Rules

(i) Net Present Value (NPV)

The NPV of a project is computed as the difference between the discounted or present value of the costs incurred by, and the present value of the benefits resulting from, the project. The discounting procedure takes account of the timing of cash flows together with the investors required rate of return on capital invested in the project.

A positive NPV indicates the project is generating a rate of return greater than that required by the investor, a negative NPV indicating the returns from the project do not meet the investors requirements.

For mutually exclusive projects (such as the above two options), the following decision rules apply to the use of the NPV as a measure of investment performance (Nattrass, 1984) :

-consider all projects which have a positive (or zero) NPV.

-select the alternative that has the highest NPV at the investors discount rate.

Table 5.8 provides a comparison of the NPV produced by the model for each development option, for each possible holding period, at the investors discount (interest) rate of 20 %. This comparison is illustrated graphically in Figure 5.1; this illustration provides a clear indication of the difference in performance between the two investment options.

Table 5.8

NPV Comparison : Options One and Two

(Note : Year 0 denotes the develop and sell option)

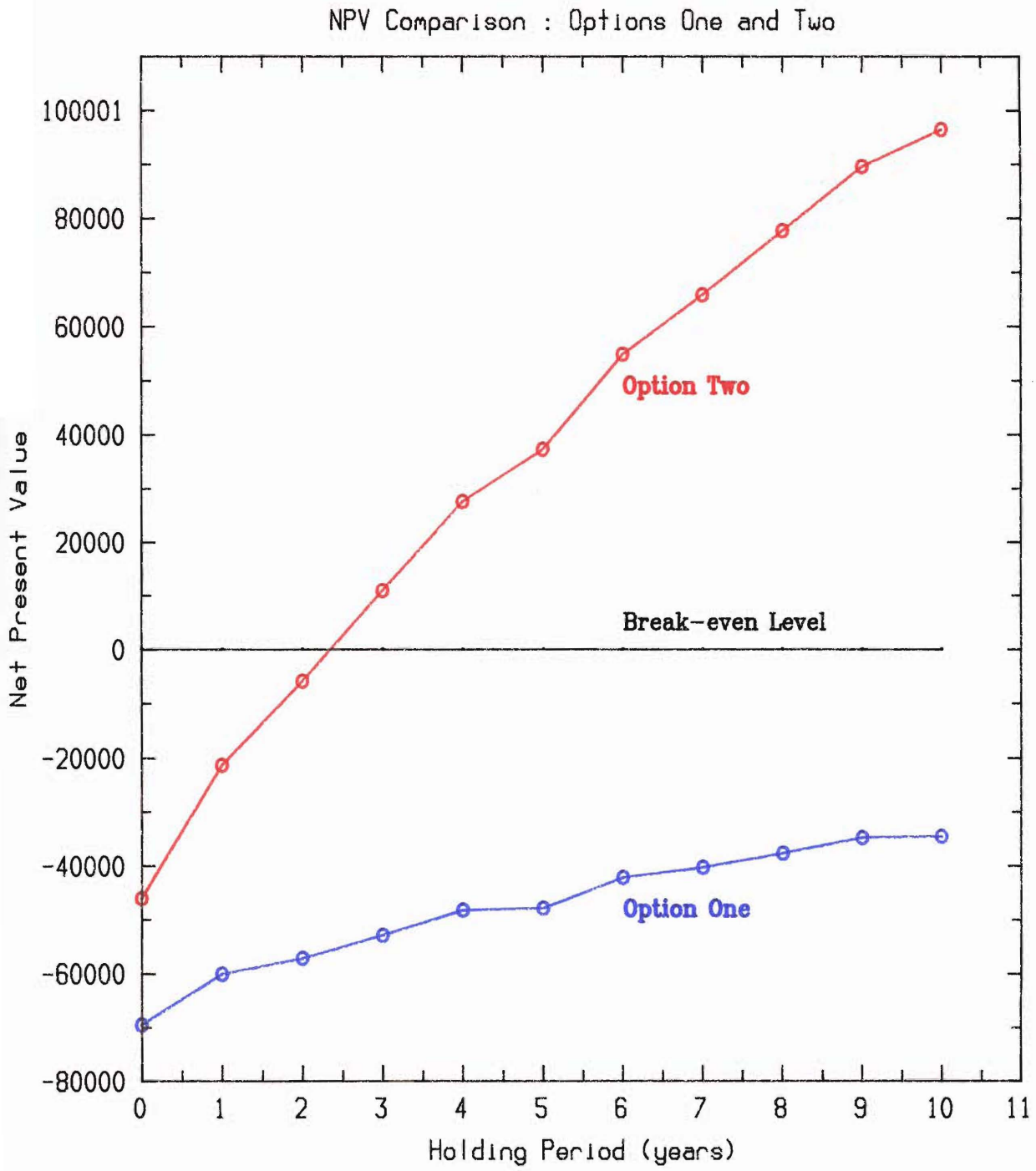
Year	Option One	Option Two
0	(69472)	(46009)
1	(60032)	(21267)
2	(57099)	(5818)
3	(52840)	10940
4	(48163)	27626
5	(47838)	37345
6	(42103)	54913
7	(40244)	65858
8	(37603)	77738
9	(34716)	89585
10	(34505)	96490

Applying the NPV criterion to differentiate between the two investment options clearly indicates the superiority of option two. Proposal one provides a negative NPV for each possible holding period, proposal two, although yielding a negative NPV for holding periods of less than three years, provides a positive NPV for holding periods of three years and greater.

(ii) Total Discounted Return (TDR)

One general disadvantage with using the NPV to discriminate between investments, is that as a measure of investment performance, it does not take account of the amount of capital invested in the project (Mishan, 1982). The TDR (and TDR as a proportion of the present value of equity invested in the project) is computed by the model to provide a measure of investment performance taking account of the amount of capital invested in the project.

FIGURE 5.1


NPV Comparison : Options One and Two
100001
80000
60000
40000
20000
0
-20000
-40000
-60000
-80000
Net Present Value
Option Two
Break-even Level
Option One
0
1
2
3
4
5
6
7
8
9
10
11
Holding Period (years)

The TDR represents the dollar value of the cummulative discounted (after tax) cash flow generated by the investment, plus the discounted value of the amount reverting to the investor upon the sale of the property (refer chapter four for a more detailed description of the TDR). It is computed for each year under the assumption of a year end sale. In computing the TDR, the model provides a measure of the magnitude of the dollar value of the return available to the investor from the project as well as representing this as a proportion of the equity (discounted) invested in the project. The discount factors are computed using the investors required rate of return.

Table 5.9 provides a comparison of the TDR for the two investment options. The results outlined in Table 5.10 are more useful as tney compare the TDR for the two options as a proportion of the discounted equity invested in each project. These comparisons are illustrated graphically in Figures 5.2 and 5.3 respectively; this illustration stresses the difference in investment performance between the two projects. (Note : The present value of the equity invested in the alternative projects has been computed by the model to be : $ 758069 for option one, $ 822682 for option two.)

Table 5.9

TDR Comparison : Options One and Two

Year	Option One	Option Two
0	688642	776672
1	698037	801414
2	700970	816863
3	705229	833622
4	709906	850308
5	710231	860027
6	715966	877595
7	717825	888540
8	720466	900420
9	723353	912267
10	723564	919172

FIGURE 5.2

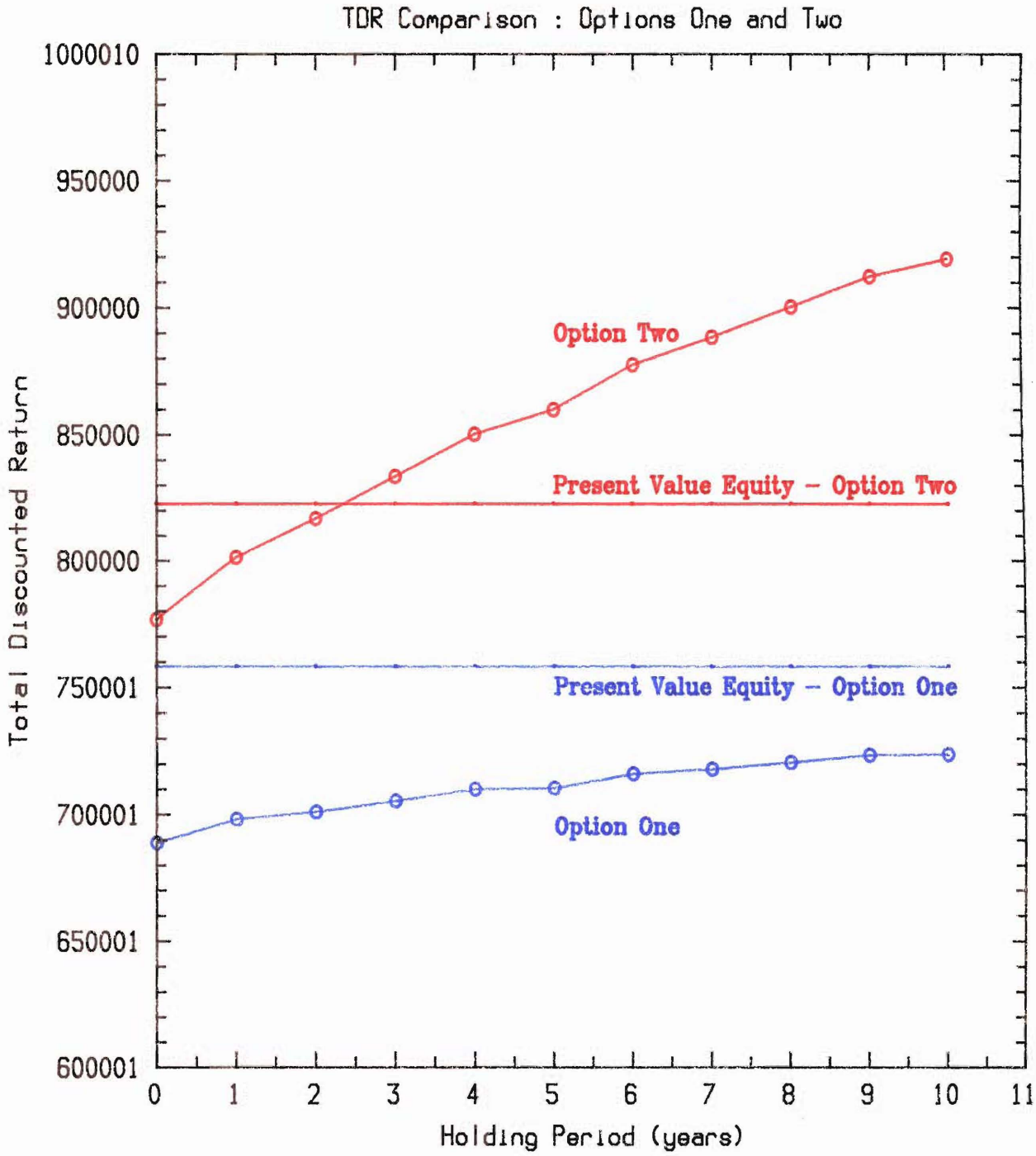

TDR Comparison : Options One and Two
1000010
950000
900000
850000
800000
750001
700001
650001
600001
Total Discounted Return
0
1
2
3
4
5
6
7
8
9
10
11
Holding Period (years)
Option Two
Present Value Equity – Option Two
Present Value Equity – Option One
Option One

Table 5.10
TDR/Present Value Equity Comparison
Options One and Two

Year	Option One	Option Two
0	.908	.944
1	.921	.974
2	.925	.993
3	.930	1.013
4	.936	1.034
5	.937	1.045
6	.944	1.067
7	.947	1.080
8	.950	1.094
9	.954	1.109
10	.954	1.117

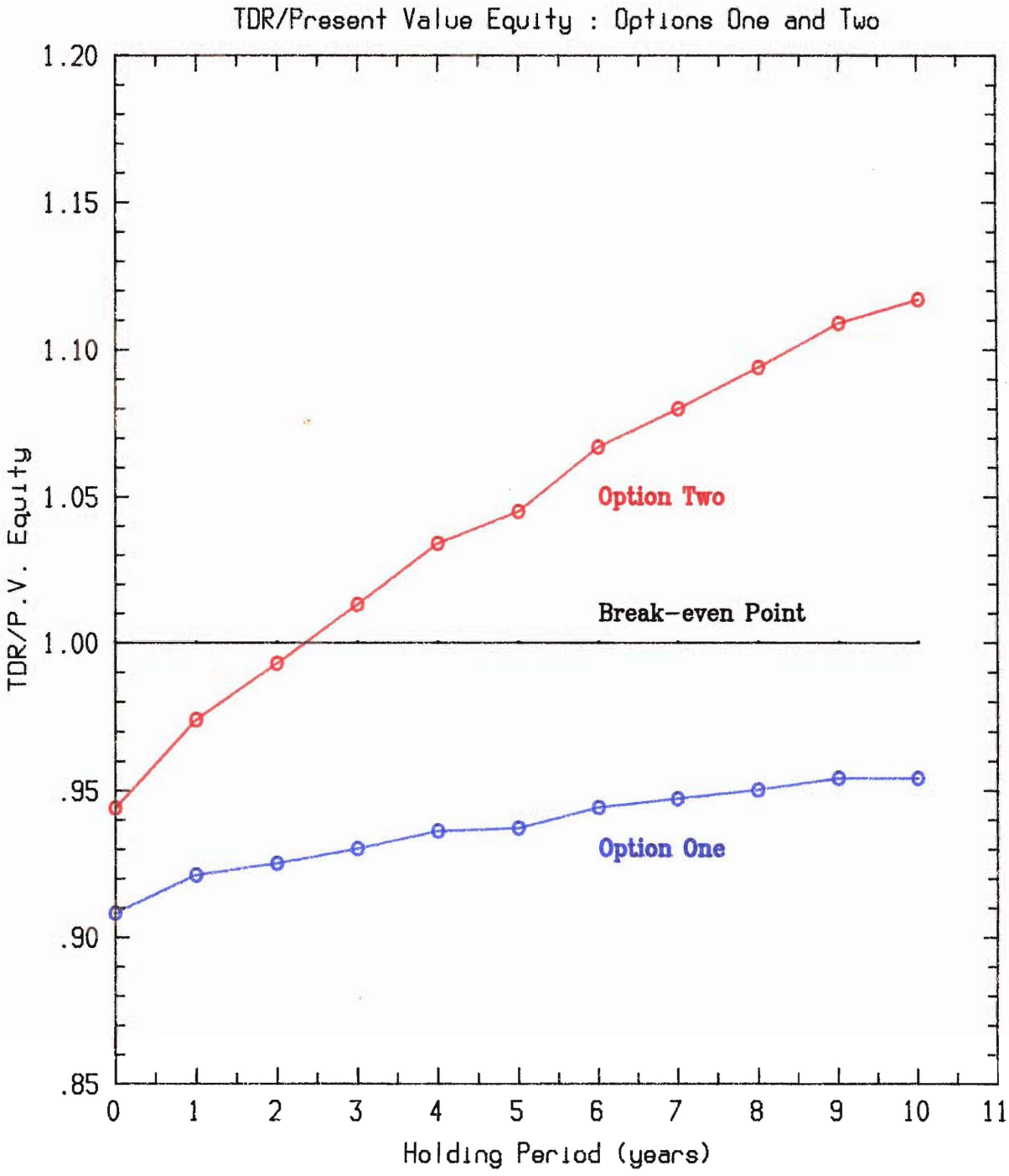
These comparisons support the NPV results in clearly indicating the superiority of option two; the TDR from option one is, for each possible holding period, not sufficient to meet the required return on equity (discounted) invested in the project. The TDR available from option two exceeds the discounted equity input for holding periods of three years and greater. This indicates that the total return on equity exceeds the required 20 % for holding periods of 3 years and greater.

(iii) Internal Rate of Return (IRR)

The IRR is the rate of interest (discount) at which the present value of the costs equals the present value of the benefits, (ie the interest rate yielding a NPV of zero). The IRR can be considered the real rate of return generated by the project (Nattrass, 1984).

Note : For each possible holding period, projects which generate an IRR less than the investors required rate will yield a negative NPV. Where the IRR is greater than the investors required rate, the NPV will be positive.

FIGURE 5.3


TDR/Present Value Equity : Options One and Two
1.20
1.15
1.10
1.05
1.00
.95
.90
.85
TDR/P.V. Equity
Option Two
Break-even Point
Option One
0
1
2
3
4
5
6
7
8
9
10
11
Holding Period (years)

For mutually exclusive projects the following decision rules apply to the use of the IRR as a measure of investment performance (Nattrass, 1984).

-consider all projects which generate an IRR equal to or greater than the investors required rate.

-select the project which generates the highest IRR.

Table 5.11 provides a comparison of the IRR for the two investment options. The difference in investment performance between these two options is perhaps more apparent in Figure 5.4 which provides a graphical comparison of the IRR, for each holding period, for the two options.

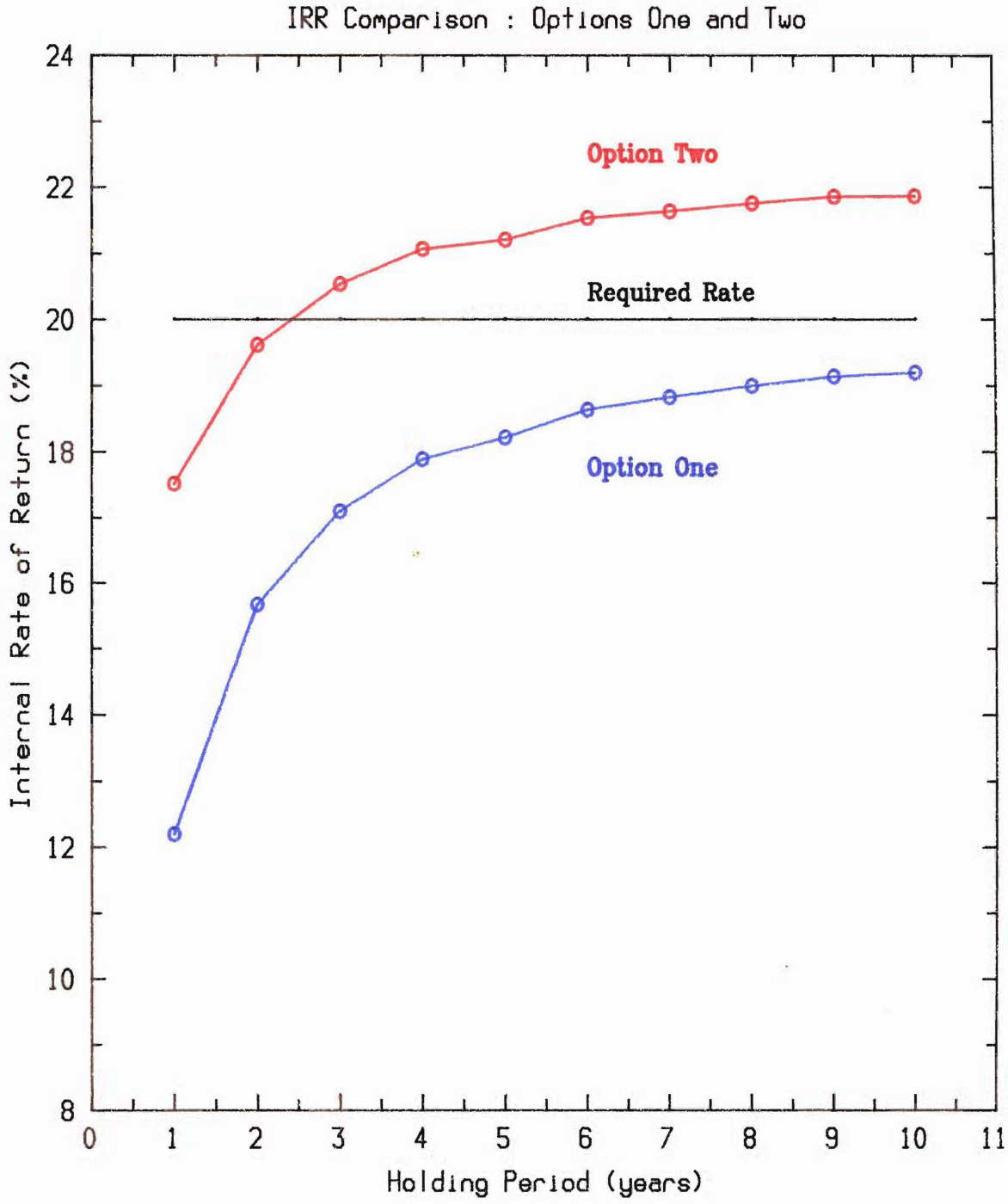
Table 5.11

IRR Comparison : Options One and Two

Year	Option One	Option Two
0	(22.29)	(5.16)
1	12.19	17.51
2	15.66	19.61
3	17.09	20.53
4	17.88	21.06
5	18.21	21.20
6	18.63	21.53
7	18.82	21.63
8	18.99	21.75
9	19.13	21.85
10	19.19	21.86

This comparison provides a clear indication of the superiority of option two in terms of the overall rate of return as a measure of investment performance. For each of the possible holding periods, investment two generates a significantly higher return rate than the alternative investment; as indicated by the NPV analysis, option one fails to generate the required rate of return for each of the possible holding periods. Option two meets the return requirements (20 %) for holding

FIGURE 5.4


IRR Comparison : Options One and Two
Option Two
Required Rate
Option One
Internal Rate of Return (%)
Holding Period (years)
24
22
20
18
16
14
12
10
8
0
1
2
3
4
5
6
7
8
9
10
11

periods of three years and over. A maximum IRR of 21.86 % is indicated for a ten year holding period.

Summary : Investment Model Results

Performance Measures	Option One	Option Two
NPV	Inferior/Inadequate	Superior/Adequate
TDR & TDR/P.V. Equity	Inferior/Inadequate	Superior/Adequate
IRR	Inferior/Inadequate	Superior/Adequate

Response to Request One

Required : A full financial analysis of the two investment options leading to the selection of the optimum site.

Response : The above results clearly indicate that option two (site two) is significantly superior in terms of overall investment performance. Under all investment performance criteria, option one fails to meet the investors requirements on capital invested in the project; option two generates the required return for holding periods of three years and greater.

Response to Request Two

Required : An analysis of the comparative financial feasibility of disposing of the property at the end of each year of a potential holding period of ten years.

Response : Under all investment performance criteria, the optimum holding period (for both investment options) is ten years. It should be noted that this period could vary with changing market conditions. The optimum holding period indicated by the above analysis should be monitored through the life of the investment to take account of any deviations to the

expected investment cash flows underlying the above analysis.

An optimum holding period of ten years indicates that the combined appreciation of rental income and equity gain (through value appreciation) is sufficient to offset the discounting of the cash flows generated over this holding period. In view of this, an analysis of potential holding periods in excess of ten years may be worthwhile, bearing in mind the difficulties in projecting future income levels and the associated sale price of the property.

Response to Request Three

Required : An analysis of the feasibility of disposing of the property at the completion of development.

Response : The results provided by the above analysis clearly indicate that a develop and sell option is not feasible. Under all investment performance criteria, disposing of the property at the completion of development yields the lowest possible return (for both investment options).

Response to Request Four

Required : The maximum that is able to be paid for the land (of the optimum site) and still enable the investment to obtain the 20 % required rate of return.

Response : An important output parameter produced by the model is the investment value of the property under investigation (refer chapter four). This item provides an indication of the maximum amount, in discounted or present value terms, that is able to be paid for the property and still enable the investment to earn the required rate of return on invested capital. The analysis outlined below is based on the investment value computed by the model for option two, which has been analysed to be the optimum of the two potential investments.

The output provided by the model for the above outlined analysis indicated an investment value for option two of $ 919172 for a ten year holding period. This is the maximum that is able to be paid for investment two, in present value terms, and still enable the investment to earn the required 20 %.

The total cost of option two has been estimated to be $ 861794 (outlined above), this consisting of an estimated land cost of $ 117400 and development costs amounting to $ 744394. The discounted or present value of this total cost, taking account of the timing of development payments and the investors discount rate, has been computed by the model to be $ 822682. Because the land is purchased at the beginning of the investment (therefore the additional cost of the land need not be discounted) the difference between the actual discounted total investment cost, and the investment value equals the maximum additional price that is able to be paid for the land (in this case).

Investment Value	$ 919172
Discounted Actual Investment Cost	$ 822682
Maximum Additional for Land	$ 96490

The previous analysis was based on an estimated land cost of $ 117400 for option two, and the expected level of development costs, rental income and capital growth. These same data, with the estimated cost of land increased to $ 213890 (117400 + 96490), were submitted to the investment model to obtain an indication of the impact of this increased land cost on the overall return generated by the investment. Table 5.12 outlines the rate of return produced by the model for each of the possible holding periods, based on a land cost of $ 213890 for option two.

Table 5.12
Rate of Return Under
Maximum Possible Payment for the Land

Year	IRR
0	(36.56)
1	7.74
2	13.68
3	16.18
4	17.56
5	18.24
6	18.93
7	19.30
8	19.61
9	19.87
10	20.00

The results outlined in Table 5.12 support the validity of the investment value computed by the model; the maximum that is able to be paid for the land is $ 213890, and at this level, the investment generates a 20 % rate of return for a holding period of ten years. A land cost in excess of this amount is likely to restrict the overall return generated by the investment to a rate lower than that required.

5.5.2.2 Sensitivity Analysis (Request Five)

The objective of the following sensitivity study is to investigate the risk of the investment (optimum site) with respect to its ability to achieve the required rate of return, and to investigate the comparative feasibility of the alternative investments, under changing market conditions.

The availability of the investment analysis model enables the analysis of the alternative options to incorporate a thorough sensitivity analysis. The study is able to investigate to what degree changes in each investment parameter affect the overall performance of each investment. In this way, the analysis identifies the critical parameters, or those to which the

success of the investment is sensitive, or at risk.

The parametrs which are considered to have a significant affect on the performance of each investment are :

(i) the initial rental level (and the "carry-over" affect to the achievable sale price of the property).

(ii) the rental appreciation rate (and carry-over affect).

(iii) the capitalisation rate adopted by the market.

(iv) the initial investment costs (land, development costs, and expenses over development).

The following analysis investigates the sensitivity of the performance of the two investment options to changes in the investment parameters listed above. The exercise involves computing the levels of return for each investment, under the minimum and maximum parameter values that are considered to be potentially possible over the duration of the ten year analysis period.

The results of this analysis are contrasted graphically against the levels of return computed under the expected values of each investment parameter. The graphical comparison of investment performance provides a clear illustration of the sensitivity of each investment to changes in the basic investment parameters.

The model output parameter of most value to this sensitivity study is the IRR, in its ability to clearly reflect changes in the performance of the investment (overall rate of return) under differing investment assumptions.

(i) Initial Rental Income

The market analysis outlined at the beginning of this chapter indicated that an initial rental in the vicinity of $ 86148 p.a., and $91080 p.a., could be expected for investment options one and two respectively. An investigation of the rentals of the properties included in the market study, suggested however that the achievement of these levels of rental income could not be anticipated with certainty. It is possible that the actual level of rental initially achieved could vary by as much as 7 % above or below the expected level, for each development option.

Since buyers take account of the actual rental being earned by a property when assessing the price they are able to pay, a variation in the initial rental level will have a carry over affect to the potential sale price of the property, for each year end.

The rental schedules and associated property sale price under the estimated minimum and maximum (7 % deviation) initial rental levels were computed for each investment option, for the ten year analysis period. These data, together with the remaining investment parameters which remain unchanged, were submitted to the investment model in an attempt to obtain an indication of the impact of these changes on the performance of each investment. Table 5.13 provides a comparison of the rate of return (IRR) generated by each investment option, under the above outlined minimum and maximum initial rental levels. Figure 5.5 provides a graphical comparison of these results, and contrasts the returns achieved under the differing initial rental assumptions, with the returns generated at the expected level of rental (outlined above). Figure 5.5 provides a clear illustration of the sensitivity of the performance of the two investments to differing levels of initial rental income.

The results outlined in Table 5.13 and Figure 5.5, indicate that the overall level of return generated by each investment is quite responsive to changes in the rental initially achieved by each property. The following conclusions are able to be drawn from these results.

- Option one has the potential to generate the required rate of return if initial rental levels are significantly higher (7 %) than expected. Under these conditions, the investment has the potential to provide a maximum overall rate of return in the vicinity of 20.39 % (nine year holding period). The above results suggest however that the potential success of this investment is highly sensitive (20.39 % verses the required 20 %) to small changes in the level of rental. This coupled with the fact that the rental is expected to be approximately 7 % lower than that which would be required to enable option one to provide the

required return, supports the previous indication of the non-feasibility of this investment.

- the achievement of an initial rental at the lower end of the potential rental range, is not likely to affect the feasibility of

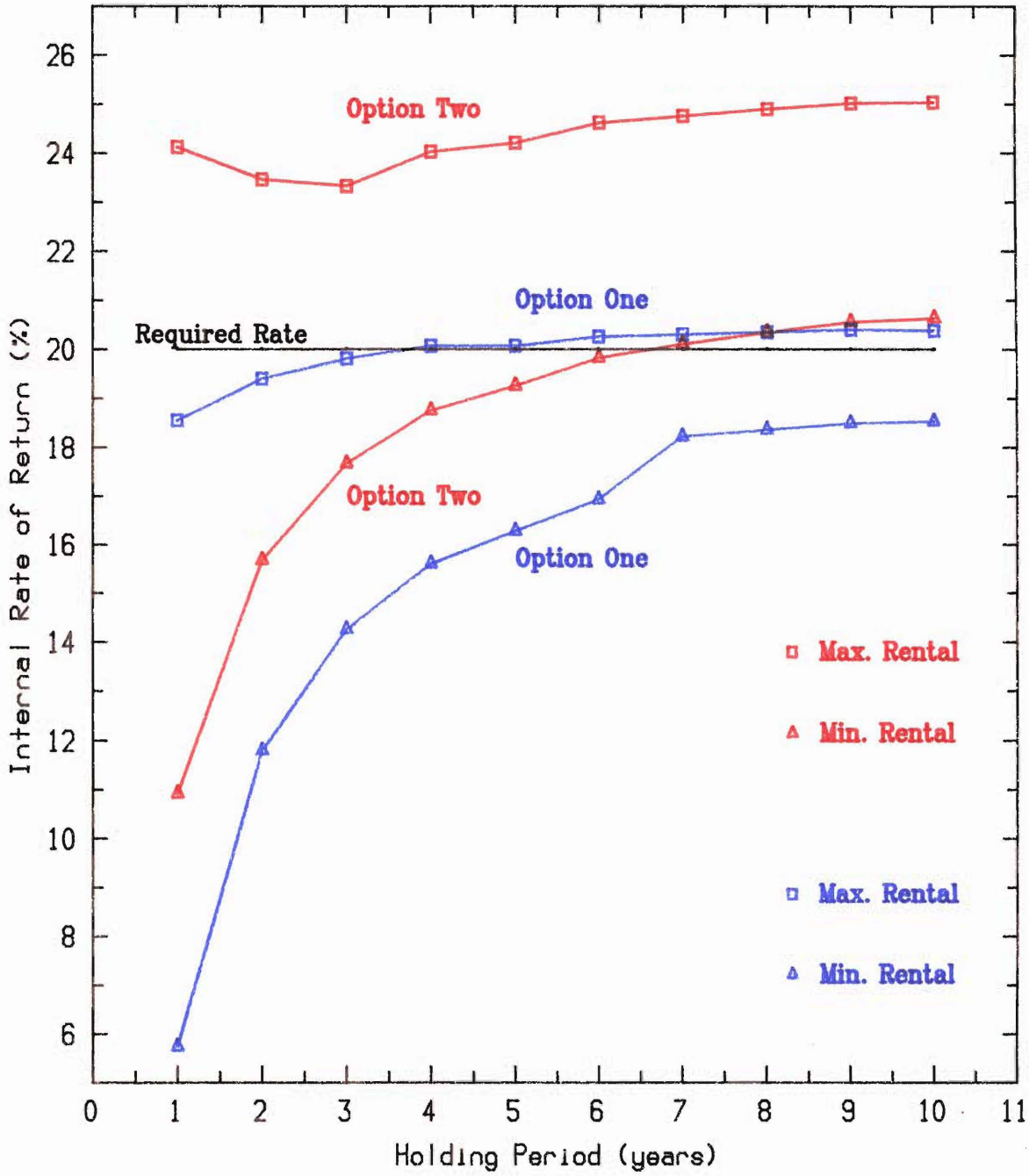
Table 5.13
IRR Generated Under the Estimated
Minimum and Maximum Initial Rental Levels

Year	Option One		Option Two	
	Min. Rental (- 7 %)	Max Rental (+ 7 %)	Min. Rental (- 7 %)	Max. Rental (+ 7 %)
0	(44.91)	5.83	(29.98)	25.32
1	5.73	18.54	10.92	24.12
2	11.78	19.39	15.68	23.46
3	14.24	19.80	17.67	23.33
4	15.59	20.06	18.76	24.03
5	16.27	20.06	19.26	24.21
6	16.92	20.25	19.83	24.62
7	18.21	20.29	20.11	24.76
8	18.35	20.34	20.35	24.90
9	18.48	20.39	20.56	25.02
10	18.52	20.37	20.64	25.04

investment option two; this option has the ability to generate the required rate of return (for holding periods of 7 years and greater), for initial rentals approximately 7 % lower than expected.

- if the property is able to attract an opening rental higher than anticipated, the investors can expect to receive a return in the range of 23 to 25 %.

FIGURE 5.5
IRR Generated Under the Estimated Minimum and Maximum Initial Rental Levels



- an initial rental significantly different from that expected, is unlikely to affect the comparative feasibility of the two options; the performance of investment two under unfavorable market conditions (lower than expected initial rentals) is superior to that of option one, even if option one is able to achieve an initial rental significantly higher than expected.

- the above results suggest that if the initial rental can be set at a level approximately 7 % higher than expected, the development and immediate sale of option two would yield a rate of return in the order of 25.32 %. The rate of return achieved by developing and selling option two, if the rental is set at the expected level (and associated sale price), has been computed to be -5.16 % (refer above). The overall rate of return generated by the develop and sell alternative is highly sensitive to the level of rental initially obtained; it is unlikely that the maximum potential rental will be achieved. It is considered that the develop and sell alternative remains non-feasibile because of the high risk in terms of achieving the required rate of return.

These conclusions would suggest that a variation between the actual and the anticipated level of rental initially achieved, is not likely to place the success of the investment at risk. Changes in the initial rental income are not likely to affect the comparative feasibility of the two development options.

(ii) Rental Appreciation Rate

An examination of the growth in industrial rentals over recent years within the Chrischurch region, indicated that on average, a likely rental appreciation rate for investment option one would be in the vicinity of 9% compound p.a.. Past rental changes have however, been variable and based on the evidence provided by the market analysis, it is estimated that this rate could range between 6 and 12 %.

The market analysis indicated that, with respect to option two, the investors could expect rental to appreciate at a rate in the vicinity of 12%, however it is estimated that this rate could vary between 8 and 15 %.

Although it is likely that the expected rentals will be achieved, a variation in rental growth will carry over to the future price achievable for each property, at each year end.

Data representing the investment cash flows under the minimum and maximum rental growth rates outlined above, together with the remaining (unchanged) investment parameters were submitted to the investment model in an attempt to examine the degree of risk associated with the actual rental growth being lower than expected, together with the impact this may have on the comparative feasibility of the two options. Table 5.14 outlines the results provided by the model, under the minimum and maximum growth rate assumptions, for the two investments. Figure 5.6 provides a graphical comparison of these results, and contrasts the levels of return achieved under these changes with the returns generated at the expected level of rental growth.

Table 5.14
IRR Generated at the Estimated
Minimum and Maximum Levels of Rental Growth

Year	Option One		Option Two	
	Min. Rate (6 %)	Max. Rate (12 %)	Min. Rate (8 %)	Max. Rate (15 %)
0	(22.29)	(22.29)	(15.15)	(15.15)
1	9.92	14.44	14.46	19.78
2	13.22	18.10	16.32	22.07
3	14.55	19.63	17.11	23.10
4	15.28	20.48	17.56	23.69
5	15.62	20.81	17.71	23.83
6	15.98	21.28	17.79	24.21
7	16.17	21.48	18.07	24.62
8	16.32	21.66	18.17	24.45
9	16.45	21.82	18.25	24.56
10	16.52	21.87	18.27	24.57

The results outlined in Table 5.14 and Figure 5.6, indicate that the overall level of return generated by each investment is highly responsive to changes in the growth of rental income over the ten year analysis period. The following conclusions may be drawn from these results.

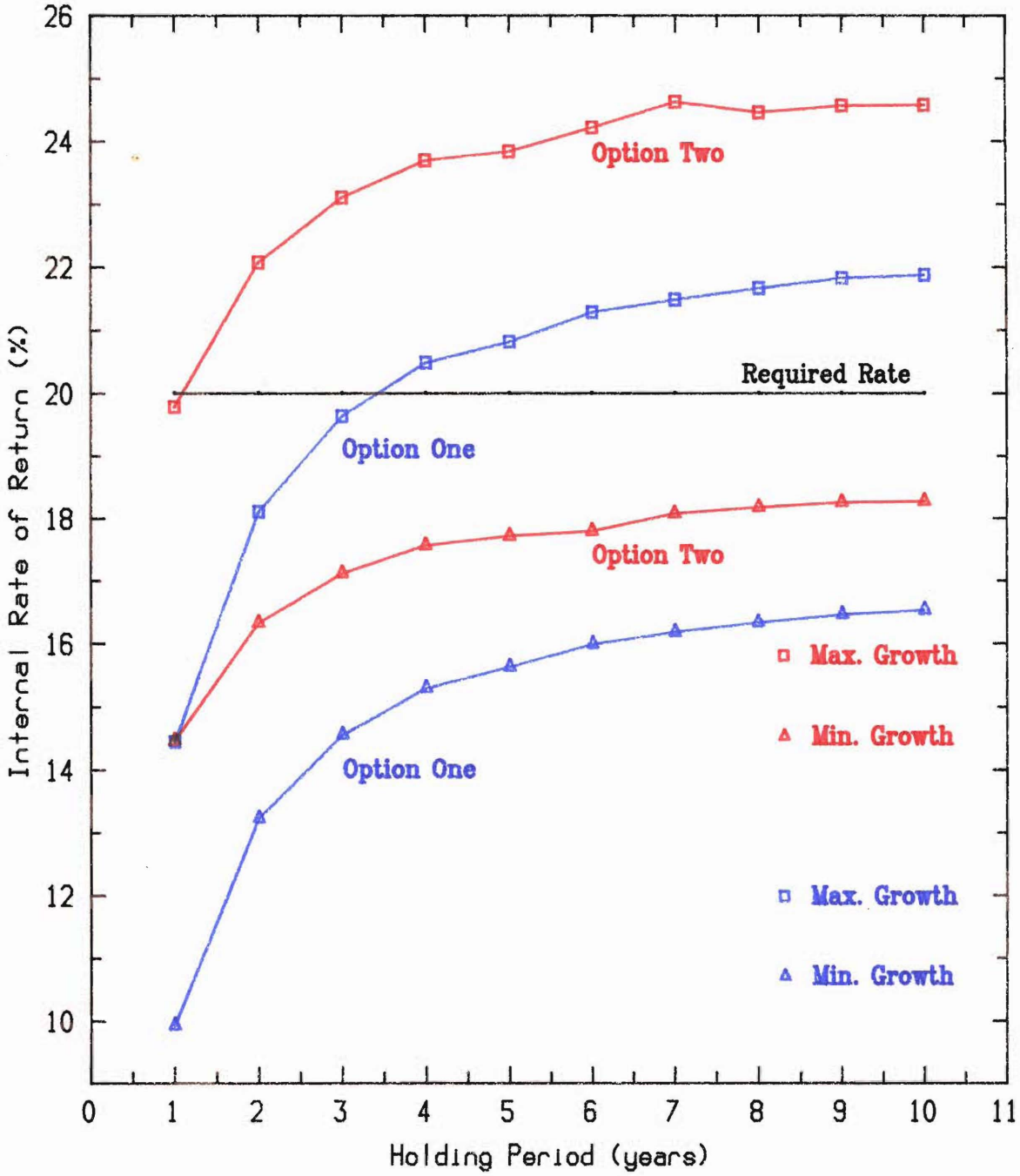
- under optimal conditions (high rental growth) for both industrial investments, option two is clearly the superior investment in terms of financial performance. If prevailing market conditions stimulate a growth in rental income in excess of that anticipated, the investors can expect (in option two) to receive a rate of return (IRR) in the range of 23 to 25 %.

- option one has the ability to meet the return requirements if rental growth is maintained in the range of 12 % p.a. compound. At this rate, investment one would generate a maximum return of approximately 21.87 % with a ten year holding period. It is however, unlikely that this proposed investment property (and location) could maintain, in the long term, a rental and associated value appreciation rate in the range of 12 % p.a., or 3 % higher than the expected rate of growth.

- the model output data indicates that the performance of option one under favorable market conditions (high rental growth), surpasses that of option two under an unfavorable or a low rate of rental growth. The two investment options are based on the same type of property (industrial warehouse) situated in the same broad market area. It is unlikely that future market conditions would favour option one (with respect to rental growth), if this investment was selected and undertaken, as opposed to stimulating poor rental growth for option two, if this investment was selected and undertaken. It is considered unlikely that deviations from the expected rate of rental growth would affect the comparative feasibility of the two investments.

- the success of the investment (option two) is vulnerable to the rate of rental growth (and associated value increase) over the ten year analysis period. If market conditions restrict rental appreciation,

FIGURE 5.6
IRR Generated at the Estimated
Minimum and Maximum Levels of Rental Growth



over the long term, to a level in the range of 8 %, option two is likely to provide an overall return (IRR) of approximately 18.27 %, for a ten year holding period. The rental growth rate is expected however, to be around 12 % and it is considered to be unlikely that market conditions would restrict the rate of growth to a level 4 % lower than expected, over the entire ten year term. It should be noted, however that the rate of growth has the potential to prevent the investment earning the required rate, and that the actual growth rate should be monitored over the life of the investment. This would enable appropriate action to be taken if actual growth is significantly less than expected.

These conclusions support the previous analysis in outlining the superiority of option two. The above analysis identifies that the rate of rental growth is critical to the success of the investment. This factor should be monitored over the life of the investment to identify the need, and to allow appropriate action to be taken where the actual growth is significantly less than the anticipated level of rental appreciation.

(iii) Capitalisation Rate

Future market conditions will have a major influence on the capitalisation rate adopted by the market, and it is possible that the actual rate may differ from the expected rate. The following analysis aims to examine the sensitivity of the overall performance of the two investment options to changes in the capitalisation rate used to compute the estimated property selling price.

The analysis of comparable rental properties which had recently sold in the Christchurch region provided an indicated capitalisation rate of 11.2 % and 10.5 % for investment options one and two respectively. Based on this analysis, it is considered that these rates are unlikely to vary beyond the range of 10.5 to 12 % (option one) and 9.5 to 11.5 % (option two). Variations to the capitalisation rate have a direct affect on the price achievable for each investment property.

Data representing the investment cash flows under the above variations to the individual capitalisation rates for each investment property were computed. These data, together with the remaining (unchanged) investment

parameters were submitted to the investment model. Table 5.15 provides a comparison of the rates of return (IRR) generated by each investment option under the estimated minimum and maximum capitalisation rates. Figure 5.7 contrasts these results graphically, against the level of return achieved by each property at the expected rate of capitalisation; this comparison provides a clear illustration of the sensitivity of the performance of the investment options to changing capitalisation rate assumptions.

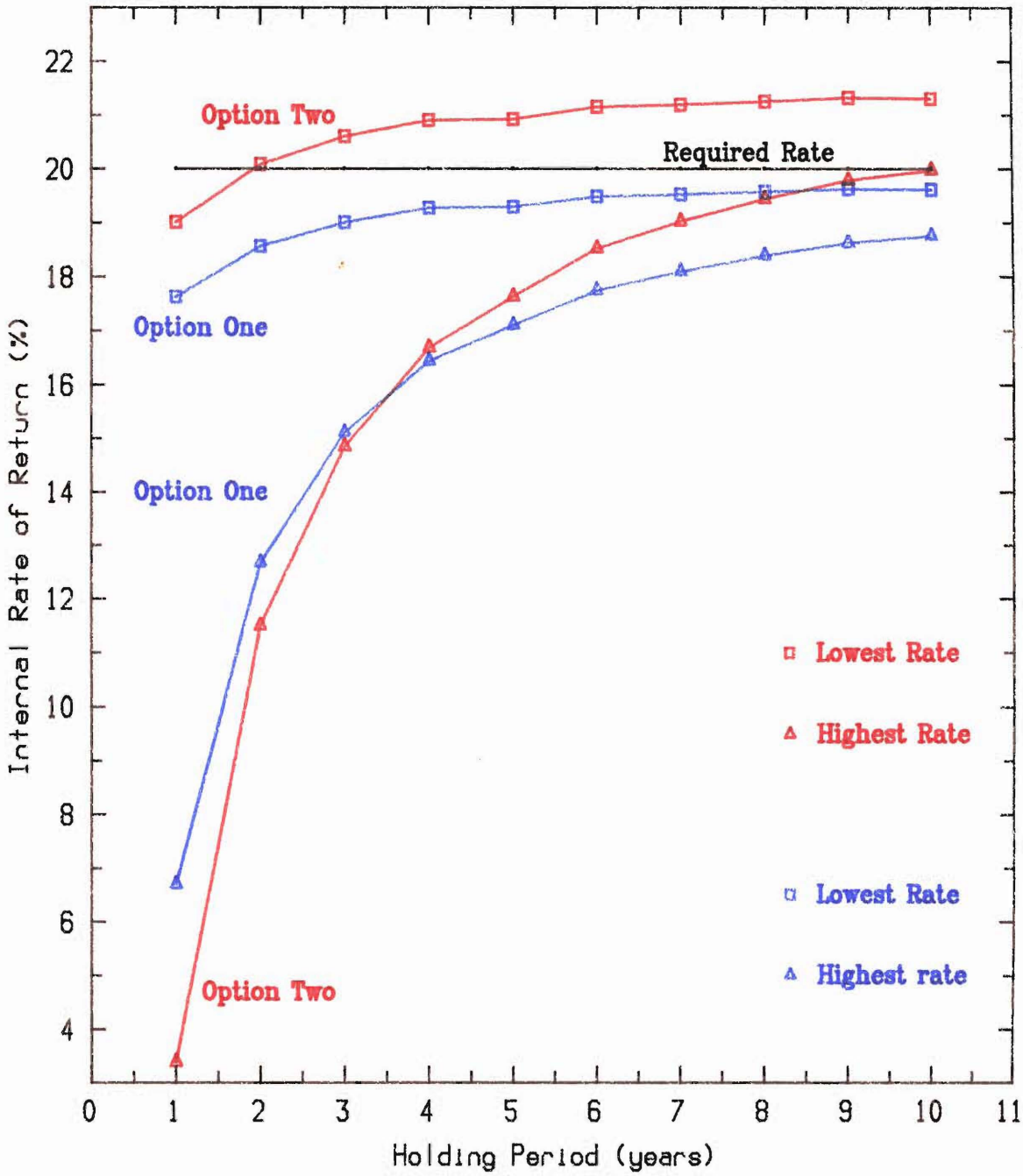
Table 5.15
IRR Generated Under the Estimated
Minimum and Maximum Rate of Capitalisation

Year	Option One		Option Two	
	Min. Rate (10.5 %)	Max. Rate (12 %)	Min. Rate (9.5 %)	Max. Rate (11.5 %)
0	4.40	(43.82)	4.10	(57.65)
1	17.62	6.69	19.02	3.39
2	18.56	12.66	20.09	11.50
3	19.00	15.10	20.61	14.85
4	19.27	16.43	20.91	16.69
5	19.29	17.09	20.93	17.64
6	19.48	17.74	21.16	18.53
7	19.52	18.09	21.20	19.03
8	19.57	18.38	21.26	19.45
9	19.62	18.62	21.33	19.79
10	19.61	18.75	21.31	19.98

The results outlined in Table 5.15 and Figure 5.7 illustrate the significant impact the capitalisation rate adopted by the market has on the overall performance of the investment property. The following conclusions may be drawn from these results.

- under market conditions stimulating low rates of capitalisation, option two is clearly superior to option one. If future market conditions stimulate a capitalisation rate in the order of 9.5 % for

FIGURE 5.7
IRR Generated Under the Estimated Minimum and Maximum Rate of Capitalisation



option two, this investment has the potential to provide an overall return on capital (IRR) approximating 21 %, at the expected level of rental income and rental growth.

- under conditions stimulating higher rates of capitalisation, option two provides the highest rates of return, however this only approximates the required rate (20 %) for a holding period of ten years (19.98 %). It is considered to be unlikely that the market would maintain a capitalisation rate (for option two) in the vicinity of 11.5 % over the long term; the rate would have to be maintained at this level to place the success of the investment at risk. This is considered to be unlikely.

- changing market conditions reflected in a change in the capitalisation rate adopted by the market, are not likely to alter the comparative feasibility of the alternative investments; the return generated by option one under a low capitalisation rate approximates, for holding periods of 7-10 years, the return generated by option two under a high capitalisation rate. This supports the superiority of option two.

- potential changes to the capitalisation rate adopted by the market are not likely to change the previously outlined conclusions with respect to the feasibility of disposing of the property at the completion of development.

The conclusions suggest that changing market conditions with regard to changes in the capitalisation rate adopted by the market, are not likely to place the success of the investment at risk, and are not likely to affect the comparative feasibility of the alternative investment options.

(iv) Initial Investment Costs

The success of the investment is also vulnerable to changes to the initial cost of the investment. The development costs outlined earlier in

this chapter were derived from an analysis of the construction costs of comparable industrial properties which are currently under construction, or have been recently completed in the Christchurch area. Construction cost data are current and considered to be accurate. In addition to this, the development payment schedules incorporated an allowance for inflation. These factors, together with the short duration of the development period, suggest that it is unlikely that the initial investment cost estimates would vary to a degree that would restrict the overall performance of the investment to a level below that required by the investors.

Summary Sensitivity Analysis :

Response to Request Five

Required : A full sensitivity study providing an insight as to the risk of the investment with respect to the required rate of return, and whether changing market conditions affect the selection of the optimum development site.

Response : The preceeding sensitivity analysis indicated that changing market conditions are not likely to affect the comparative feasibility of the two investment options, ie option two is likely to remain the optimum investment under the potential range of current and future market conditions. The develop and sell alternative is clearly not feasible; in the main, this alternative is likely to yield the lowest level of return under the range of market conditions considered to be potentially possible.

The conclusions drawn from the above study suggested that the degree of risk with respect to the success of the investment is minimal. The only factor that might place the investment at risk is the rate of rental growth achieved by the investment (option two). The results indicate that if this rate was to fall to and stabilise at a level in proximity to 8 % (as opposed to the expected rate of 12 %), then the investment would be likely to generate a level of return less than that required by the investors. It is considered that this situation would be unlikely to eventuate. The above

results suggest that the continued ability of investment option two to generate the required level of return can be accepted with a satisfactory degree of confidence.

5.6 Recommendations

1. Option two be selected as the optimum site for development.

2. It is recommended that the investors attempt to obtain the land at the lowest possible cost, and that the price paid for the land should not exceed $213890. A price in excess of this amount is likely to restrict the overall return to a level lower than the specified requirement.

3. Based on the expected investment costs and level of rental income and capital growth, an initial holding period of ten years be selected. For a holding period of this duration, the investment is likely to provide an overall rate of return on equity in the order of 21.86 %. It is recommended that the feasibility of this term be monitored at regular and frequent intervals during the holding period, with particular attention to the level of rental growth achieved by the property.

4. The lease aggreement recommended above, be adopted for the duration of the holding period.

5.7 Deterministic verses Probalistic Sensitivity Studies

The analysis illustrated above provides an example of a deterministic sensitivity study. It involved stabilising the remaining (unchanging) investment parameters at a predetermined level while a single parameter is varied through the likely range to examine the impact on the overall performance of the investment.

The problem with this approach, is that even with the availability of a model such as the one developed within this study, it is difficult (if simply due to the time involved) to investigate the impact of each of the multitude of possible combinations of investment parameter values. To do this would involve a full factorial design, the dimensions of this design being dependent upon the number of parameters included in the analysis, together with the number of values each parameter may take.

Chapter two briefly introduced the concept of computer simulation modelling. One method which has become practical since the advent of the computer, is stocastic simulation modelling; this attempts to imitate the various ways that all the variables which influence the success of the investment could combine over the term of the project. Probability distributions are estimated for each factor which ultimately affects the investment, and the possible combinations of the values for each factor are then simulated in order to determine the range of possible outcomes. One objective of this simulation is to produce a probability distribution for the overall rate of return generated by the investment. In this way, the analysis and investment decision is able to take account of the probabilities associated with the possible rates of return generated by the investment, which in themselves reflect the probabilities associated with the different possible combinations of investment parameters.

A number of authors (Stevenson and Jackson 1977, Martin 1978), have outlined the application of this method to real estate analysis. Pyhrr (1973) provides a particularly useful review of the philosophical and technical application of stocastic modelling to real estate investment analysis. The advantages of this method suggest that stocastic simulation modelling has a great deal of potential as an analysis tool.

Optimum Seeking Designs

An extension to deterministic and stocastic simulation modelling, optimum seeking designs have an important role to play in effective and efficient simulation experiments. It is logical in simulation modelling, when attempting to investigate the combination of factors leading to the optimum or the most desired outcome, to use information provided by previous treatments (combinations of factors) in guiding the placement of later treatments. Blackie and Dent (1979b) provide a useful review of a number of these designs; for a detailed discussion of the mathematics and the theory of optimum seeking designs, the reader is referred to Harrison (1978).

Within real estate, investors often have the opportunity to determine, to varying degrees, the structure and components of the investment - such as the financial structure (equity capital, equity participation, the number, type, terms and conditions of mortgages), the holding period, or the rental agreement (lease type, renewal provisions, review provisions etc.). Optimum seeking designs, using models of a deterministic or a probalistic nature, have the ability to efficiently experiment with the possible combinations of investment factors or parameters, and provide analysts and decision-makers with the combination likely to provide the optimum or near optimum outcome. The same result could be achieved by re-running the basic model using each of the possible combinations of factors, ie a full factorial design. The inefficiency of this however, becomes prohibitive when the number of factors increases; for seven investment "policy" variables for example, each which is to be evaluated at 4 levels, the full factorial design would involve (4 ** 7) = 16348 simulation runs (Blackie and Dent, 1979b). The efficiency and effectiveness of optimum seeking designs, greatly enhances the potential of computer simulation modelling.

Summary

The above discussion illustrates an example application of the investment analysis model. The results developed by the model are contrasted with those derived from traditional investment appraisal techniques. The traditional approach involves a simplistic examination of comparitive investment performance which was incapable of distinguishing between the investment options.

The investment model developed within this study attempts to incorporate in the analysis, all the factors that are likely to have an impact on the overall performance of the investment. The discounting procedures incorporated within the model enable investment decisions to take account of both the magnitude and the timing of investment cash flows.

One advantage resulting from the development and application of the model, is that the individual and the comparative feasibility of a number of investment options is able to be efficiently examined with assured accuracy; the model has been designed to be as flexible as possible in order to cater for the likely range of property investment types and options.

A further advantage resulting from the availability of the model is the ability to incorporate a comprehensive sensitivity study in the analysis of the investment proposal; re-running the model using data representing the range of values important input parameters may take, enables investment decisions to take account of the sensitivity of the performance of the investment to those parameters. The model enables this to be carried out efficiently, and with assured accuracy. The time involved and the potential for errors often, in part, prohibits manual investment appraisal exercises incorporating a comprehensive sensitivity study.

An investment can ultimately be considered to consist of a series of cash flows. Although designed specifically for real estate investment analysis, the model has the potential for wider application. If the constraints and controls (such as taxation requirements) faced by any

particular investment are in accordance with those set within the model, or the analyst is able to set the cash flows to comply with the requirements of the model, then the output parameters and results developed by the model are able to assist the analysis of that investment. The flexibility of the model enhances its potential application.

CHAPTER SIX

Summary and Conclusions

6.1 Summary

The objective of this study is to lay the foundation, and to provide a general direction, for the development and achievement of superior information services to individuals involved in the analysis of urban real estate investment.

The nature, the magnitude, and the consequences of the changes which are surrounding, and taking place within the property environment have been stressed. Because of the large sums involved and the increasing risk brought about by the growing complexity of the factors determining the success of investment in property, the cost of uncertainty and subsequent failure are far greater than before. Effective decision-making is becoming increasingly reliant on the availability of information able to reduce uncertainty and to manage the complexity of the factors influencing the performance of the investment property, thus enabling investors to discriminate between potentially viable investments and those more vulnerable to failure. The study has concluded that information as an active resource offers a great deal of potential to those who have the capability to put the resource to productive use.

Past attitudes to information on behalf of property analysts and investors have been poor. The "state of the art" has accepted decisions based on implicit analysis and on intuition. Comprehensive market data and information have not been seen as a prerequisite for effective decision-making. Consequently little attention has been directed at the development of information services to practitioners involved in the analysis of investment property; analysts have had to rely on formal services developed specifically for other groups, and on informal sources seen as able to provide useful information. Many practitioners see their current sources of information as inadequate. The study has concluded that the increasing requirement for information, coupled with the inadequacy of

current information sources, creates the potential for the development and utilization of an information system for practitioners involved in the analysis of real estate investment. Advances in computer technology, which have been widely recognised and utilized by practitioners, coupled with the likely availability of an extensive central data base, and an increasing ability on behalf of practitioners to put the resource to productive use, suggests that there is a growing ability to achieve this potential.

The study has attempted to stimulate some thought with regard to the direction of future developments, in conceptualising an information system that could develop within the field of property investment analysis. The conceptualised system is ambitious in its entirety; the development and continued operation of such a system would have to overcome considerable obstacles. The study has attempted to illustrate the increasing ability to achieve a comprehensive system, in developing a computer assisted information system (model) for property investment analysis. The potential contribution and the advantages of this model have been identified, and are illustrated by the type of approach to investment analysis made possible through the availability and use of the model. In developing the model, the study has attempted to provide a small component of a comprehensive information system conceptualised within the field of real estate investment analysis.

6.2 Conclusions

While concentrating on information, the study has attempted to illustrate that the achievement of an improved approach to property investment analysis, is reliant on the improved education of analysts, coupled with the development and provision of pertinent information. The above discussion suggests that sufficient educational facilities are now available to enable the analysis field as a whole to move towards achieving an improved standard of education and analytical ability. The potential for achieving superior information services has been stressed. It would appear that the degree to which an improved analysis discipline is achieved, is in

the hands of each practitioner, and is dependent upon individual and collective attitudes with respect to improving analysis procedures. Attitudes within the analysis field appear to be varied. While a certain amount of negative feedback was received, the response to the 1984 Survey was encoraging; the majority of respondents appeared to have an interest in the topics covered in this study. Within the New Zealand property analysis field, there appears to be a diverse range of attitudes and approaches to investment analysis. The methodologies relied on by many are primitive, while a number of individuals of a more progressive nature, are making use of more up-to-date and precise techniques and approaches.

As the level of education and analytical ability on behalf of progressive individuals improves, and the advantages of technological developments are more widely recognised and utilized, the gap between the intuitive and the more precise analysts, is likely to widen. The growing complexity of the property sector, and the large sums of capital invested in property, place a greater responsibility on analysts. This is likely to encorage, over time, the intuitive practitioners to acquire and develop appropriate analytical competence, or to relocate themselves in a more sedate and protective field.

A characteristic of the property investment field is that a large portion of analysts have acquired their expertise through experience. Although the facilities exist, it appears likely that an advanced level of education, will take some time to permeate the industry. Because of a lack of advanced education there is a lack of a wide awareness of the various analytical techniques and methods which have the potential to aid the analysis of property. Prime examples of techniques offering extensive potential to property analysis, would be econometric modelling, linear programming, and computer simulation modelling. The principles underlying techniques such as these, are not widely understood by practitioners. Because of this, developments such as the investment analysis model, are likely to receive slow acceptance and utilisation by practicing analysts.

The application of the model developed within this study is reliant on data developed by, and input by the model user. One area offering potential for further research and development, is the creation of a wider information system, comprising the investment model, a data base, and

linkage programs. The model could be linked to the data base, which could, via data processing packages and programs, automatically provide the majority, or a portion of the input data required by the model. This system could be considered to be one advanced from the isolated investment model. Although an extensive task, it is not unrealistic to expect this sort of system to become a practical reality in the forseeable future. Research and development in this area, can be seen as a step towards achieving the comprehensive information system conceptualised within this study.

The investment analysis model developed within this study provides a single deterministic simulation for each set of investment input data. The difficulties of completing a comprehensive sensitivity study using a model providing a single deterministic simulation, have been outlined (chapter five); this would involve a full factorial design. Opportunities for further research and development exist within the areas of stocastic modelling (Blackie and Dent, 1979b), and optimum seeking designs (Harrison, 1978).

Developing the model to provide a stocastic simulation offers distinct advantages, in the ability to take account explicitly of the nature and the associated probabilities of the risks inherent in the investment. Optimum seeking designs enable models run in deterministic or in probalistic mode, to analyse efficiently, the range of alternative combinations of important investment parameters, to provide the combination yielding the optimum or near optimum output.

Well directed research in the directions outlined above has the potential to provide the next significant developments in the techniques and facilities assisting the analysis of investment property. The American real estate industry have shown signs of utilizing advanced types of computer modelling. Within the New Zealand analysis field, there appears to be considerable scope for the development and utilization of these types of decision support techniques.

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APPENDIX 1

1984 Property Management Survey

Survey Procedure

Survey Questions

Survey Results

1984 Property Management Survey

(a) Survey Procedure

Survey Sample

The survey sample was established from full and probationary members of the Property Management Institute (PMI), as at June 1984. From the list of members, any individuals who were not likely to be involved in the analysis of investment property were deleted. These were mainly :

- civil servants.
- retired members.
- individuals not operating in the market, eg university lecturers.

The survey aimed to obtain only one reply from each firm surveyed, and Institute members who were from firms which were already on the mailing list were deleted.

The deletion procedure was kept as objective as possible in order to eliminate any bias that might be introduced in compiling the survey sample. This procedure reduced the potential mailing list to 194 individuals. A questionnaire was sent (by post) to each of these 194 individuals. Questionnaires were kept completely anonymous in an attempt to maximise the response rate and ensure the honesty of responses; 102 satisfactory responses were completed and returned, providing a response rate of 52.5 %.

(b) Survey Questions/Results

Individual questions comprising the survey are outlined below, followed in each case by a statistical summary of the responses received. Chapter two of this thesis, provides a descriptive interpretation of the statistical results of the survey; this appendix provides a statistical summary only.

Statistical Reliability of Results

The majority of questions comprising the 1984 Survey, were designed to provide a proportion (percentage) figure relating to some aspect of the market, such as the proportion of firms currently using computer technology of some kind.

As a general statistical concept, a statistic provided by a sample becomes more reliable when a larger sample size is used. It is possible to obtain an indication, based on the size of the survey sample, of the reliability of the statistical results provided by a survey.

It can be shown (Laplin, 1978) that the required sample size to approximate a required level of statistical reliability with respect to a sample derived proportion, is gived by :

$$N = (Z^{**}2) * ((A)*(1-A)) / (E^{**}2)$$

where N = required sample size

A = population proportion (estimate) the sample is attempting to estimate

E = tolerable error level, ie the maximum allowable deviation between A (true population proportion) and its sample estimator P ; E is expressed as a decimal fraction.

Z = a value (normal distribution deviate) expressing the desired reliability (probability) that P will not differ from A by more than the tolerable error level (E); for example, for a 90 % probability level, Z = 1.64

(source : Laplin (1978), page 265).

By rearranging this formula, and setting an appropriate reliability level (Z), the error associated with a given sample size N (102 for the 1984 Survey) can be found. Rearranging this formula yields :

$$(E^{**}2) = (Z^{**}2) * ((A)*(1-A)) / N$$

It is reasonable to select a 95 % reliability (Z = 1.96) in computing

the approximate error level associated with a sample size of 102. Because this test is directed at the reliability of the sample results as a whole, verses the reliability of a single estimated proportion, A takes on the value of .5; this value maximises the component (A * (1-A)) of the above formula, and thus ensures the error level is not underestimated in allowing A to take the value of .5.

Substituting for each of the variables in the formula, provides the following level of error :

$$(E^{**}2) = (1.96^{**}2) * ((.5)*(1-.5)) / 102$$
$$(E^{**}2) = .00941568$$
$$E = .097$$

Statistically, this test suggests that with a sample size of 102, it can be held with approximately 95 % confidence, that the true population parameters do not differ from the sample derived estimates (proportions), by more than 10% (9.7 %).

In interpreting the results of the survey, it should be noted that practitioners who are concerned with, and have an interest in the topics covered in this survey, may be more interested in satisfactorily completing and returning questionnaires than those who have a less progressive attitude and are less interested in these matters. It is therefore possible, that the statistical measures and results provided by this survey, are more representative of the more progressive investment analysts than of the less advanced practitioners.

The following discussion provides an outline of the questions and the results provided by the sample outlined above. A specialised computer program (Statistical Package for the Social Sciences) provided the analysis of the survey response data. For each survey question, the percentage figures outlined below, represent the adjusted relative frequency of response for each response option, ie missing responses were not included in the computation of the percentage figures. The number of missing responses for each question are indicated.

Note : The survey response data providing the following percentage figures, are available from the author.

QUESTION 1 : DOES YOUR FIRM CURRENTLY USE ANY KIND OF COMPUTER (SYSTEM)?

RESPONSE

	%
Yes	71.6
No	28.4
Don't know	0.0
	100.0

IF YES, WHAT TYPE OF SYSTEM ?

	% of respondents currently using computer technology
Computer service bureau	5.5
Time sharing with other users	5.5
Your own in-house system	89.0
Other	0.0
Don't know	0.0
	100.0

IF NO, DO YOU (YOUR FIRM) INTEND TO UTILISE SOME FORM OF COMPUTER TECHNOLOGY : ?

	% of respondents not currently using computer technology.
Not in the forseeable future	13.8
Within one year	34.5
Within three years	3.5
Within five years	0.0
Soon, but unsure when	44.8
Don't know	3.4
	100.0

No Missing Responses.

QUESTION 2 : DISREGARDING THE PREVIOUS QUESTIONS, TO WHICH OF THE FOLLOWING AREAS DO YOU ENVISAGE COMPUTER TECHNOLOGY COULD BE OF USE ?

	% Yes	Missing Responses
	%	No.
Information storage and retrieval	94.1	1
Property management accounting	80.2	1
Sales analysis	58.4	1
Lease analysis	54.4	1
Value estimates	36.6	1
Lease management	48.5	1
Construction project & contract mgt.	44.6	1
Investment analysis :		
- cash flow analysis	62.4	1
- investment return analysis	56.4	1
- forecasting and projections	52.5	1
- sensitivity/risk analysis	36.6	1
Other	13.9	1

QUESTION 3 : IN ORDER FOR YOU (YOUR FIRM) TO CARRY OUT YOUR WORK INVOLVED WITH PROPERTY MANAGEMENT, WHAT TYPE OF INFORMATION DO YOU REQUIRE AND CURRENTLY MAKE AN EFFORT TO COLLECT ?

	% Yes	Missing Responses
	%	No.
Comparable sales information	63.3	4
Construction cost information	65.3	4
Lease information :		
- comparable rentals	86.7	4
- occupancy/vacancy rates	58.2	4
- operating expense information	73.5	4
- comparable lease terms and conditions	74.5	4
Market trend information	56.1	4
Other	7.1	4

QUESTION 4 : HOW DO YOU (YOUR FIRM) CURRENTLY OBTAIN THIS INFORMATION ? IE RANK THE FOLLOWING INTO ORDER OF IMPORTANCE AS INFORMATION SOURCES TO YOUR FIRM.

The results of the responses to this question are able to be illustrated in table form. It should be noted that the percentage figures outlined below exclude missing responses. Where the figures do not add (horizontally) exactly to 100 %, the difference is due to rounding errors within the computer package used to analyse responses.

Source 1 : FROM THE PORTFOLIOS OF THE PROPERTIES YOU MANAGE.
Source 2 : SPECIFIC INFORMATION SOURCES (PROPERTY LISTING ETC.)
Source 3 : FORMAL SOURCES GENERALLY EXCLUSIVE TO YOU (YOUR FIRM).
Source 4 : INFORMAL SOURCES (NEWSPAPERS, BUSINESS CONTACTS, ETC.).
Source 5 : OTHER

RESPONSE 1 = Most Important, 5 = Least Important, 0 = Not Important

Rank =	1	2	3	4	5	0	Missing Responses
	%	%	%	%	%	%	No.
Source 1	40.6	25.0	9.4	11.5	4.6	9.4	6
Source 2	27.1	18.8	34.4	11.5	3.1	5.2	6
Source 3	28.1	32.3	16.7	12.5	4.2	6.3	6
Source 4	12.5	12.5	25.0	35.4	8.3	6.3	6
Source 5	6.3	7.3	4.2	6.3	44.8	31.3	6

The above results (question 4) are able to provide a general indication as to the relative importance of sources of information. The statistics are of little value in providing specific indications, such as the degree of importance of each source.

Within each information source the postition (rank 1-5 & 0) of the highest percentage figure or figures, indicates the relative importance of

that source, as indicated by the largest proportion of respondents. Source 1 for example, is seen by the highest proportion (40.6 %) of respondents to be the most important (rank of 1) source. The highest proportion of respondents (32.3 %) consider source 3 (32.3 % at rank 2) to be the second most important source. Source 2 is seen to be the third most important source, followed by source four (35.4 % at rank 4). OTHER sources are seen by the largest proportion of respondents to be the least important (44.8 % at rank 5).

The relative postition (rank) of the highest percentage figures, as opposed to the single highest percentage figure, can be used to gauge the relative importance, in situations where two or more sources may be indicated to be of approximate equal importance.

QUESTION 5 : DO YOU SEE YOUR ABOVE INDICATED SOURCES AS ADEQUATE ?

	% Yes
Currently - Yes	61.6
No	35.4
Don't Know	3.0
Missing Responses = 3	100.0
For the forseeable future -	
Yes	39.2
No	52.6
Don't Know	8.2
Missing Responses = 5	100.0

QUESTION 6 : THE NEW ZEALAND INSTITUTE OF VALUERS (NZIV) OFFERS (TO ANYONE WISHING TO SUBSCRIBE) AN INFORMATION SERVICE WHICH PROVIDES SALES INFORMATION ON ALL RECENT PROPERTY TRANSACTIONS THROUGHOUT THE COUNTRY.
DO YOU (YOUR FIRM) SUBSCRIBE TO THE INSTITUTE OF VALUER'S INFORMATION SERVICE ?

RESPONSE	%
Yes	48.0
No	42.2
No, but soon intend to	7.8
Don't know	2.0
Missing Responses = 2	100.0

QUESTION 7 : DO YOU SEE A NEED FOR AN INFORMATION SYSTEM TO THE PROPERTY MANAGEMENT INDUSTRY ?

	%
Currrently -	
Yes	82.8
No	12.1
Don't Know	5.1
Missing Responses = 3	100.0
For the forseeable future -	
Yes	91.8
No	4.7
Don't Know	3.5
Missing Responses = 17	100.0

QUESTION 8 : IF SUCH A SERVICE WAS DEVELOPED WHAT TYPE OF INFORMATION DO YOU THINK SHOULD BE AVAILABLE ? IE RANK THE FOLLOWING AS YOU SEE THEIR ORDER OF IMPORTANCE REGARDING INCLUSION IN AN INFORMATION SERVICE.

RESPONSE

The layout and interpretation of the response to this question follows the procedure outlined for question four (above).

Type 1 Comparable sales information
Type 2 Construction cost information
Type 3 Comparable rentals
Type 4 Occupancy rates
Type 5 Operating expense information
Type 6 Comparable lease terms and conditions
Type 7 Market trend information
Type 8 Other

1 = Most important, 8 = Least important, 0 = Not important

Rank =	1	2	3	4	5	6	7	8	0	Miss. Response
Type 1	43.6	9.6	6.4	7.4	8.5	8.5	6.4	0.	9.6	8
Type 2	14.9	16.0	9.6	12.8	13.8	14.9	9.6	0.	8.5	8
Type 3	47.9	24.5	10.6	4.3	4.3	2.1	0.	0.	6.4	8
Type 4	8.5	13.8	7.4	17.0	14.9	14.9	10.6	0.	12.8	8
Type 5	11.7	12.8	20.2	18.1	14.9	5.3	4.3	0.	12.8	8
Type 6	13.8	12.8	31.9	18.1	8.5	6.4	0.	0.	8.5	8
Type 7	14.9	6.4	9.6	9.6	9.6	7.4	17.0	0.	25.5	8
Type 8	5.3	0.	0.	0.	0.	0.	0.	0.	94.7	8

Question four provides an outline of the approach used to interpret the above results.

QUESTION 9 : WOULD YOU (YOUR FIRM) SUBSCRIBE TO SUCH A SERVICE IF IT BECAME AVAILABLE ?

RESPONSE

		%
Currently -		
	Yes	68.4
	No	10.5
	Don't Know	21.1
Missing Responses = 7		100.0
In the forseeable future -		
	Yes	73.5
	No	3.6
	Don't Know	22.9
Missing Responses = 19		100.0

QUESTION 10 : CERTAIN DATA MUST BE AVAILABLE IN ORDER FOR AN INVESTMENT ANALYSIS TO BE COMPLETED FOR ANY PARTICULAR PROPERTY INVESTMENT.

IRRESPECTIVE OF WHETHER YOU CONSIDER ALL OR ANY OF THE FOLLOWING DATA TYPES TO BE IRRELEVANT, WHICH COULD YOU FEASIBLY OBTAIN TO ASSIST YOU IN MAKING A PARTICULAR PROPERTY INVESTMENT DECISION ?

RESPONSE

		% Yes	Miss. Res.
		%	No.
Development Costs	- land	82.2	1
	- improvements	84.2	1
Acquisition cost total (property purchase)		90.1	1
	-land value	91.1	1
Economic life of the structure		65.3	1
Investors required rate of return		87.1	1
Potential gross income		88.1	1
Occupancy/vacancy rate		64.4	1
Operating expenses		86.1	1
Rental appreciation estimate		60.4	1
Operating expense appreciation estimate		56.4	1
Value appreciation estimate		56.4	1
None of the above		2.0	1
Don't know		0.	1

QUESTION 11 : THIS SURVEY DEFINES INVESTMENT ANALYSIS QUITE BROADLY COVERING ANY WORK INVOLVED WITH EXAMINING OR CONSIDERING ANY INVESTMENT IN URBAN PROPERTY, BOTH BACKGROUND AND INVESTIGATING THE MERITS OF A SPECIFIC INVESTMENT IN INCOME PRODUCING PROPERTY.

HOW MUCH OF YOUR FIRM'S WORK IS INVOLVED WITH INVESTMENT ANALYSIS (IN PERCENTAGE MANHOURS) ?

RESPONSE : Responses to this question were analysed by classes as illustrated below.

% Manhours	% of respondents within this class
0 - 10	62.2
11 - 20	13.4
21 - 30	13.4
31 - 40	1.1
41 - 50	4.4
51 - 60	1.1
61 - 70	1.1
71 - 80	1.1
81 - 90	1.1
91 -100	1.1
Missing Responses = 12	100.0

IS THIS :

	% Yes
- increasing	42.6
- steady	48.9
- decreasing	3.2
- don't know	5.3
Missing Responses = 8	100.0

QUESTION 12 : TYPICALLY IN THE ANALYSIS OF AN INCOME PRODUCING PROPERTY INVESTMENT, WHICH OF THE FOLLOWING DO YOU (YOUR FIRM) ACTUALLY INVESTIGATE/CONSIDER ?

RESPONSE

	% Yes	Miss. Response
	%	No.
Capital gain potential	86.5	6
Cash flow	85.4	6
Return to overall capital	85.4	6
Return to equity	58.3	6
Liquidity (ease of disposal)	55.2	6
Taxation factors	53.1	6
Investment internal rate of return	51.0	6
Computation of the investment value of the property	47.9	6
Leverage	33.3	6
Non-monetary onjectives of the investor	29.2	6
Discounted cash flow	28.1	6
Risk/sensitivity analysis	28.1	6
Ellwood type analysis	3.1	6
None of the above	0.	6

There appears to be a discrepancy between the percentage of respondents who incorporate a discounted cash flow analysis, and the percentage who investigate the internal rate of return and investment value of an investment property; both of these measures require the application of discounting procedures. It is possible that a number of respondents misinterpreted the nature of the internal rate of return and the investment value. The interpretation of the above results should take account of this possiblility.

QUESTION 13 : DISREGARDING THE PREVIOUS QUESTIONS, RANK THE FOLLOWING AS YOU SEE THEIR ORDER OF IMPORTANCE IN A TYPICAL INVESTMENT ANALYSIS :

RESPONSE

The layout and interpretation of the responses to this question, again follows the approach outlined in question four (above).

Factor 1 Cash flow
Factor 2 Leverage
Factor 3 Liquidity
Factor 4 Capital gains potential
Factor 5 Taxation factors
Factor 6 Investment Risk
Factor 7 Overall return on investment
Factor 8 Return to equity
Factor 9 Non-monetary objectives of investor

Rank =	1	2	3	4	5	6	7	8	9	0	Mis.Re.
Factor 1	13.8	16.0	16.0	21.3	12.8	8.5	4.3	3.2	3.2	1.1	8
Factor 2	4.3	2.2	4.3	4.3	14.0	12.9	28.0	11.8	9.7	8.6	9
Factor 3	5.3	0.	11.7	12.8	21.3	18.1	11.7	11.7	3.2	4.3	8
Factor 4	24.5	23.4	23.4	12.8	6.4	5.3	4.3	0.	0.	0.	8
Factor 5	1.1	6.5	8.6	14.0	12.9	21.5	9.7	19.4	1.1	5.4	9
Factor 6	12.8	17.0	14.9	18.1	13.8	7.4	8.5	5.3	0.	2.1	8
Factor 7	36.2	20.2	11.7	7.4	6.4	5.3	3.2	5.3	2.1	2.1	8
Factor 8	12.8	11.7	13.8	6.4	16.0	8.5	10.6	12.8	4.3	3.2	8
Factor 9	2.1	2.1	2.1	2.1	3.2	3.2	4.3	12.8	59.6	8.5	8

QUESTION 14 : WITH REGARD TO PROPERTY INVESTMENT, DO YOU CONSIDER THE INVESTIGATION OR CONSIDERATION OF RISK TO BE :

	% Yes
Increasing in importance	60.6
Steady	33.4
Decreasing in importance	3.0
Don't know	3.0
Missing Responses = 3	100.0

APPENDIX 2

Program Listing : Investment Analysis Model

: Main Program

: Subroutine Subprograms

: Function Subprograms

```
C**********************************************************************
C**********************************************************************
C
C                Urban Property Investment Analysis Model
C
C                Programmed in Standard Fortran 77
C
C                Programmer : Anthony Beverley
C                             (Winter - 1984.)
C
C       ------------------------------------------------------------
C
C       The objective of this  program is to complete a comprehensive
C       investment analysis of a  predefined investment in urban real
C       estate. The components and component relationships underlying
C       the  program are  outlined in  detail in  chapter four of the
C       thesis submitted by the above  programmer to  Lincoln College
C       in part fulfilment of a Master of Commerce, 1984. The program
C       has been  designed to  provide a  financial  analysis of both
C       Property  Development  and  Property  Purchase  Investments.
C       All analysis data are supplied and input by the program user.
C
C        ------------------------------------------------------------
C
C                 Hierarchy of Subroutines and Modules
C
C       Subroutine
C       ----------
C       DEVELOPMENT      ! Property Development Option
C            DEV         ! Development Cost Data
C            EQUITY      ! Equity Capital Data
C            INCOME      ! Income Over Development
C            MORT        ! Development Mortgage Finance
C              BRIDGE    ! Development Bridging Finance
C
C       ACQUIRE          ! Property Purchase Investment
C            ! Purchase Module rather than Subroutine
C            ! Equity Module rather than Subroutine
C            ! Cash Flow Module rather than Subroutine
C            ! Mortgage Finance Module rather than Subroutine
C       IRRETURN         ! Internal Rate of Return Subroutine
C
C
C**********************************************************************
C                                                                     *
C                        MAINLINE PROGRAM BEGINS                      *
C
C
      PROGRAM MODEL
C
      DIMENSION IOINTEREST(3,50),IOPRINCIPAL(3,50),IOPRIN_P(3,50),
     1          IPRINCIPAL(3,150),IPRIN_PAY(3,150),INTEREST(3,150),
     2          IGROSS(50),IOPEX(50),IMPR(50),IEF(50),NOI(50),
     3          ITOT_PRIN(50),ITOT_INTO(50),IUMB(0:50),IC_PP(50),
     4          ICTOE(50),ITAXD(50),IDEPN(50),ITAX_INC(50),
     5          ITSHEL(50),ITAX(50),IATCF(50),IDATCF(50),IC_D_ATCF(0:50),
     6          IA_R_ON_S(0:50),ISPRICE(0:50),ISEX(0:50),IREP(0:50),
     7          IGAIN(0:50),IBOOKVB(0:50),IB_T_ER(0:50),IT_ON_S(0:50),
     8          IA_T_ER(0:50),ID_ATER(0:50),ITDR(0:50),TOT_REQ(0:50),
     9          INPV(0:50),RIRR(0:50),FACTOR(0:50),IBAL_OP(0:50),
     1          IBAL_DEV(0:150),IOPRIN_REP(3,50),IOP_EQ(0:50),
     2          INVV(50),TOT_EQUITY(0:50),ITOTAL_PRIN(0:50),
     3          IOPRIN_IN(3,50),IOVERALL_BAL(0:550),IPRIN_IN(3,150),
     4          IPRIN_REP(3,150),IEQUITY(0:150),INCOME_D(0:150),
     5          IE_REP(150),IB_INT_P(150),IB_BOR(0:150),IC_GROSS(50),
```

```
     6          IOC_PRIN_P(3,50),IOC_INTEREST(3,50),IC_OPEX(50),
     7          ITOT_C_PRIN(50),ITOT_C_INTO(50),NOI_C(50),ITOT_BINT(150),
     8          IB_INT_ACT_P(150),ITSH(150),ITAXDEV(150),IGEF(50)
C
      DATA       IOINTEREST/150*0/,IOPRINCIPAL/150*0/,IOPRIN_P/150*0/,
     1           IPRINCIPAL/450*0/,IPRIN_PAY/450*0/,INTEREST/450*0/,
     2           IGROSS/50*0/,IOPEX/50*0/,IMPR/50*0/,IEF/50*0/,NOI/50*0/,
     3           ITOT_PRIN/50*0/,ITOT_INTO/50*0/,IUMB/51*0/,IC_PP/50*0/,
     4           ICTOE/50*0/,ITAXD/50*0/,IDEPN/50*0/,ITAX_INC/50*0/,
     5           ITSHEL/50*0/,ITAX/50*0/,IATCF/50*0/,IDATCF/50*0/,
     6           IC_D_ATCF/51*0/,IA_R_ON_S/51*0/,ISPRICE/51*0/,
     7           ISEX/51*0/,IREP/51*0/,IGAIN/51*0/,IBOOKVB/51*0/,
     8           IB_T_ER/51*0/,IT_ON_S/51*0/,IA_T_ER/51*0/,ID_ATER/51*0/,
     9           ITDR/51*0/,TOT_REQ/51*0/,INPV/51*0/,RIRR/51*0/,FACTOR/51*0/,
     1           IBAL_OP/51*0/,IBAL_DEV/151*0/,IOPRIN_REP/150*0/,IOP_EQ/51*0/,
     2           INVV/50*0/,TOT_EQUITY/51*0/,ITOTAL_PRIN/51*0/,
     3           IOPRIN_IN/150*0/,IOVERALL_BAL/551*0/,IPRIN_IN/450*0/,
     4           IPRIN_REP/450*0/,IEQUITY/151*0/,INCOME_D/151*0/,
     5           IE_REP/150*0/,IC_GROSS/50*0/,IOC_PRIN_P/150*0/,
     6           IOC_INTEREST/150*0/,IC_OPEX/50*0/,NOI_C/50*0/,
     7           IOC_PRIN_P/150*0/,IOC_PRIN_P/150*0/,ITOT_C_INTO/50*0/,
     8           ITOT_C_PRIN/50*0/,ITSH/150*0/,ITAXDEV/150*0/
C
      CHARACTER SPACE*1,ANSWER*1,ANSWER7*1,WARN*45
      LOGICAL DEVEL_P,DED_INT,BRIDGE_PAY,FINISH,CHANGE1,CHANGE2,WARNTYPE
      IOSTAT=LIB$ERASE_PAGE(1,1)
C
      ANSWER='Z'       !ANY ARBITRARY CHARACTER
      TYPE *,'
      TYPE *,'         ** ENSURE INPUT REPLY ARE IN CAPITALS **'
      TYPE *,'
      TYPE *,'         DOES THE INVESTMENT INVOLVE A :'
      TYPE *,'
      TYPE *,'              1. PROPERTY DEVELOPMENT  '
      TYPE *,'
      TYPE *,'              2. PROPERTY PURCHASE     '
      TYPE *,'
      TYPE *,'                 (TYPE 1 OR 2)         '
      ACCEPT *,IZ
      IOSTAT=LIB$ERASE_PAGE(1,1)
      TYPE *,'         INVESTMENT ANALYSIS OVER OPERATING PERIOD'
      TYPE *,'         IS ON AN ANNUAL BASIS ::                 '
      TYPE *,'
      TYPE *,'         INPUT THE DESIRED NUMBER OF YEARS        '
      TYPE *,'         FOR OPERATING PERIOD ANALYSIS            '
      ACCEPT *,IPERIOD

C
      IF(IZ.EQ.1)THEN
         DEVEL_P=.TRUE.
         CALL DEVELOPMENT(IEQUITY,IOPRIN_IN,IOPRINCIPAL,IOINTEREST,IOPRIN_P,
     1LAND,ISTRUC,IPERIOD,IPERIOD_D,MN,IOP_EQ,IOPRIN_REP,
     1NPER_ANN,INTEREST,IPRIN_PAY,IPRIN_REP,IPRIN_IN,INCOME_D,DISC,DR,
     1IE_REP,IREP,IB_INT_P,IB_BOR,IBAL_DEV,IOC_INTEREST,IOC_PRIN_P,
     1ITOT_BINT,IB_INT_ACT_P)
         ICOST=ISTRUC+LAND
      ELSE
         DEVEL_P=.FALSE.
         NPER_ANN=1
         CALL ACQUIRE(LAND,ISTRUC,IOINTEREST,IOPRINCIPAL,
     1IOPRIN_P,IPERIOD,MN,IPRICE,IOP_EQ,IOPRIN_REP,IREP,
     2IOPRIN_IN,DISC,DR,INTEREST,IPRIN_PAY,IPRIN_IN,NPER_ANN,IOC_INTEREST,
     3IOC_PRIN_P)
         IPRICE=LAND+ISTRUC
      ENDIF
```

```
      IVALUE=LAND+ISTRUC
C
C     OBTAIN DATA COVERING OPERATION PERIOD
C
      IOSTAT=LIB$ERASE_PAGE(1,1)
      TYPE *,'         OPERATING PERIOD DATA'
      TYPE *,'         '
      TYPE *,'         GROSS INCOME          '
      TYPE *,'         '
      TYPE *,'         IS GROSS INCOME TO BE INPUT AS :'
      TYPE *,'         '
      TYPE *,'            1. INITIAL LUMP SUM & APPRECIATION RATE'
      TYPE *,'         '
      TYPE *,'            2. LUMP SUM PER PERIOD                 '
      TYPE *,'         '
      TYPE *,'                        (TYPE 1 OR 2)              '
      ACCEPT *,IMETH
300   IOSTAT=LIB$ERASE_PAGE(1,1)
      TYPE *,'         GROSS INCOME DATA '
      KOUNT=1
C
301   IF(IMETH.EQ.1)THEN
         TYPE *,'      INPUT GROSS INCOME FOR PERIOD 1'
         ACCEPT *,IGR
         TYPE *,'      '
         TYPE *,'      INPUT THE APPRECIATION RATE (DECIMAL)'
         TYPE *,'      AND INTERVAL(NO. OF YEARS)BETWEEN    '
         TYPE *,'      INCOME INCREASES                     '
         ACCEPT *,RATE,INTERVAL
         IGROSS(1)=IGR
C
         RATE=RATE+1.
         DO IG=1+INTERVAL,IPERIOD,INTERVAL
              IGR=NINT(IGR*RATE)
              IGROSS(IG)=IGR
         ENDDO
         DO IG=2,IPERIOD
            IF(IGROSS(IG).EQ.0)THEN
               IGROSS(IG)=IGROSS(IG-1)
            ENDIF
         ENDDO
C
      ELSE              !LUMP SUM PERIODIC INPUTS
C
       DO WHILE(KOUNT.LE.IPERIOD)
         IF(IPERIOD.EQ.1)THEN
              TYPE *,'         '
              TYPE *,'         INPUT GROSS INCOME ($)'
              ACCEPT *,IGROSS(1)
              GOTO 302
         ELSEIF(KOUNT.LE.IPERIOD)THEN
              TYPE *,'         '
              TYPE *,'         INPUT GROSS INCOME ($)'
              TYPE *,'         FOR YEAR    ',KOUNT
              ACCEPT *,IGR
              TYPE *,'         '
              TYPE *,'         INPUT THE NUMBER OF YEARS'
              TYPE *,'         GROSS INCOME EQUALS ',IGR
              ACCEPT *,MNCI
              IF(KOUNT+MNCI-1.GT.IPERIOD)THEN
                      TYPE *,'         ERROR ** OPERATING PERIOD EXCEEDED'
                      TYPE *,'               ** RE-ENTER  DATA           '
                      GOTO 300
              ELSE
                      DO IGG=KOUNT,KOUNT+MNCI-1
```

```
                        IGROSS(IGG)=IGR
                      ENDDO
              ENDIF
              KOUNT=KOUNT+MNCI
           ENDIF
         ENDDO
        ENDIF
C
C       GROSS INCOME DATA COMPLETED
C
C       COMPOUND THE GROSS INCOME FIGURE TO AN EQUIVALENT
C       YEAR END FIGURE
C
        IOSTAT=LIB$ERASE_PAGE(1,1)
        TYPE *,'         ENTER THE NUMBER OF              '
        TYPE *,'         INSTALLMENTS THAT COMPRISE       '
        TYPE *,'         ANNUAL GROSS INCOME              '
        ACCEPT *,MA
        DIR=DISC**(1./MA)
        DO IA=1,IPERIOD
              IG=IGROSS(IA)/MA
              DO IO=1,MA
                 IC_GROSS(IA)=IC_GROSS(IA)+IG*(DIR**(MA-IO+1))
              ENDDO
        ENDDO


C
C       OCCUPANCY DATA
C
302     IOSTAT=LIB$ERASE_PAGE(1,1)
        TYPE *,'         OCCUPANCY/VACANCY DATA'
        TYPE *,'                              '
        TYPE *,'INPUT THE ANNUAL OCCUPANCY RATE (DECIMAL)'
        TYPE *,'                              '
        TYPE *,'         NOTE ** THIS RATE IS TO INCLUDE'
        TYPE *,'                 ANY BAD DEBT ALLOWANCE '
        ACCEPT *,RATE_OCC
C
C       OPERATING EXPENSE DATA
C
        IOSTAT=LIB$ERASE_PAGE(1,1)
        TYPE *,'         OPERATING  EXPENSE  DATA'
        TYPE *,'                              '
        TYPE *,'         SELECT THE METHOD OF INCLUSION'
        TYPE *,'         OF ANNUAL OPERATING EXPENSE   '
        TYPE *,'                              '
        TYPE *,'          1.AS A PERCENTAGE OF EFFECTIVE GROSS INCOME'
        TYPE *,'                              '
        TYPE *,'          2.AS A PERIODIC LUMP SUM INPUT   '
        TYPE *,'                              '
        TYPE *,'                 (TYPE 1 OR 2)             '
        ACCEPT *,METH
311     KO=1
        IF(METH.EQ.1)THEN
           IOSTAT=LIB$ERASE_PAGE(1,1)
           TYPE *,'      OPERATING EXPENSE :                    '
           TYPE *,'                              '
           TYPE *,'      INPUT THE OPERATING EXPENSE RATIO       '
           TYPE *,'      AS A PERCENTAGE OF EFF. GROSS INCOME    '
           TYPE *,'                        (DECIMAL)             '
           ACCEPT *,OP_RATE
C
           DO IOP=1,IPERIOD
              IOPEX(IOP)=NINT(IGROSS(IOP)*RATE_OCC*OP_RATE)
```

```
          ENDDO
        ELSE
         DO WHILE(KO.LE.IPERIOD)
          IF(IPERIOD.EQ.1)THEN
               TYPE *,'         INPUT THE OPERATING EXPENSE'
               ACCEPT *,IOPEX(1)
               GOTO 313
          ELSEIF(KO.LE.IPERIOD)THEN
               TYPE *,' '
               TYPE *,'         INPUT THE OPERATING EXPENSE ($)'
               TYPE *,'         FOR PERIOD ',KO
               ACCEPT *,IOP
               TYPE *,'         '
               TYPE *,'         INPUT THE NUMBER OF PERIODS     '
               TYPE *,'         OPERATING EXPENSES EQUALS ',IOP
               ACCEPT *,MNCO
               IF(KO+MNCO-1.GT.IPERIOD)THEN
                       TYPE *,'         ERROR ** OPERATING PERIOD EXCEEDED'
                       TYPE *,'                  RE-INPUT DATA             '
                       GOTO 311
               ELSE
                       DO ICO=KO,KO+MNCO-1
                          IOPEX(ICO)=IOP
                       ENDDO
               ENDIF
               KO=KO+MNCO
          ENDIF
         ENDDO
        ENDIF
C
C       CONVERT OPERATING EXPENSE TO AN EQUIVALENT YEAR END FIGURE
C
313     IOSTAT=LIB$ERASE_PAGE(1,1)
        TYPE *,'         :OPERATING EXPENSE:                              '
        TYPE *,'         '
        TYPE *,'          CONVERSION TO EQUIVALENT YEAR END ($) SUM       '
        TYPE *,'         '
        TYPE *,'          SELECT THE METHOD OF CONVERSION                 '
        TYPE *,'         '
        TYPE *,'          1. COMPOUNDING PERIODIC INSTALLMENTS           '
        TYPE *,'          2. SINGLE LUMP SUM COMPOUND CONVERSION         '
        TYPE *,'          3. NO CONVERSION REQUIRED                      '
        ACCEPT *,MIM
        IF(MIM.EQ.1)THEN
           IOSTAT=LIB$ERASE_PAGE(1,1)
           TYPE *,'         '
           TYPE *,'      ENTER THE NO. OF PERIODIC INSTALLMENTS           '
           TYPE *,'      COMPRISING THE ANNUAL OPERATING EXPENSES         '
           ACCEPT *,MO
           DIROP=DISC**(1./MO)  !DISC=ORIG. DISC+1.
C
C          RECALL OPEX PAID AT END OF PERIODIC PERIOD VS. INCOME @ START
C          OF PERIODIC PERIOD
C
           DO IA=1,IPERIOD
                IOP=IOPEX(IA)/MO
                DO IJ=1,MO
                   IC_OPEX(IA)=IC_OPEX(IA)+IOP*(DIROP**(MO-IJ))
                ENDDO
           ENDDO
        ELSEIF(MIM.EQ.2)THEN
           IOSTAT=LIB$ERASE_PAGE(1,1)
           TYPE *,'      INPUT THE NO. OF MONTHS THE LUMP          '
           TYPE *,'      SUM IS TO BE COMPOUNDED ie THE NO.        '
           TYPE *,'      OF MONTHS PRIOR TO YEAR END THE           '
```

```
            TYPE *,'     EXPENSE PAYMENT IS ACTUALLY MADE          '
            ACCEPT *,MO
            DIROP=(DISC**(1./12.))**MO
            DO IA=1,IPERIOD
               IC_OPEX(IA)=IOPEX(IA)*DIROP
            ENDDO
         ELSE
            DO IA=1,IPERIOD
                 IC_OPEX(IA)=IOPEX(IA)
            ENDDO
         ENDIF
         IOSTAT=LIB$ERASE_PAGE(1,1)
C
C        TAXATION DATA
C
         TYPE *,'         TAXATION DATA '
         TYPE *,'                       '
         TYPE *,'         INPUT THE INVESTORS MARGINAL TAX RATE'
         ACCEPT *,TAXRATE
C
C        CAPITAL IMPROVEMENT DATA
C
         IOSTAT=LIB$ERASE_PAGE(1,1)
         ANSWER='Z'       !ANY ARBITRARY CHARACTER
         TYPE *,'         CAPITAL IMPROVEMENT DATA'
         TYPE *,'                       '
         TYPE *,'         NOTE : ITEMS ASSUMED TO BE IMPROVEMENTS TO THE      '
         TYPE *,'                STRUCTURE AND ARE MADE AT THE BEGINNING      '
         TYPE *,'                OF THE YEAR :IMPROVEMENTS THEREFORE INCREASE '
         TYPE *,'                THE BOOK VALUE OF THE STRUCTURE FOR YEAR THE'
         TYPE *,'                IMPROVEMENT WAS MADE                         '
         TYPE *,'                       '
         TYPE *,'                       '
         TYPE *,'         INPUT THE NUMBER OF ANNUAL CAPITAL IMPROVEMENTS'
         TYPE *,'         ADDED TO THE PROPERTY OVER OPERATING PERIOD'
         ACCEPT *,MNCA
         IF(MNCA.GT.0)THEN
          DO ICA=1,MNCA
            TYPE *,'      CAPITAL IMPROVEMENT : ',ICA
            TYPE *,'      '
            TYPE *,'      INPUT THE ($) AMOUNT AND YEAR '
            TYPE *,'      IN WHICH THE IMPROVEMENT IS MADE'
            ACCEPT *,IMP,IYEAR
            IMPR(IYEAR)=IMP
C
            TYPE *,'      '
            TYPE *,'      IS THIS IMPROVEMENT TO BE FINANCED BY     '
            TYPE *,'      EQUITY OR HAS IT BEEN COVERED BY MORTGAGE'
            TYPE *,'      FINANCE                                   '
            TYPE *,'      '
            TYPE *,'      ENTER E FOR EQUITY,M FOR MORTGAGE FINANCE'
            ANSWER='Z'       !ANY ARBITRARY CHARACTER
            ACCEPT '(A1)',ANSWER
            IF(ANSWER.EQ.'E')THEN
                 IOP_EQ(IYEAR)=IOP_EQ(IYEAR)+IMP
            ENDIF
            TYPE *,'      '
            TYPE *,'      IS THIS ($) IMPROVEMENT TO BE ADDED TO '
            TYPE *,'      THE EST. YEAR END SALE PRICE           '
            TYPE *,'              (TYPE Y OR N)                  '
            ANSWER='Z'       !ANY ARBITRARY CHARACTER
            ACCEPT '(A1)',ANSWER
            IF(ANSWER.EQ.'Y')THEN
                 ISPRICE(IYEAR)=ISPRICE(IYEAR)+IMP
            ENDIF
```

```
         ENDDO
         ENDIF
C
C
C
C        PROMPT FOR DEPRECIATION DATA
C
C        NOTE : ACCELERATED DEPRECIATION IS NOT EQUIVALENT TO
C               FIRST YEAR DEPRECIATION FOR TAX PURPOSES THEREFORE
C               IS NOT ASSESSABLE IF PROFIT MADE ON SALE < 10 YEARS
C
         IBOOKVB(1)=ISTRUC
C
C        BOOK VALUE @ START OF YEAR
C
         IOSTAT=LIB$ERASE_PAGE(1,1)
         ANSWER='Z'       !ANY ARBITRARY CHARACTER
         TYPE *,'         DEPRECIATION  ALLOWANCE                '
         TYPE *,'                                                '
         TYPE *,'         DEPRECIATION ALLOWANCE ON BUILDINGS    '
         TYPE *,'         IS USUALLY COMPUTED ON A COST PRICE    '
         TYPE *,'         BASIS : ANNUAL DEPRECIATION ALLOWANCE  '
         TYPE *,'         REMAINING CONSTANT OVER HOLDING PERIOD'
         TYPE *,'                                                '
         TYPE *,'         SELECT THE METHOD OF DEPRECIATION APPLICABLE'
         TYPE *,'                                                '
         TYPE *,'          1. COST PRICE BASIS'
         TYPE *,'                                                '
         TYPE *,'          2. DIMINISHING VALUE BASIS'
         TYPE *,'                                                '
         TYPE *,'                 (TYPE 1 OR 2)'
         TYPE *,'                                                '
         ACCEPT *,M3
C
         IOSTAT=LIB$ERASE_PAGE(1,1)
         TYPE *,'         INVESTMENTS COMPRISING NEWLY CONSTRUCTED    '
         TYPE *,'         RENTAL HOUSING ARE ABLE TO CLAIM  AN        '
         TYPE *,'         ACCELERATED RATE OF DEPRECIATION  FOR       '
         TYPE *,'         THE FIRST FIVE YEARS OF OPERATION           '
         TYPE *,'                                                     '
         TYPE *,'         IS ACCELERATED DEPRECIATION TO BE CLAIMED   '
         TYPE *,'                          (Y OR N)                   '
         ACCEPT'(A1)',ANSWER
         IF(ANSWER.EQ.'Y')THEN
            ANSWER='Z'
            TYPE *,'      THE INLAND REVENUE DEPARTMENT ADVERTISE THE '
            TYPE *,'      FOLLOWING RATES OF ACCELERATED DEPRECIATION '
            TYPE *,'                                                  '
            TYPE *,'                                                  '
                 TYPE *,'         REINFORCED CONCRETE,STEEL OR REINFORCED '
                 TYPE *,'         CONCRETE FRAMED WITH WALLS OF PERMANENT
         1   2 % CP'
                 TYPE *,'         MATERIALS                                '
                 TYPE *,'                                                  '
                 TYPE *,'                                                  '
                 TYPE *,'         BRICK STONE OR CONCRETE WALLED WITHOUT '
                 TYPE *,'         STEEL OR REINFORCED CONCRETE FRAME,STUCCO,
         1 4 % CP'
                 TYPE *,'         STEELTEX OR OTHER SIMILAR CONSTRUCTION '
                 TYPE *,'         WITH WOODEN FRAME                       '
                 TYPE *,'                                                 '
                 TYPE *,'                                                 '
                 TYPE *,'         WOODEN FRAME NOT SPECIFIED ELSEWHERE
         1   5 % CP'
                 TYPE *,'                                                 '
```

```
            TYPE *,'         INPUT THE RATE OF ACCELERATED DEPRECIATION'
            TYPE *,'                                    (DECIMAL)        '
            ACCEPT *,RATEAA
            IF(M3.EQ.1)THEN
               DO IDA=1,5
                  ISTRUC=ISTRUC+IMPR(IDA)
                  IBOOKVB(IDA)=IBOOKVB(IDA)+IMPR(IDA)
                  IDEPN(IDA)=RATEAA*ISTRUC
                  IBOOKVB(IDA+1)=IBOOKVB(IDA)-IDEPN(IDA)
               ENDDO
               IBEGIN=6
            ELSE              !DIMINISHING VALUE BASIS
               DO IDA=1,5
                  ISTRUC=ISTRUC+IMPR(IDA)
                  IBOOKVB(IDA)=IBOOKVB(IDA)+IMPR(IDA)
                  IDEPN(IDA)=RATEAA*IBOOKVB(IDA)
                  IBOOKVB(ID+1)=IBOOKVB(IDA)-IDEPN(IDA)
               ENDDO
               IBEGIN=6
            ENDIF
         ELSE
            IOSTAT=LIB$ERASE_PAGE(1,1)
            TYPE *,'      IS FIRST YEAR DEPRECIATION TO BE CLAIMED'
            TYPE *,'                          (TYPE Y OR N)'
            ACCEPT '(A1)',ANSWER7
            IF(ANSWER7.EQ.'Y')THEN
                 TYPE *,'         FIRST YEAR DEPRECIATION'
                 TYPE *,'         '
                 TYPE *,'         INPUT THE FIRST YEAR RATE'
                 TYPE *,'         OF DEPRECIATION (% OF COST PRICE)'
                 ACCEPT *,DRATE
                 ISTRUC=ISTRUC+IMPR(1)
                 IDEPN(1)=DRATE*ISTRUC
                 IBOOKVB(2)=IBOOKVB(1)-IDEPN(1)
                 IBEGIN=2
            ELSE
                 IBEGIN=1
            ENDIF
         ENDIF
         ANSWER7='Z'
C
         IF(M3.EQ.1)THEN
                 IOSTAT=LIB$ERASE_PAGE(1,1)
                 TYPE *,'         DEPRECIATION : COST PRICE BASIS'
                 TYPE *,'         '
                 TYPE *,'         THE INLAND REVENUE DEPT. ADVERTISE'
                 TYPE *,'         THE FOLLOWING SCHEDULE RATES OF DEPRECIATION'
                 TYPE *,'         FOR BUILDINGS :'
                 TYPE *,'         '
                 TYPE *,'         REINFORCED CONCRETE,STEEL OR REINFORCED '
                 TYPE *,'         CONCRETE FRAMED WITH WALLS OF PERMANENT
     1    1 % CP'
                 TYPE *,'         MATERIALS                                '
                 TYPE *,'         '
                 TYPE *,'         '
                 TYPE *,'         BRICK STONE OR CONCRETE WALLED WITHOUT '
                 TYPE *,'         STEEL OR REINFORCED CONCRETE FRAME,STUCCO,
     1 2 % CP'
                 TYPE *,'         STEELTEX OR OTHER SIMILAR CONSTRUCTION '
                 TYPE *,'         WITH WOODEN FRAME                      '
                 TYPE *,'         '
                 TYPE *,'         '
                 TYPE *,'         WOODEN FRAME NOT SPECIFIED ELSEWHERE
     1       2.5 % CP'
                 TYPE *,'         '
```

```
            TYPE *,'   INPUT THE DEPRECIATION RATE (DECIMAL)
            ACCEPT *,PER
            DO IDE=IBEGIN,IPERIOD   !COST PRICE BASIS
                    IBOOKVB(IDE)=IBOOKVB(IDE)+IMPR(IDE)
                    ISTRUC=ISTRUC+IMPR(IDE)
                    IDEPN(IDE)=ISTRUC*PER
                    IBOOKVB(IDE+1)=IBOOKVB(IDE)-IDEPN(IDE)
                    IF(IBOOKVB(IDE+1).LT.0)IBOOKVB(IDE+1)=0
            ENDDO
        ELSE
            IOSTAT=LIB$ERASE_PAGE(1,1)
            TYPE *,'        DIMINISHING VALUE BASIS'
            TYPE *,'        '
            TYPE *,'        INPUT THE DEPRECIATION RATE'
            TYPE *,'        AS % OF DIMINISHING VALUE'
            ACCEPT *,PER
            DO IDE=IBEGIN,IPERIOD
                    IBOOKVB(IDE)=IBOOKVB(IDE)+IMPR(IDE)
                    IDEPN(IDE)=IBOOKVB(IDE)*PER
                    IBOOKVB(IDE+1)=IBOOKVB(IDE)-IDEPN(IDE)
                    IF(IBOOKVB(IDE+1).LT.0)IBOOKVB(IDE+1)=0
            ENDDO
        ENDIF
C
C       PROPERTY APPRECIATION (VALUE) DATA
C
        IOSTAT=LIB$ERASE_PAGE(1,1)
        ANSWER='Z'      !ANY ARBITRARY CHARACTER
        IF(DEVEL_P)THEN
           TYPE *,'     INITIAL PROPERTY COST(LAND '
           TYPE *,'     & STRUCTURE) EQUALS $ ',IVALUE
           TYPE *,'     '
           TYPE *,'     ENTER THE ESTIMATED SALE PRICE'
           TYPE *,'     OF THE PROPERTY AT COMPLETION '
           TYPE *,'     OF THE DEVELOPMENT PERIOD ($) '
           ACCEPT *,ISP
           ISPRICE(0)=ISPRICE(0)+ISP  !IMPR(0) PREVIOUSLY ADDED
        ELSE
           ISPRICE(0)=ISPRICE(0)+IPRICE   !IMPR(0) PREVIOUSLY ADDED

           TYPE *,'     '
           TYPE *,'     NOTE : INITIAL PROPERTY VALUE (PURCHASE PRICE '
           TYPE *,'            PLUS INITIAL CAPITAL IMPROVEMENT EQUALS $',
        1ISPRICE(0)
        ENDIF
        TYPE *,'        '
        TYPE *,'        '
        TYPE *,'        WILL THE PROPERTY APPRECIATE/DEPRECIATE'
        TYPE *,'        IN VALUE OVER THE OPERATING PERIOD     '
        TYPE *,'                        (TYPE Y OR N)          '
        ACCEPT '(A1)',ANSWER
        IF(ANSWER.EQ.'Y')THEN

                IOSTAT=LIB$ERASE_PAGE(1,1)
                TYPE *,'        PROPERTY APPRECIATION/DEPRECIATION DATA'
                TYPE *,'        '
                TYPE *,'        '
                TYPE *,'        SELECT THE METHOD OF INCLUDING'
                TYPE *,'        FUTURE SALE PRICE OF PROPERTY '
                TYPE *,'        '
                TYPE *,'         1. LUMP SUM ($) INPUT FOR EACH YEAR'
                TYPE *,'        '
                TYPE *,'         2. INITIAL VALUE & ANNUAL APP/DEP RATE'
                TYPE *,'        '
                TYPE *,'                        (TYPE 1 OR 2) '
```

```
            TYPE *,'          '
            ACCEPT *,M1
C
            IF(M1.EQ.1)THEN
               IOSTAT=LIB$ERASE_PAGE(1,1)
               TYPE *,'      FUTURE SALE PRICE DATA'
               DO IAA=1,IPERIOD
                  TYPE *,'   '
                  TYPE *,'  YEAR     ',IAA
                  TYPE *,'   '
                  TYPE *,'  INPUT THE ESTIMATED SELLING     '
                  TYPE *,'  PRICE FOR YEAR END  EXCLUSIVE   '
                  TYPE *,'  OF ANY CAPITAL IMPROVEMENTS     '
                  TYPE *,'  FOR CURRENT YEAR                 '
                  TYPE *,'   '
                  ACCEPT *,ISPP
                  ISPRICE(IAA)=ISPRICE(IAA)+ISPP
               ENDDO
C
            ELSE
               IOSTAT=LIB$ERASE_PAGE(1,1)
               TYPE *,'      FUTURE SALE PRICE DATA'
               TYPE *,'      '
               TYPE *,'      ARE VALUE CHANGES TO BE :  '
               TYPE *,'       1. POSITIVE (APPRECIATION)'
               TYPE *,'       2. NEGATIVE (DEPRECIATION)'
               TYPE *,'      '
               TYPE *,'                (TYPE 1 OR 2)     '
               ACCEPT *,M2
               IF(M2.EQ.1)THEN
                    TYPE *,'         INPUT THE ANNUAL APPRECIATION RATE
     1(DECIMAL)'
                    TYPE *,'         '
                    TYPE *,'         NOTE :  APPRECIATION IS COMPOUND'
                    ACCEPT *,ARATE
                    ARATE=ARATE+1.
                    DO IAP=1,IPERIOD
                       ISPRICE(IAP)=(ISPRICE(IAP)+ISPRICE(IAP-1))*ARATE
                    ENDDO
               ELSE          !VALUE DEPRECIATION
C
                    TYPE *,'         INPUT THE ANNUAL DEPRECIATION RATE
     1(DECIMAL)'
                    TYPE *,'         '
                    TYPE *,'         NOTE : DEPRECIATION IS COMPOUND'
                    ACCEPT *,DRATE
                    DRATE=1.-DRATE
                    DO IDE=1,IPERIOD
                       ISPRICE(IDE)=(ISPRICE(IDE)+ISPRICE(IDE-1))*DRATE
                       IF(ISPRICE(IDE).LT.0)ISPRICE(IDE)=0
                    ENDDO
               ENDIF
            ENDIF
     ELSE             !NO VALUE CHANGE
            DO IAA=1,IPERIOD
                    ISPRICE(IAA)=ISPRICE(IAA)+ISPRICE(0) !IMPR(IAA)ALREADY
            ENDDO                                        !ADDED
     ENDIF
C
C    NOW CATER FOR SALE EXPENSES
C
     IOSTAT=LIB$ERASE_PAGE(1,1)
     ANSWER='Z'       !ANY ARBITRARY CHARACTER
     TYPE *,'         SELLING EXPENSES'
     TYPE *,'         '
```

```
      TYPE *,'        ARE SELLING EXPENSES TO BE INCLUDED '
      TYPE *,'                        (ENTER Y OR N)      '
      ACCEPT '(A1)',ANSWER
      IF(ANSWER.EQ.'Y')THEN
      IOSTAT=LIB$ERASE_PAGE(1,1)
      TYPE *,'        SELLING EXPENSES'
      TYPE *,'        '
      TYPE *,'        SELECT THE METHOD OF '
      TYPE *,'        INCLUDING SELLING EXPENSES'
      TYPE *,'        '
      TYPE *,'         1. STANDARD % ON CONSIDERATION'
      TYPE *,'         '
      TYPE *,'         2. USER INPUT                  '
      TYPE *,'               (TYPE 1 OR 2)            '
      ACCEPT *,METHSE
      ANSWER='Z'      !ANY ARBITRARY CHARACTER
      IF(METHSE.EQ.1)THEN
C
            IOSTAT=LIB$ERASE_PAGE(1,1)
            TYPE *,'        THE FOLLOWING ARE STANDARD SCALE CHARGES'
            TYPE *,'        '
            TYPE *,'         1. REAL ESTATE AGENTS FEE              '
            TYPE *,'        '
            TYPE *,'                 Basic Fee                    $100  '
            TYPE *,'                 First $125000 Consideration    3  %'
            TYPE *,'                 Bal.  Over $125000             1.5 %'
            TYPE *,'        '
            TYPE *,'        '
            TYPE *,'         2. CONVEYANCE  FEE                     '
            TYPE *,'        '
            TYPE *,'                 Under $50000                 Nil  '
            TYPE *,'                 First $50000                  1  %'
            TYPE *,'                 Next  $50000                 1.5 %'
            TYPE *,'                 Bal. Above $100000            2  %'
            TYPE *,'        '
            TYPE *,'            NOTE : REBATE OF $500 ON FIRST '
            TYPE *,'                     $50000 FOR RESIDENTIAL  '
            TYPE *,'                   HOME TYPE PROPERTY       '
            TYPE *,'        '
            TYPE *,'        '
            TYPE *,'        <PRESS RETURN TO CONTINUE>             '
            ACCEPT '(A1)',SPACE
            TYPE *,'        SELECT THE COMBINATION OF SELLING
     1EXPENSE COMPONENTS'
            TYPE *,'        1. R.E. AGENTS FEES ONLY               '
            TYPE *,'        2. CONVEYANCE FEE ONLY                 '
            TYPE *,'        3. R.E. AGENTS FEES + CONVEYANCE FEE   '
            TYPE *,'                (TYPE 1 OR 2 OR 3)             '
            ACCEPT *,MFEE
            IF(MFEE.EQ.1)THEN
              DO ISE=0,IPERIOD
C
                 IF(ISPRICE(ISE).LE.125000)THEN
                    ISEX(ISE)=(.03*ISPRICE(ISE))+100   !100 BASIC FEE
                 ELSE
                    ISEX(ISE)=(.03*125000)+((ISPRICE(ISE)-125000)*.015)
     1                          +100                   !100 BASIC FEE
                 ENDIF
              ENDDO
            ELSEIF(MFEE.EQ.2)THEN
                 ANSWER7='Z'       !ANY ARBITRARY CHARACTER
C
                 TYPE *,'   DOES THE PROPERTY QUALIFY FOR THE $500'
                 TYPE *,'   REBATE (ON TYPICAL RESIDENTIAL "HOME")'
                 TYPE *,'                      (TYPE Y OR N)    '
```

```
                ACCEPT '(A1)',ANSWER7
               DO ISE=0,IPERIOD
                IF(ISPRICE(ISE).LE.50000)THEN
                   ISEX(ISE)=0
                ELSEIF(ISPRICE(ISE).LE.100000)THEN
                   ISEX(ISE)=(50000*.01)+((ISPRICE(ISE)-50000)*.015)
                ELSE
                   ISEX(ISE)=(50000*.01)+(50000*.015)+((ISPRICE(ISE)
     1                          -100000)*.02)
                ENDIF
                IF(ANSWER7.EQ.'Y')ISEX(ISE)=ISEX(ISE)-500
                IF(ISEX(ISE).LT.0)ISEX(ISE)=0
               ENDDO
             ELSEIF(MFEE.EQ.3)THEN
               ANSWER7='Z'       !ANY ARBITRARY CHARACTER
                  TYPE *,'   DOES THE PROPERTY QUALIFY FOR THE $500'
                  TYPE *,'   REBATE (ON TYPICAL RESIDENTIAL "HOME")'
                  TYPE *,'                        (TYPE Y OR N)   '
                  ACCEPT '(A1)',ANSWER7
               DO ISE=0,IPERIOD
C
                  IF(ISPRICE(ISE).LE.125000)THEN
                     ISEX(ISE)=(.03*ISPRICE(ISE))+100
                  ELSE
                     ISEX(ISE)=(.03*125000)+((ISPRICE(ISE)-125000)*.015)
     1                          +100            !100  BASIC FEE
                  ENDIF
C
                  IF(ISPRICE(ISE).LE.50000)THEN
                     ISEX(ISE)=ISEX(ISE)+0
                  ELSEIF(ISPRICE(ISE).LE.100000)THEN
                     ISEX(ISE)=ISEX(ISE)+(50000*.01)+((ISPRICE(ISE)
     1                          -50000)*.015)
                  ELSE
                     ISEX(ISE)=ISEX(ISE)+(50000*.01)+(50000*.015)
     1                          +((ISPRICE(ISE)-100000)*.02)
                  ENDIF
                  IF(ANSWER7.EQ.'Y')THEN
                     ISEX(ISE)=ISEX(ISE)-500
                  ENDIF
                  IF(ISEX(ISE).LT.0)ISEX(ISE)=0
               ENDDO
             ENDIF
ELSE               !LUMP SUM USER INPUT
             IOSTAT=LIB$ERASE_PAGE(1,1)
             DO ISE=0,IPERIOD
                TYPE *,'      ENTER THE SELLING EXPENSE '
                TYPE *,'      FOR YEAR END              ',ISE
                TYPE *,'      '
                ACCEPT *,ISEX(ISE)
             ENDDO
ENDIF
ENDIF                      !FOR SELLING EXPENSES Y OR N.
C
C       TECHNICAL DATA
C
        IF(MN.GT.0)THEN
          IOSTAT=LIB$ERASE_PAGE(1,1)
          ANSWER='Z'       !ANY ARBITRARY CHARACTER
          TYPE *,'       IS THE INVESTMENT ABLE TO CLAIM  '
          TYPE *,'       INTEREST AS A TAX DEDUCTIBLE ITEM'
          TYPE *,'       '
          TYPE *,'              (TYPE Y OR N)'
          ACCEPT '(A1)',ANSWER
C
```

```
          IF(ANSWER.EQ.'Y')THEN
                DED_INT=.TRUE.
          ELSE
                DED_INT=.FALSE.
          ENDIF
C
        ELSE
                DED_INT=.FALSE.
        ENDIF
C
C          MAY REFINANCE @ YEAR 1 IN DEV. THEREFORE NEED TO
C          INCREASE IOPRINCIPAL( ,1)BY AMOUNT OF THAT REFINANCE
C          REDUCTION(ie IOPRIN_REP(IM,0) AND ALSO REDUCE IT BY
C          ANY PRINCIPAL BORROWED IN FIRST YEAR(ie IOPRIN_IN(IM,1)
C          NOTE: IOPRIN_REP...effectively repaid 1st day next period
c                IOPRIN_IN ...effectively 1st day current period
C
        DO IM=1,MN
           IUMB(0)=IUMB(0)+IOPRINCIPAL(IM,1)+IOPRIN_REP(IM,1)-
     1                 IOPRIN_IN(IM,1)
        ENDDO
C
        FACTOR(0)=1.     !! ie 1./(DISC)**0
C
C       NOW COMPUTE THE PRESENT VALUE OF EQUITY INPUTS OVER
C       BOTH THE DEVELOPMENT AND OPERATING PERIOD
C       NEED PV. FOR EACH PERIOD AS LIQUIDATION MEASURES FOR
C       EACH PERIOD NOT INTERESTED IN SUBSEQUENT EQUITY INPUTS.
C       NEED REAL NUMBER NOTATION
C       DR= PERIODIC "INTEREST RATE" ie CONVERTED FROM DISC.
C
C       TOT_ED=PV. DEVEL. PERIOD EQUITY INPUTS
C       TOT_EQUITY=PV. OF EQUITY INPUTS OVER BOTH DEVEL.& OPERATING
C
        IF(DEVEL_P)THEN !DEVELOPMENT INVESTMENT
           TOT_ED=0.
           DO IJ=0,IPERIOD_D
C
C       FIRSTLY TRANSFORM IE_REP() WHICH IS @ START OF YEAR TO SIMILAR
C       SUM @ YEAR END BY IE_REP()*DR : AS DIRECT EQUITY INPUTS OVER DEVEL.
C       ARE AT YEAR END
C       NOTE : IEQUITY() INCLUDES PREVIOUS EQUITY INPUT VIA REFINANCE
C       THEREFORE MUST REDUCE IEQUITY() BY THAT AMOUNT AND ADD BACK THE
C       SUM TRANCFORMED TO YEAR END FIGURE
C
                TOT_ED=TOT_ED+((IEQUITY(IJ)-IE_REP(IJ)+(IE_REP(IJ)*DR))
        1*(1./(DR)**(IJ)))
C
           ENDDO
           DO IJ=0,IPERIOD
                TOT_EQUITY(IJ)=TOT_ED+
C
C               FIRSTLY DISCOUNT THE EQUITY INPUT BACK TO
C               BEGINING(POINT 0)OF OPERATING PERIOD
C
C       RECALL THAT MORTGAGE REFINANCE AND ANY CAPITAL IMPROVEMENTS OCCURS
C       AT YEAR START THEREFORE BECAUSE EQUITY INPUT(APART FROM INITIAL)
C       OVER OPERATING PERIOD CAN ONLY ARISE VIA REFINANCE OR CAP .IMP.
C       PV. FOR DISC**IJ-1 ie EFFECTIVELY
C       END OF PREVIOUS PERIOD : HAVE NOT IN MORT. ROUTINE TRANSFORMED
C       IOP_EQ(IJ) TO YEAR END USING IOP_EQ(IJ)*DISC
C
        1               IOP_EQ(IJ)*(1./(DISC)**(IJ-1))*
C
C               THEN DISCOUNT THIS SUM BACK TO BEGINING(POINT 0)
```

```
C                OF DEVEL. PERIOD
C
     1           (1./(DR)**IPERIOD_D)
                 ENDDO
C
                 ELSE    !INVESTMENT = PROPERTY ACQUISTION
C
C                RECALL THAT MORTGAGE REFINANCE AND ANY CAPITAL IMPROVEMENTS OCCURS
C                AT YEAR START THEREFORE BECAUSE EQUITY INPUT(APART FROM INITIAL)
C                OVER OPERATING PERIOD CAN ONLY ARISE VIA REFINANCE OR CAP .IMP.
C                PV. FOR PERIOD IJ =IOP_EQ(IJ)*(1./DISC**IJ-1 ie EFFECTIVELY
C                END OF PREVIOUS PERIOD
C
                    TOT_EQUITY(0)=IOP_EQ(0)
                    DO IJ=1,IPERIOD
                         TOT_EQUITY(IJ)=TOT_EQUITY(IJ-1)+IOP_EQ(IJ)*(1./(DISC)**(IJ-1))
                    ENDDO
C
                 ENDIF
C
C                NOW COMPUTING THE PV. OF MORTGAGE PRINCIPAL BORROWED
C                FOR PROJECT : THIS FIGURE NEEDED FOR PRODUCTION OF
C                THE INVESTMENT VALUE OF THE PROJECT FOR EACH YEAR
C                ANALYSED : NEED PERIODIC RECORDING OF THIS AS
C                INVESTMENT VALUE FOR ANY PERIOD NOT INTERESTED IN
C                PRINCIPAL BORROWED SUBSEQUENT TO THAT PERIOD
C
C                RECALL IPRIN_REP(IM,IJ)REFERS TO REPAID PRINCIPAL ON
C                FIRST DAY OF FOLLOWING PERIOD : INTERESTED HERE IN
C                WHEN PRINCIPAL COMES IN OR IS REPAID THEREFORE CURRENT
C                PERIOD INTERESTED IN IPRIN_IN(CURRENT),IPRIN_REP(CURRENT-1)
C
                 IF(MN.GT.0)THEN
C
                    IF(DEVEL_P)THEN  !DEVELOPMENT INVESTMENT
C
                         DO IJ=1,IPERIOD_D
C
                            ITOT_P=0
                            DO IM=1,MN
                                 ITOT_P=ITOT_P+IPRIN_IN(IM,IJ)-IPRIN_REP(IM,IJ)
                            ENDDO
C                           NOW DISC THIS TO BEGINING OF DEVEL. PERIOD
C                TOTAL PRINCIPAL "BALANCE" FOR CURRENT PERIOD IS TAKEN
C                AT BEGINNING OF PERIOD : TO COMPUTE THE PV OF THIS
C                MUST DISCOUNT BY CURRENT-1 AS DICOUNTING ASSUMES LUMP
C                SUM REPRESENTED AT PERIOD END :THEREFORE DISCOUNT BY (IJ-1)
                            ITOTAL_P=ITOTAL_P+(ITOT_P*(1./(DR)**(IJ-1)))
                         ENDDO
C
                         DO IJ=1,IPERIOD
                            ITOT_P=0
                            DO IM=1,MN
                                 ITOT_P=ITOT_P+IOPRIN_IN(IM,IJ)-IOPRIN_REP(IM,IJ)
                            ENDDO
                            ITOTAL_PRIN(IJ)=ITOTAL_P+(ITOT_P*(1./(DISC)**(IJ-1)))*
     1                                      (1./(DR)**IPERIOD_D)
                         ENDDO
C
                    ELSE !INVESTMENT = PROPERTY PURCHASE
C
                         DO IJ=1,IPERIOD
                            ITOT_P=0
                            DO IM=1,MN
                                 ITOT_P=ITOT_P+IOPRIN_IN(IM,IJ)-IOPRIN_REP(IM,IJ)
```

```
            ENDDO
            ITOTAL_PRIN(IJ)=ITOTAL_PRIN(IJ-1)+
     1(ITOT_P*(1./DISC**(IJ-1)))
          ENDDO
       ENDIF
     ENDIF   !ENDIF FOR MN.GT.0
C
C    COMPUTE INFORMATION ON DEVELOPMENT PERIOD CASH FLOWS
C
     IF(DEVEL_P)THEN
       WRITE(7,9988)' '
       WRITE(7,*)'                ****************************************
     1**********'
       WRITE(7,*)'          PROPERTY  DEVELOPMENT                 '
       WRITE(7,*)'                                                '
       WRITE(7,*)'          ESTIMATED TOTAL DEVELOPMENT COST    $ ',
     1ICOST
       WRITE(7,*)'                                                '
       WRITE(7,*)'          ESTIMATED LAND VALUE                $ ',LAND
       WRITE(7,*)'                                                '
       WRITE(7,*)'          PRESENT VALUE  EQUITY INPUT         $  ',
     1TOT_EQUITY(IPERIOD)
       WRITE(7,*)'                                                '
       WRITE(7,*)'          PRESENT VALUE  MORTGAGE FINANCE     $ ',
     1ITOTAL_PRIN(IPERIOD)
       WRITE(7,*)'                                                '
       WRITE(7,*)'          INCOME TAX PERCENTAGE               %  ',
     1TAXRATE
       WRITE(7,*)'                                                '
       WRITE(7,*)'          INVESTORS REQUIRED RETURN           %  ',
     1DISC-1.        !AS PREVIOUSLY ..DISC=DISC+1.
       WRITE(7,*)'                                                '
       WRITE(7,*)'          ANALYSIS TERM  : DEVELOPMENT PERIODS  ',
     1IPERIOD_D
       WRITE(7,*)'                                                '
       WRITE(7,*)'                           : OPERATING   (YEARS)  ',
     1IPERIOD
            IY=1               !YEAR COUNTER
            INCPV=0            !PV INCOME OVER DEVEL.
            INTPV=0            !PV INTEREST PAID
            IPPPV=0            !PV PRIN. PAID
            INCT=0             !ACTUAL(NOMINAL) INCOME
            INTT=0             !ACTUAL INTEREST
            IPPPT=0            !ACTUAL PRINCIPAL
            IATAX=0            !ACTUAL TAX DUE
            IATSH=0            !ACTUAL TAX SHELTER
            KOUNTD=NPER_ANN
            DIRD=DISC**(1./NPER_ANN)
            BRIDGE_PAY=.FALSE.
            FINISH=.FALSE.
C
            WRITE(7,9988)' '
            WRITE(7,*)'     TAXATION OVER DEVELOPMENT                '
            WRITE(7,*)' '
C
            DO IA=1,IPERIOD_D
               INTPV=INTPV+((INTEREST(1,IA)+INTEREST(2,IA)+INTEREST(3,IA))
     1               *(1./DIRD**IA))
               IPPPV=IPPPV+((IPRIN_PAY(1,IA)+IPRIN_PAY(2,IA)+
     1               IPRIN_PAY(3,IA))*(1./DIRD**IA))
               INCPV=INCPV+INCOME_D(IA)*(1./DIRD**IA)
C
               INTT=INTT+INTEREST(1,IA)+INTEREST(2,IA)+INTEREST(3,IA)
               IPPPT=IPPPT+IPRIN_PAY(1,IA)+IPRIN_PAY(2,IA)+IPRIN_PAY(3,IA)
C              WILL NOT AT THIS STAGE INCLUDE BRIDGING FINANCE IN
```

```
C                COMPUTATION OF TOTAL INTEREST OR PRINCIPAL PAID OVER DEVEL.
                 INCT=INCT+INCOME_D(IA)
                 IF(IB_INT_ACT_P(IA).GT.0)THEN   !BRIDGING REPAID
                      BRIDGE_PAY=.TRUE.
                      IBI=ITOT_BINT(IA)
                      IBIPV=IBI*(1./DIRD**IA)
                 ENDIF
C
                 IF(IA.EQ.KOUNTD)THEN   !YEAR PERIOD END
                      INC=0
                      INT=0
                      DO IR=KOUNTD,ISTOPP,-1
                           INC=INC+INCOME_D(IR)
                           INT=INT+INTEREST(1,IR)+INTEREST(2,IR)+
     1                          INTEREST(3,IR)
                      ENDDO
                      IF(BRIDGE_PAY)THEN
                         INT=INT+IBI
                         BRIDGE_PAY=.FALSE.
                      ENDIF
                      IF(DED_INT)THEN
                         IOSTAT=LIB$ERASE_PAGE(1,1)
                         TYPE *,'     '
                         TYPE *,'     TOTAL INTEREST DEDUCTION  '
                         TYPE *,'     FOR DEVELOPMENT YEAR      ',IY
                         TYPE *,'                       EQUALS  $ ',INT
                         TYPE *,'     '
                         TYPE *,'     ENTER ANY OTHER TAX DEDUCTIBLE  '
                         TYPE *,'         ITEMS FOR DEVELOPMENT YEAR
     1    ',IY
                         TYPE *,'             (ENTER 0 IF NIL)        '
                         ACCEPT *,ITT
                         ITAXDD=INT+ITT
                      ELSE
                         IOSTAT=LIB$ERASE_PAGE(1,1)
                         TYPE *,'     '
                         TYPE *,'     ENTER ANY TAX DEDUCTIBLE           '
                         TYPE *,'     ITEMS FOR DEVELOPMENT YEAR ',IY
                         TYPE *,'             (ENTER 0 IF NIL)           '
                         ACCEPT *,ITAXDD
                      ENDIF
                      ITAX_INCD=INC-ITAXDD
                      IF(KOUNTD.EQ.IPERIOD_D)THEN
                         FINISH=.TRUE.
                         KI=(IY*NPER_ANN)-IPERIOD_D
                      ENDIF
                      IF(ITAX_INCD.LT.0)THEN !TAX SHELTER
                         ITSH(IA)=-ITAX_INCD*TAXRATE
                         IATSH=IATSH+ITSH(IA)
                         IF(FINISH)THEN      !- BELOW TO ENSURE + ITSHPV
                            ITSHPV=ITSHPV-
C
C        ALTHOUGH DISCOUNTING FROM YEAR END OF DEVELOPMENT TERM USING NOMINAL
C        DOLLARS AS TAX ASSESSED IN NOM. DOLLARS
C
     1(ITAX_INCD*TAXRATE)*(1./DIRD**(IPERIOD_D+KI))
                         ELSE        !NOT IN LAST YEAR OF DEVELOPMENT
                            ITSHPV=ITSHPV-(ITAX_INCD*TAXRATE)*(1./DIRD**IA)
                         ENDIF
                      ELSE                     !TAX TO PAY
                         ITAXDEV(IA)=ITAX_INCD*TAXRATE
                         IATAX=IATAX+ITAXDEV(IA)
                         IF(FINISH)THEN
                            ITAXDPV=ITAXDPV+(ITAX_INCD*TAXRATE)
     1*(1./DIRD**(IPERIOD_D+KI))
```

```
                     ELSE
                        ITAXDPV=ITAXDPV+(ITAX_INCD*TAXRATE)*
     1(1./DIRD**IA)
                     ENDIF
                  ENDIF
                  KOUNTD=KOUNTD+NPER_ANN
                  IF(KOUNTD.GT.IPERIOD_D)THEN
                     KOUNTD=IPERIOD_D
                     ISTOPP=IY*NPER_ANN+1
                  ELSE
                     ISTOPP=KOUNTD-NPER_ANN+1
                  ENDIF
                  IY=IY+1

            WRITE(7,*)' '
            WRITE(7,*)'     DEVELOPMENT "YEAR"                ',IY-1
            WRITE(7,*)' '
            WRITE(7,*)'     NET  INCOME                                ',INC
            WRITE(7,*)'        - TAX  DEDUCTIBLES                      ',
     1ITAXDD
            WRITE(7,*)'        ----------------      '
            WRITE(7,*)'     TAXABLE INCOME                             ',
     1ITAX_INCD
            WRITE(7,*)'        * TAX     RATE                          ',
     1TAXRATE
            WRITE(7,*)'        ----------------      '
            IF(ITAX_INCD.LT.0)THEN
            WRITE(7,*)'     TAX     SHELTER                            ',
     1ITSH(IA)
            ELSE
            WRITE(7,*)'     INCOME  TAX                                ',
     1ITAXDEV(IA)
            ENDIF
            WRITE(7,*)' '
               ENDIF
            ENDDO
C
            INTT=INTT+IBI
            INTPV=INTPV+IBIPV
            IF(KI.GT.0)THEN
               ITAXDEV(IPERIOD_D)=ITAXDEV(IPERIOD_D)*(1./DIRD**KI)
               ITSH(IPERIOD_D)=ITSH(IPERIOD_D)*(1./DIRD**KI)
            ENDIF
            WRITE(7,*)' '
            WRITE(7,*)' '
            WRITE(7,*)'     DEVELOPMENT  TERM                          '
            WRITE(7,*)'                  '
            WRITE(7,*)'     NOMINAL/PRESENT VALUE ANALYSIS             '
            WRITE(7,*)'                  '
            WRITE(7,*)'     ****************************************
     1************'
            WRITE(7,*)'     NET           INCOME                       ',
     1INCT
            WRITE(7,*)'     NET           INCOME             PV        ',
     1INCPV
            WRITE(7,*)'         TOTAL INTEREST  PAYMENT                ',INTT
            WRITE(7,*)'         TOTAL PRINCIPAL PAYMENT                ',IPPPT
            WRITE(7,*)'         TOTAL INTEREST  PAYMENT       PV       ',INTPV
            WRITE(7,*)'         TOTAL PRINCIPAL PAYMENT       PV       ',IPPPV
            WRITE(7,*)'     CASH T.  0.  EQUITY                        ',
     1INCT-INTT-IPPPT
            WRITE(7,*)'     CASH T.  0.  EQUITY             PV         ',
     1INCPV-INTPV-IPPPV
            WRITE(7,*)'     INCOME TAX                                 ',
     1IATAX
```

```
            WRITE(7,*)'     TAX SHELTER                                  ',
     1IATSH
            WRITE(7,*)'     INCOME TAX                          PV       ',
     1ITAXDPV
            WRITE(7,*)'     TAX SHELTER                         PV       ',
     1ITSHPV
            IA_T_C_F  =INCT-INTT-IPPPT-IATAX+IATSH
            IA_T_C_FPV=INCPV-INTPV-IPPPV-ITAXDPV+ITSHPV
            WRITE(7,*)'     AFTER TAX CASH FLOW                          ',
     1IA_T_C_F
            WRITE(7,*)'     AFTER TAX CASH FLOW (disc.)         PV       ',
     1IA_T_C_FPV
            WRITE(7,*)'     '
            WRITE(7,*)'     EST SELLING PRICE                            ',
     1ISPRICE(0)-IMPR(0)
            WRITE(7,*)'         SELLING EXPENSES                         ',
     1ISEX(0)
            WRITE(7,*)'         REPAY.  PENALTY                          ',
     1IREP(0)
            IAM=ISPRICE(0)-IMPR(0)-ISEX(0)-IREP(0)
            WRITE(7,*)'     AMOUNT REAL. ON SALE                         ',
     1IAM
            WRITE(7,*)'         UNPAID MORTGAGE BAL.                     ',
     1IUMB(0)
            WRITE(7,*)'     EQUITY REVERSION                             ',
     1IAM-IUMB(0)
            IDER=(IAM-IUMB(0))*(1./DIRD**IPERIOD_D)
            WRITE(7,*)'     DISC. EQUITY REVERSION                       ',
     1IDER
            WRITE(7,*)'     TOTAL DISC. RETURN                           ',
     1IA_T_C_FPV+IDER
            WRITE(7,*)'     TDR / PV EQUITY                               ',
     1(IA_T_C_FPV+IDER)/TOT_EQUITY(0)
C
C           MUST NOW COMPUTE THE IRR FOR DEVELOP. & SELL
            WARNTYPE=.FALSE.
            WARN=' '
            IMRY=0
            IP=0
            DO I=0,IPERIOD_D
               IBAL_DEV(I)=IBAL_DEV(I)-ITAXDEV(I)+ITSH(I)
               IOVERALL_BAL(I)=IBAL_DEV(I)
            ENDDO
            IOVERALL_BAL(IPERIOD_D)=IOVERALL_BAL(IPERIOD_D)+IAM-IUMB(0)
            X=1./(DISC)**(1./NPER_ANN)
            CALL IRRETURN(IPERIOD,IPERIOD_D,IBAL_OP,RATE,DEVEL_P,NPER_ANN,
     1IP,IOVERALL_BAL,X)
            RIRR(0)=((1./(RATE**NPER_ANN)-1.)*100.)
C
C       COMP. N P V
C
            INPVT=IOVERALL_BAL(0)
            DO I=1,IPERIOD_D
                  INPVT=INPVT+IOVERALL_BAL(I)*(1./DR**I)
            ENDDO
            INPV(0)=INPVT
            WRITE(7,*)'         N P V
     1      ',INPV(0)


C
C       CHECK IF MULTIPLE ROOTS LIKELY TO BE PROBLEM
C
        DO I=0,IPERIOD_D-2
            IF(IOVERALL_BAL(I).LT.0)THEN
```

```
                L0=-1
            ELSE
                L0=1
            ENDIF
            IF(IOVERALL_BAL(I+1).LT.0)THEN
                L1=-1
            ELSE
                L1=1
            ENDIF
            IF(IOVERALL_BAL(I+2).LT.0)THEN
                L2=-1
            ELSE
                L2=1
            ENDIF
            IF((L0*L1).LT.0)THEN
                CHANGE1=.TRUE.
            ENDIF
            IF((L1*L2).LT.0)THEN
                CHANGE2=.TRUE.
            ENDIF
            IF(CHANGE1.AND.CHANGE2)THEN
                WARNTYPE=.TRUE.
                WARN='  ** WARNING : MULTIPLE ROOTS POSSIBLE **  '
                GOTO 1213
            ENDIF
        ENDDO
1213        IOVERALL_BAL(IPERIOD_D)=IOVERALL_BAL(IPERIOD_D)-IAM+IUMB(0)
            WRITE(7,*)'     IRR                                    ',
     1RIRR(0),WARN
            WRITE(7,*)'     INVESTMENT VALUE                       ',
     1IA_T_C_FPV+IDER+ITOTAL_P
            WRITE(7,*)'     ***************************************
     1************'
        ELSE
           WRITE(7,9988)' '
           WRITE(7,*)'                ********************************
     1*****************'
           WRITE(7,*)'          PROPERTY  PURCHASE                    '
           WRITE(7,*)'                                                '
           WRITE(7,*)'          ESTIMATED TOTAL ACQUISITION COST    $ ',
     1IPRICE
           WRITE(7,*)'                                                '
           WRITE(7,*)'          ESTIMATED LAND VALUE                $ ',LAND
           WRITE(7,*)'                                                '
           WRITE(7,*)'          PRESENT VALUE  EQUITY INPUT         $  ',
     1TOT_EQUITY(IPERIOD)
           WRITE(7,*)'                                                '
           WRITE(7,*)'          PRESENT VALUE  MORTGAGE FINANCE     $ ',
     1ITOTAL_PRIN(IPERIOD)
           WRITE(7,*)'                                                '
           WRITE(7,*)'          INCOME TAX PERCENTAGE               %  ',
     1TAXRATE
           WRITE(7,*)'                                                '
           WRITE(7,*)'          INVESTORS REQUIRED RETURN      .    %  ',
     1DISC-1.        !AS PREVIOUSLY ..DISC=DISC+1.
           WRITE(7,*)'                                                '
           WRITE(7,*)'          ANALYSIS TERM      (YEARS)            ',IPERIOD
           WRITE(7,*)'                ********************************
     1*****************'

        ENDIF
        IC_D_ATCF(0)=IA_T_C_FPV
C
        DO IP=1,IPERIOD
C
```

```
      IF(DEVEL_P)THEN
           FACTOR(IP)=1./DR**(IPERIOD_D+(IP*NPER_ANN))
      ELSE
           FACTOR(IP)=1./DISC**IP
      ENDIF
C
      IEF(IP)=NINT(IC_GROSS(IP)*RATE_OCC)
      NOI(IP)=(IGROSS(IP)*RATE_OCC)-IOPEX(IP) !NEED THIS FOR TAXATION
      NOI_C(IP)=IEF(IP)-IC_OPEX(IP)
C
      DO IM=1,MN
           ITOT_PRIN(IP)=ITOT_PRIN(IP)+IOPRIN_P(IM,IP)
           ITOT_INTO(IP)=ITOT_INTO(IP)+IOINTEREST(IM,IP)
           ITOT_C_INTO(IP)=ITOT_C_INTO(IP)+IOC_INTEREST(IM,IP)
           ITOT_C_PRIN(IP)=ITOT_C_PRIN(IP)+IOC_PRIN_P(IM,IP)
C
C          IOPRIN_REP( )=REPAID PRIN EFFECTIVELY REPAID
C          ON LAST DAY OF PRECEEDING PERIOD AND INCLUDED
C          IN IOPRINCIPAL( +1) THEREFORE FOR TRUE UMB HAVE TO
C          EXCLUDE THE REPAID PRINCIPAL(FROM REFINANCING THE
C          FOLLOWING YEAR) : ALSO REDUCE IUMB BY ANY INCREASED
C          PRINCIPAL THAT IS BORROWED(NOW INCLUDED IN
C          IOPRINCIPAL(IM,IP)
C
           IUMB(IP)=IUMB(IP)+IOPRINCIPAL(IM,IP+1)+IOPRIN_REP(IM,IP+1)-
     1                IOPRIN_IN(IM,IP+1)
      ENDDO
      IC_PP(IP)=IC_PP(IP-1)+ITOT_PRIN(IP)
      ICTOE(IP)=NOI_C(IP)-ITOT_C_INTO(IP)-ITOT_C_PRIN(IP)
C
C     TAX ITEMS BASED ON ACTUAL $ FIGURES AND NOT COMPOUNDED YEAR
C     END EQUIVALENT FIGURES
C
      IF(DED_INT)THEN
           ITAXD(IP)=ITOT_INTO(IP)+IDEPN(IP)
      ELSE
           ITAXD(IP)=IDEPN(IP)
      ENDIF
      ITAX_INC(IP)=NOI(IP)-ITAXD(IP)
C
      IF(ITAX_INC(IP).LT.0)THEN
           ITSHEL(IP)=-(ITAX_INC(IP)*TAXRATE)
      ELSE
           ITAX(IP)=ITAX_INC(IP)*TAXRATE
      ENDIF
C
      IATCF(IP)=ICTOE(IP)-ITAX(IP)+ITSHEL(IP)
C
      IDATCF(IP)=IATCF(IP)*FACTOR(IP)
C
      IC_D_ATCF(IP)=IC_D_ATCF(IP-1)+IDATCF(IP)
C
C     NOW CATER FOR THE LIQUIDATION PER PERIOD
C
      IA_R_ON_S(IP)=ISPRICE(IP)-ISEX(IP)-IREP(IP)
C
C     MUST DEDUCT NEXT 'YEARS' IMPR AS NOT APPLICABLE IF SELL
C     NOTE : BECAUSE UNABLE TO DEDUCT DEPRECIATION IN THE YEAR SELL
C     MUST DEDUCT DEPN. FOR THE CURRENT YEAR WHEN COMPUTING CAPITAL GAIN
C     OR SIMPLY USE CURRENT YEARS OPENING BOOK VALUE.
C
      IGAIN(IP)=IA_R_ON_S(IP)-(IBOOKVB(IP)+LAND)
C
      IB_T_ER(IP)=IA_R_ON_S(IP)-IUMB(IP)
C
```

```
            IA_T_ER(IP)=IB_T_ER(IP)-IT_ON_S(IP)!POSSIBLE LATER SALE TAX
C                                              !IT_ON_S(IP) CURRENTLY REDUNDANT
            ID_ATER(IP)=IA_T_ER(IP)*FACTOR(IP)
C
C           BECAUSE UNABLE TO CLAIM DEPRECIATION IN THE YEAR IN WHICH
C           PROPERTY SOLD,DEPRECIATION FOR THE YEAR IS DEDUCTED FROM THE
C           TOTAL DISCOUNTED RETURN.UNABLE TO CLAIM DEPRECIATION IN YEAR
C           OF SALE IRRESPECTIVE OF WHETHER A PROFIT IS MADE OR NOT.
C
            ITDR(IP)=ID_ATER(IP)+IC_D_ATCF(IP)-(IDEPN(IP)*TAXRATE*FACTOR(IP))
C
            TOT_REQ(IP)=ITDR(IP)/TOT_EQUITY(IP)
C
C           INVESTMENT VALUE = ITDR + P.V. OF TOTAL BORROWED
C           ITOTAL_PRIN( ) = P. V. PRINCIPAL INVESTED.
C
            INVV(IP)=ITDR(IP)+ITOTAL_PRIN(IP)
          ENDDO
C
C         NOW COMPUTE NET CASH BALANCE FOR EACH OF THE OPERATING PERIODS
C         FOR THE IRR AND NPV COMPUTATIONS
C
C         LOGIC : PRINCIPAL INCOMING AT START OF THE YEAR VERSES ALL
C         OTHER CASH FLOWS AT YEAR END , MUST TRANSFORM INCOMING PRINCIPAL
C         TO AN EQUIVALENT SUM AS IF END OF YEAR BASED ON INVESTORS DISCOUNT
C         SIMILAR LOGIC TO PRINCIPAL REPAYMENT
C         RATE ... IOPRININ(IM, )*(DISC) AS DISC NOW =1.+DISC
C         NOTE ICTOE(IRR) NOW ACURATE YEAR END ($) SUM
C
C         AS ADDING INCOMING PPRINCIPAL VIA REFINANCE DUE TO IMP. AS POSITIVE
C         CASH THROW MUST INCLUDE THE IMPR AS COST ELSE DOUBLE COUNTING WILL
C         RESULT FROM INCREASED SALE PRICE
C
            DO IRR=2,IPERIOD
               IBAL_OP(IRR)=ICTOE(IRR)+ITSHEL(IRR)+
     1         (IOPRIN_IN(1,IRR)+IOPRIN_IN(2,IRR)+IOPRIN_IN(3,IRR))
     1 -       (ITAX(IRR)+IOPRIN_REP(1,IRR)+IOPRIN_REP(2,IRR)+
     1         IOPRIN_REP(3,IRR)+IMPR(IRR))
            ENDDO
C
            IBAL_OP(1)=ICTOE(1)+ITSHEL(1)-(ITAX(1)+IOPRIN_REP(1,1)+
           1IOPRIN_REP(2,1)+IOPRIN_REP(3,1)+IMPR(1))
C
C           IRR ROUTINE : IF DEVEL_P THEN CONVERT ALL OPERATING BALANCES
C                         TO DEVELOPMENT PERIOD TIME HORIZON
C
            IF(DEVEL_P)THEN
               DO I=0,IPERIOD_D
                  IOVERALL_BAL(I)=IBAL_DEV(I)
               ENDDO
C
               IT=IPERIOD_D+NPER_ANN!+NPER_ANN ASSUMES FLOWS IN IPERIOD
               DO I=1,IPERIOD       !ARE @ YEAR END
                  IOVERALL_BAL(IT)=IBAL_OP(I)
                  IT=IT+NPER_ANN
               ENDDO
            ELSE
               IBAL_OP(0)=IBAL_OP(0)-IPRICE+IOPRIN_IN(1,1)+IOPRIN_IN(2,1)+
           1IOPRIN_IN(3,1)
            ENDIF
C
            IBAL_OP(1)=ICTOE(1)+ITSHEL(1)-(ITAX(1)+IOPRIN_REP(1,1)+
           1IOPRIN_REP(2,1)+IOPRIN_REP(3,1)+IMPR(1))
C
            DO IP=1,IPERIOD
```

```
            IF(DEVEL_P)THEN
               X=1./(DISC)**(1./NPER_ANN)
C
C              MUST ADD LIQUIDATION CASH FLOWS TO THE APPROPRIATE
C              PERIODS
C
C              REDUCE YEAR END BALANCE BY THE AMOUNT OF DEPRECIATION
C              CLAIMED FOR THE YEAR ie NO DEPRECIATION ABLE TO BE
C              CLAIMED IN YEAR PROPERTY SOLD.
C
               IOVERALL_BAL(IPERIOD_D+IP*NPER_ANN)=
     1IOVERALL_BAL(IPERIOD_D+IP*NPER_ANN)+IA_R_ON_S(IP)-IUMB(IP)-
     1(IDEPN(IP)*TAXRATE)
               CALL IRRETURN(IPERIOD,IPERIOD_D,IBAL_OP,RATE,DEVEL_P,
     1              NPER_ANN,IP,IOVERALL_BAL,X)
               RATE=(RATE**NPER_ANN)
               RIRR(IP)=((1./RATE)-1.)*100.
C
C           PROPERTY DEVELOPMENT : COMPUTE NPV FROM CASH BALANCES
C           USED TO COMPUTE IRR
C
               INPVT=IOVERALL_BAL(0)
               DO I=1,IPERIOD_D+IP*NPER_ANN
                  INPVT=INPVT+IOVERALL_BAL(I)*(1./DR**I)
               ENDDO
               INPV(IP)=INPVT
C
C           CHECK IF MULTIPLE ROOTS LIKELY TO BE PROBLEM
C
            IF(.NOT.WARNTYPE)THEN
            DO I=IPERIOD_D,IPERIOD_D+((IP-2)*NPER_ANN),NPER_ANN
               IF(IOVERALL_BAL(I).LT.0)THEN
                     L0=-1
               ELSE
                     L0=1
               ENDIF
               IF(IOVERALL_BAL(I+NPER_ANN).LT.0)THEN
                     L1=-1
               ELSE
                     L1=1
               ENDIF
               IF(IOVERALL_BAL(I+2*NPER_ANN).LT.0)THEN
                     L2=-1
               ELSE
                     L2=1
               ENDIF
               IF((L0*L1).LT.0)THEN
                     CHANGE1=.TRUE.
               ENDIF
               IF((L1*L2).LT.0)THEN
                     CHANGE2=.TRUE.
               ENDIF
               IF(CHANGE1.AND.CHANGE2)THEN
               WARN='  ** WARNING : IRR : MULTIPLE ROOTS POSSIBLE ** '
                     IMRY=I/NPER_ANN+1
               ENDIF
            ENDDO
            ENDIF
C
C              MUST NOW REDUCE THE APPROPRIATE BALANCES TO ENSURE
C              LATER BALANCES DO NOT INCLUDE CURRENT LIQUIDATION
C              CASH FLOW DATA
C
               IOVERALL_BAL(IPERIOD_D+IP*NPER_ANN)=
     1 IOVERALL_BAL(IPERIOD_D+IP*NPER_ANN)-IA_R_ON_S(IP)+IUMB(IP)+
```

```
     1(IDEPN(IP)*TAXRATE)
           ELSE
              X=1./(DISC)
              IBAL_OP(IP)=IBAL_OP(IP)+IA_R_ON_S(IP)-IUMB(IP)-
     1(IDEPN(IP)*TAXRATE)
              CALL IRRETURN(IPERIOD,IPERIOD_D,IBAL_OP,RATE,DEVEL_P,
     1             NPER_ANN,IP,IOVERALL_BAL,X)
              RIRR(IP)=((1./RATE)-1.)*100.
              TYPE *,'I R R YEAR ',IP ,'=',RIRR(IP)
C
C    COMPUTE NPV FROM YEAR END BAL. USED FOR IRR
C
              INPVT=IBAL_OP(0)
              DO I=1,IP
                 INPVT=INPVT+IBAL_OP(I)*(1./DISC**I)
              ENDDO
              INPV(IP)=INPVT
C
C    CHECK IF MULTIPLE ROOTS LIKELY TO BE PROBLEM
C
     IF(.NOT.WARNTYPE)THEN
     DO I=0,IP-2
              IF(IBAL_OP(I).LT.0)THEN
                       L0=-1
              ELSE
                       L0=1
              ENDIF
              IF(IBAL_OP(I+1).LT.0)THEN
                       L1=-1
              ELSE
                       L1=1
              ENDIF
              IF(IBAL_OP(I+2).LT.0)THEN
                       L2=-1
              ELSE
                       L2=1
              ENDIF
              IF((L0*L1).LT.0)THEN
                       CHANGE1=.TRUE.
              ENDIF
              IF((L1*L2).LT.0)THEN
                       CHANGE2=.TRUE.
              ENDIF
              IF(CHANGE1.AND.CHANGE2)THEN
              WARN='  ** WARNING : IRR : MULTIPLE ROOTS POSSIBLE **  '
                       IMRY=I
              ENDIF
     ENDDO
     ENDIF
              IBAL_OP(IP)=IBAL_OP(IP)-IA_R_ON_S(IP)+IUMB(IP)+
     1(IDEPN(IP)*TAXRATE)
           ENDIF
        ENDDO
     J=IPERIOD
     K=1
     IF(J.GT.10)THEN
        L=10
     ELSE
        L=J
     ENDIF
11   WRITE(7,9988)' '
9988 FORMAT('1',A1)
     WRITE(7,*)'      '
     WRITE(7,*)'      '
     WRITE(7,*)'OPERATING/LIQUIDATION ANALYSIS
```

```
      WRITE(7,*)'*****************************
      WRITE(7,*)'     '
      WRITE(7,*)'CASH FLOW ITEMS'
      WRITE(7,*)'     '
      WRITE(7,700)(I,I=K,L)
700   FORMAT(' YEAR',14X,2X,10(4X,I3,3X))
C
      WRITE(7,701)(FACTOR(I),I=K,L)
701   FORMAT('   DISC. FACTOR',4X,2X,10(2X,F8.7))
C
      WRITE(7,702)(IGROSS(I),I=K,L)
702   FORMAT(' GROSS INCOME',6X,2X,10(I10))
C
      WRITE(7,764)(IC_GROSS(I),I=K,L)
764   FORMAT(' GROSS INCOME',6X,'C',1X,10(I10))
C
      WRITE(7,703)(RATE_OCC,I=K,L)
703   FORMAT('   OCC. RATE',7X,2X,10(6X,F4.2))
C
      DO I=1,IPERIOD
         IGEF(I)=IGROSS(I)*RATE_OCC
      ENDDO
      WRITE(7,604)(IGEF(I),I=K,L)
604   FORMAT(' EFF. GROSS INC.',3X,2X,10(I10))
C
      WRITE(7,704)(IEF(I),I=K,L)
704   FORMAT(' EFF. GROSS INC.',3X,'C',1X,10(I10))
C
      WRITE(7,705)(IOPEX(I),I=K,L)
705   FORMAT('   TOT. OP. EXP.',3X,2X,10(I10))
C
      WRITE(7,605)(IC_OPEX(I),I=K,L)
605   FORMAT('   TOT. OP. EXP.',3X,'C',1X,10(I10))
C
      WRITE(7,706)(NOI(I),I=K,L)
706   FORMAT(' NET OP. INCOME',4X,2X,10(I10))
C
      WRITE(7,607)(NOI_C(I),I=K,L)
607   FORMAT(' NET OP. INCOME',4X,'C',1X,10(I10))
C
      WRITE(7,707)(ITOT_INTO(I)+ITOT_PRIN(I),I=K,L)
707   FORMAT('  TOT.ANN.DEBT.SER.',2X,10(I10))
C
      WRITE(7,708)(ITOT_INTO(I),I=K,L)
708   FORMAT('   ANN. INT. PAY.',2X,2X,10(I10))
C
      WRITE(7,709)(ITOT_PRIN(I),I=K,L)
709   FORMAT('   ANN. PRIN. PAY.',1X,2X,10(I10))
C
      WRITE(7,608)(ITOT_C_INTO(I),I=K,L)
608   FORMAT('   ANN. INT. PAY.',2X,'C',1X,10(I10))
C
      WRITE(7,609)(ITOT_C_PRIN(I),I=K,L)
609   FORMAT('   ANN. PRIN. PAY.',1X,'C',1X,10(I10))
C
      WRITE(7,610)(NOI(I)-ITOT_INTO(I)-ITOT_PRIN(I),I=K,L)
610   FORMAT('  CASH T.O. EQUITY',1X,2X,10(I10))

      WRITE(7,710)(ICTOE(I),I=K,L)
710   FORMAT('  CASH T.O. EQUITY',1X,'C',1X,10(I10))
C
      WRITE(7,711)(IC_PP(I),I=K,L)
711   FORMAT('   CUMM. PRIN. PAY.',2X,10(I10))
C
      WRITE(7,712)(IUMB(I),I=K,L)
```

```
712     FORMAT(' UNPAID MORT.BAL.',2X,10(I10))
C
        WRITE(7,713)(IMPR(I),I=K,L)
713     FORMAT(' CAPITAL IMP.',5X,2X,10(I10))
C
        WRITE(7,714)(IBOOKVB(I),I=K,L)
714     FORMAT(' B. V. BLD.(OPEN)',1X,2X,10(I10))
C
        WRITE(7,715)(IDEPN(I),I=K,L)
715     FORMAT(' DEPREC. ALLOW.',3X,2X,10(I10))
C
        WRITE(7,716)(ITAXD(I),I=K,L)
716     FORMAT(' SUM TAX DED.',6X,2X,10(I10))
C
        WRITE(7,717)(ITAX_INC(I),I=K,L)
717     FORMAT(' TAXABLE INCOME',4X,2X,10(I10))
C
        WRITE(7,718)(TAXRATE,I=K,L)
718     FORMAT(' TAX RATE',8X,2X,10(7X,F3.2))
C
        WRITE(7,719)(ITAX(I),I=K,L)
719     FORMAT(' INCOME TAX',7X,2X,10(I10))
C
        WRITE(7,720)(ITSHEL(I),I=K,L)
720     FORMAT(' TAX SHELTER',6X,2X,10(I10))
C
        WRITE(7,621)(NOI(I)-ITOT_INTO(I)-ITOT_PRIN(I)
        1-ITAX(I)-ITSHEL(I),I=K,L)
621     FORMAT(' AFTER TAX C.F.',4X,2X,10(I10))
C
        WRITE(7,721)(IATCF(I),I=K,L)
721     FORMAT(' AFTER TAX C.F.',4X,'C',1X,10(I10))
C
        WRITE(7,722)(IDATCF(I),I=K,L)
722     FORMAT(' DISC. A.T.C.F.',4X,2X,10(I10))
C
        WRITE(7,723)(IDATCF(I)/TOT_EQUITY(I),I=K,L)
723     FORMAT(' DATCF/ P.V.EQUITY',1X,2X,10(3X,F7.3))
C
        WRITE(7,724)(IC_D_ATCF(I),I=K,L)
724     FORMAT(' CUMM. DATCF.',6X,2X,10(I10))
C
        WRITE(7,*)'      '
        WRITE(7,*)'INV. LIQUIDATION '
        WRITE(7,*)'      '
        WRITE(7,725)(ISPRICE(I),I=K,L)
725     FORMAT(' EST. SELLING PRICE',2X,10(I10))
C
        WRITE(7,726)(ISEX(I),I=K,L)
726     FORMAT(' SELLING EXP.',4X,2X,10(I10))
C
        WRITE(7,727)(IREP(I),I=K,L)
727     FORMAT(' REPAY. PENAL.',3X,2X,10(I10))
C
        WRITE(7,728)(IA_R_ON_S(I),I=K,L)
728     FORMAT(' AMOUNT RE. ON SALE',2X,10(I10))
C
C       BECAUSE ANALYSIS OF PPTY SALE IS AT YEAR END CAPITAL GAIN
C       MUST BE AT YEAR END : BOOK VALUE OF PPTY IS AT YEAR START
C       THEREFORE NEED IBBOKVB(I+1) WHICH REPRESENTS DEPRECIATED
C       BOOK VALUE FOR YEAR
C
        WRITE(7,729)(IBOOKVB(I+1)-IMPR(I+1)+LAND,I=K,L)
729     FORMAT(' B.V. PPTY(CLOSE)',2X,10(I10))
C
```

```
      WRITE(7,730)(IGAIN(I),I=K,L)
730   FORMAT(' CAP.GAIN(IN.DEPN)',2X,10(I10))
C
      WRITE(7,629)(IBOOKVB(I)+LAND,I=K,L)
629   FORMAT('   B.V.  (EX. DEPN)',2X,10(I10))
C
      WRITE(7,630)(IA_R_ON_S(I)-IBOOKVB(I)+LAND,I=K,L)
630   FORMAT(' CAP.GAIN(EX.DEPN)',2X,10(I10))
C
      WRITE(7,731)(IUMB(I),I=K,L)
731   FORMAT(' UNPAID MORT. BAL.',1X,2X,10(I10))
C
      WRITE(7,732)(IA_T_ER(I),I=K,L)
732   FORMAT(' EQUITY REVERSION',2X,2X,10(I10))
C
      WRITE(7,733)(ID_ATER(I),I=K,L)
733   FORMAT(' DISC. EQ. REV.',4X,2X,10(I10))
C
      WRITE(7,734)(ITDR(I),I=K,L)
734   FORMAT(' TOT. DISC. RET.',3X,2X,10(I10))
C
      WRITE(7,735)(ITDR(I)/TOT_EQUITY(I),I=K,L)
735   FORMAT(' TOT. RET. TO EQ.',2X,2X,10(3X,F7.3))
C
      WRITE(7,736)(INPV(I),I=K,L)
736   FORMAT(' N P V',13X,2X,10(I10))
C
      WRITE(7,737)(RIRR(I),I=K,L)
737   FORMAT(' I R R',13X,2X,10(1X,F9.2))
C
      WRITE(7,738)(INVV(I),I=K,L)
738   FORMAT(' INVESTMENT VALUE',2X,2X,10(I10))
C
      WRITE(7,*)'      '
      IF(WARNTYPE)THEN
            WRITE(7,*)'      ',WARN,' YEAR ',IMRY
      ENDIF
      J=J-10
      IF(J.GT.0)THEN
         K=K+10
         IF(J.LT.10)THEN
            L=L+J
         ELSE
            L=L+10
         ENDIF
         GOTO 11
      ENDIF
C
      IF(DEVEL_P)THEN
            DO I=0,IPERIOD_D+IPERIOD*NPER_ANN
                  WRITE(11,*)' IOVERALL_BAL PERIOD ',I,'  =  ',
     1IOVERALL_BAL(I)
            ENDDO
      ELSE
            DO I=0,IPERIOD
                  WRITE(11,*)'  IBAL_OP YEAR ',I,'  =  ',IBAL_OP(I)
            ENDDO
      ENDIF
      STOP
      END
C                                                                      *
C                        MAINLINE PROGRAM ENDS                         *
C**********************************************************************
C                                                                      *
C                        SUBROUTINE  ACQUIRE                           *
```

```
C
      SUBROUTINE ACQUIRE(LAND,ISTRUC,IOINTEREST,IOPRINCIPAL,
     1IOPRIN_P,IPERIOD,MN,IPRICE,IOP_EQ,IOPRIN_REP,IREP,
     2IOPRIN_IN,DISC,DR,INTEREST,IPRIN_PAY,IPRIN_IN,NPER_ANN,
     3IOC_INTEREST,IOC_PRIN_P)
C
      DIMENSION IOINTEREST(3,50),IOPRINCIPAL(3,50),IOPRIN_P(3,50),
     1          IOP_EQ(0:50),IOPRIN_REP(3,50),INTEREST(3,150),
     2          IPRINCIPAL(3,150),IPRIN_PAY(3,150),IREP(0:50),
     3          IOPRIN_IN(3,50),IOC_INTEREST(3,50),IOC_PRIN_P(3,50),
     4          ITYP_MOR(3)
C
      CHARACTER ANSWER*1,TYPEM*1,ANSWER7*1
C
      IOSTAT=LIB$ERASE_PAGE(1,1)
      ANSWER='Z'       !ANY ARBITRARY CHARACTER
      TYPE *,'         PROPERTY PURCHASE DATA'
      TYPE *,'         '
      TYPE *,'         INPUT THE INVESTORS INITIAL ($) EQUITY'
      ACCEPT *,IOP_EQ(0)
      TYPE *,'         '
      TYPE *,'         INPUT THE TOTAL AQUISITION PRICE'
      ACCEPT *,IPRICE
      TYPE *,'         '
      TYPE *,'         INPUT THE ESTIMATED LAND VALUE'
      ACCEPT *,LAND
      ISTRUC=IPRICE-LAND
C
C     DISCOUNT RATE
C
      IOSTAT=LIB$ERASE_PAGE(1,1)
      TYPE *,'         !INPUT THE INVESTORS REQUIRED'
      TYPE *,'         RATE OF RETURN (DECIMAL)     '
      TYPE *,'                 (ANNUAL DISCOUNT RATE)'
      ACCEPT *,DISC
      DISC=DISC+1.
      DR=DISC**(1./NPER_ANN)
      TYPE *,'         '
      TYPE *,'         DOES THE INVESTMENT INVOLVE'
      TYPE *,'         MORTGAGE FINANCE             '
      TYPE *,'                 (TYPE Y OR N)        '
      ACCEPT '(A1)',ANSWER
C
      IF(ANSWER.EQ.'Y')THEN
      IOSTAT=LIB$ERASE_PAGE(1,1)
      TYPE *,'  '
      TYPE *,'         MORTGAGE FINANCE DATA'
      TYPE *,'         **********************'
      TYPE *,'  '
      TYPE *,'         INPUT THE NUMBER OF MORTGAGES'
      TYPE *,'         TAKEN OVER OPERATING  PERIOD '
      ACCEPT *,MN
C
      WRITE(7,1089)'  '
1089  FORMAT('1',A1)
      WRITE(7,*)'  '
      WRITE(7,*)'      MORTGAGE  INFORMATION (OPERATING)        '

C
      LPT=0
c
      DO IM=1,MN
         ITYP_MOR(IM)=0
         IOSTAT=LIB$ERASE_PAGE(1,1)
         TYPE *,'  '
```

```
      TYPE *,'     MORTGAGE :',IM
      TYPE *,' '
      TYPE *,' '
      TYPE *,'     INPUT THE MORTGAGE TYPE :TABLE(T) FLAT(F)'
      ACCEPT '(A1)',TYPEM
      TYPE *,' '
      TYPE *,'     INPUT THE MORTGAGE :PRINCIPAL            '
      TYPE *,'                        :LOAN TERM(YEARS)     '
      TYPE *,'                           :INTEREST(DECIMAL)    '
      ACCEPT *,LPRIN,LTERM,TINT
      TYPE *,' '
      TYPE *,'     INPUT THE NUMBER OF REPAYMENTS PER ANNUM'
      ACCEPT *,L_ANN_REP
      ITOT_PAY=L_ANN_REP*LTERM
      IOPRIN_IN(IM,1)=LPRIN
C
      WRITE(7,*)'     ************************************'
      WRITE(7,*)' '
      WRITE(7,*)'     MORTGAGE                 :  ',IM
      WRITE(7,*)' '
      IF(TYPEM.EQ.'T')THEN
      WRITE(7,*)'     TYPE OF MORTGAGE         :         TABLE'
      ELSE
      WRITE(7,*)'     TYPE OF MORTGAGE         :          FLAT'
      ENDIF
      WRITE(7,*)' '
      WRITE(7,*)'     PRINCIPAL                : $',LPRIN
      WRITE(7,*)' '
      WRITE(7,*)'     LOAN TERM (YEARS)        :  ',LTERM
      WRITE(7,*)' '
      WRITE(7,*)'     INTEREST  RATE (ANNUAL)  :   ',TINT
      WRITE(7,*)' '
      WRITE(7,*)'     NO. ANNUAL REPAYMENTS    :  ',L_ANN_REP
      WRITE(7,*)' '

c
      IPRINCIPAL(IM,1)=LPRIN
      RINT=TINT/L_ANN_REP
c
C     ALTHOUGH TRUE LOAN PERIOD WILL EXCEED THE FOLLOWING
C     MEASURE IE LPERIOD,LPERIOD SIMPLY PREVENTS THE PROGRAM
C     COMPUTING LOAN PAYMENTS PAST THE COMPLETION OF THE
C     OPERATING PERIOD AND HENCE OF NO USE TO THE ANALYSIS
C
      LPERIOD=L_ANN_REP*LTERM
C
      IF(LPERIOD.GT.IPERIOD*L_ANN_REP)THEN
           LPERIOD=(IPERIOD+1)*L_ANN_REP
      ELSE
           LPERIOD=LPERIOD
      ENDIF
C
      IF(TYPEM.EQ.'T')THEN !TABLE MORTGAGE
C
         ITYP_MOR(IM)=1 !1 INDICATES TABLE MORTGAGE
         FACTOR=RINT/(1.-(1./((1.+RINT)**ITOT_PAY)))
         IPAYMENT=NINT(FACTOR*LPRIN)
C
         DO JJ=1,LPERIOD   ! NOT IPERIOD
C
            INTEREST(IM,JJ)=NINT(IPRINCIPAL(IM,JJ)*RINT)
            IPRIN_PAY(IM,JJ)=IPAYMENT-INTEREST(IM,JJ)
            IPRINCIPAL(IM,JJ+1)=IPRINCIPAL(IM,JJ)
     1                         -IPRIN_PAY(IM,JJ)
```

```
                IF(IPRINCIPAL(IM,JJ+1).LT.0)IPRINCIPAL(IM,JJ+1)=0
             ENDDO
C
          ELSE                        !FLAT MORTGAGE
             IPAYMENT=NINT(RINT*LPRIN)
             DO JJ=1,LPERIOD
C
                INTEREST(IM,JJ)=IPAYMENT
                IPRINCIPAL(IM,JJ)=LPRIN
             ENDDO
             IPRINCIPAL(IM,JJ+1)=LPRIN
          ENDIF
C
          IOPRINCIPAL(IM,1)=IPRINCIPAL(IM,1)
C
          KSTART=1
          KSTOP=1+L_ANN_REP-1
          DIRM=DISC**(1./L_ANN_REP)
               DO I11=1,IPERIOD+1 !PREVIOUSLY HAD ONLY IPERIOD HOWEVER
                  IIINT=0         !NOW IPERIOD AS WANT TO COMPUTE 1 PAST
                  IPPP=0          !IPERIOD TO ENABLE INT. FOR REPAY.
                  IIINTC=0        !PEN. (TABLE) FOR IPERIOD+1 TO BE COMPUTED
                  IPPPC=0
                  DO I1=KSTART,KSTOP
                       IIINT=IIINT+INTEREST(IM,I1)
                       IPPP=IPPP+IPRIN_PAY(IM,I1)
                       IIINTC=IIINTC+(INTEREST(IM,I1)*(DIRM**(KSTOP-I1)))
                       IPPPC=IPPPC+(IPRIN_PAY(IM,I1)*(DIRM**(KSTOP-I1)))
                  ENDDO
                  IOINTEREST(IM,I11)=IIINT
                  IOPRIN_P(IM,I11)=IPPP
                  IOC_INTEREST(IM,I11)=IIINTC
                  IOC_PRIN_P(IM,I11)=IPPPC
                  IOPRINCIPAL(IM,I11+1)=IOPRINCIPAL(IM,I11)-IPPP
                  IF(IOPRINCIPAL(IM,I11+1).LT.0)IOPRINCIPAL(IM,I11+1)=0
C
C       SIMPLY ALLOCATE TO 0 ALL PRINCIPAL BALANCES FOR OPERATING
C       PERIOD AFTER THE PERIOD FOLLOWING THE COMPLETION OF A
C       FLAT MORTGAGE
                  IF(IOINTEREST(IM,I11).LE.0)THEN
                       IOPRINCIPAL(IM,I11+1)=0
                  ENDIF
                  KSTART=KSTOP+1
                  KSTOP=KSTART+L_ANN_REP-1
               ENDDO
C
C       NOW CATER FOR REFINANCING OF ANY FLAT MORTGAGES
C       OVER OPERATING PERIOD
C
          ANSWER7='Z'       !ANY ARBITRARY CHARACTER
          IF(TYPEM.EQ.'F')THEN
             IOSTAT=LIB$ERASE_PAGE(1,1)
             TYPE *,'  WILL THIS MORTGAGE BE REFINANCED        '
             TYPE *,'  OVER THE OPERATING PERIOD               '
             TYPE *,'          (ENTER Y OR N)                  '
             ACCEPT '(A1)',ANSWER7
             IF(ANSWER7.EQ.'Y')THEN
                IOSTAT=LIB$ERASE_PAGE(1,1)
                TYPE *,'        REFINANCE DATA :MORTGAGE ',IM
                TYPE *,'
                TYPE *,'        NOTE :REFINANCE IS ASSUMED '
                TYPE *,'              TO TAKE PLACE AT THE '
                TYPE *,'              BEGINNING OF THE YEAR'
                TYPE *,'
                TYPE *,'
```

```
                TYPE *,'        ENTER THE YEAR IN WHICH    '
                TYPE *,'        THE MORTGAGE IS REFINANCED'
                TYPE *,'        '
                ACCEPT *,IYR
                LAST_F=((IYR-1)*L_ANN_REP+1)
                TYPE *,'        ENTER THE :PRINCIPAL SUM ($)              '
                TYPE *,'                  :NEW INTEREST RATE (ANNUAL)     '
                TYPE *,'                  :NEW LOAN TERM (YEARS)          '
                TYPE *,'                  :NO. OF PAYMENTS PER ANNUM      '
                ACCEPT *,LPRIN1,TINT,LTERM,L_ANN_REP
                RINT=TINT/L_ANN_REP
                WRITE(7,*)'     REFINANCE DATA                '
                WRITE(7,*)'     '
                WRITE(7,*)'     YEAR REFINANCED          :  ',IYR
                WRITE(7,*)'     '
                WRITE(7,*)'     PRINCIPAL SUM ($)        :  ',LPRIN1
                WRITE(7,*)'     '
                WRITE(7,*)'     NEW INTEREST RATE        :  ',TINT
                WRITE(7,*)'     '
                WRITE(7,*)'     NEW LOAN TERM            :  ',LTERM
                WRITE(7,*)'     '
                WRITE(7,*)'     NO. ANNUAL PAYMENTS      :  ',L_ANN_REP
C
C               ALLOCATE ALL SUBSEQUENT INTEREST AND PRINCIPAL
C               BALANCES TO 0
C
                DO JJ=LAST_F,LPERIOD+5          !ARBITRARY HIGH NUMBER
                      INTEREST(IM,JJ)=0
                      IPRINCIPAL(IM,JJ)=0
                ENDDO
C
                LPERIOD=LAST_F+LTERM*L_ANN_REP-1
                IF(LAST_F+(IPERIOD-IYR+1)*L_ANN_REP.LT.LPERIOD)THEN
                   LPERIOD=LAST_F+(IPERIOD-IYR+1)*L_ANN_REP
                ENDIF
                IPAYMENT=NINT(RINT*LPRIN1)
                DO JJ=LAST_F,LPERIOD
                      INTEREST(IM,JJ)=IPAYMENT
                      IPRINCIPAL(IM,JJ)=LPRIN1
                ENDDO
                IPRINCIPAL(IM,LPERIOD+1)=LPRIN1
C
                IOPRINCIPAL(IM,IYR)=LPRIN1
C       IF NEW PRIN. SUM > INITIAL PRIN SUM THEN DIFFERENCE = BORROWED
C       CAPITAL ELSE DIFFERENCE EQUALS EQUITY INPUT INTO PROJECT
C
C       RECALL START OF CURRENT PERIOD IS EFFECTIVELY EQUAL TO
C       END OF PREVIOUS PERIOD FOR PURPOSES OF EQUITY INPUT AND
C       PRINCIPAL REPAYMENT : ALLOCATING TO END OF PREVIOUS PERIOD
C       SIMPLY TO ENSURE TIME HORIZON FOR DISCOUNTING IS AS ACCURATE
C       OR AS VALID AS POSSIBLE
C
                IF(LPRIN1.LT.LPRIN)THEN
                   IOP_EQ(IYR)=IOP_EQ(IYR)+
      1(LPRIN-LPRIN1)  !AS DISC AT THIS STAGE = BASIC i RATE
                   IOPRIN_REP(IM,IYR)=LPRIN-LPRIN1
C
C                  FOR COMPUTATION OF INVESTMENT VALUE NEED TO COMPUTE
C                  THE PRESENT VALUE OF MORTGAGE INPUTS : THIS EQUALS
C                  THE ORIGINAL MORTGAGE PRINCIPALS PLUS/MINUS DISCOUNTED
C                  REFINANCED PRINCIPAL :ITOTAL_PRIN( )=PV ALL MORT. PRIN.
C
                ELSE                                        !IN START YEAR
                   IOPRIN_IN(IM,IYR)=LPRIN1-LPRIN
                ENDIF
```

```
C
                KSTART=LAST_F  !PERIOD REFINANCING BEGINS
                KSTOP=KSTART+L_ANN_REP-1
                DIRM=DISC**(1./L_ANN_REP)
                DO I11=IYR,IPERIOD+1!PREVIOUSLY HAD ONLY IPERIOD HOWEVER
C                                   !WANT INT. FOR IPREIOD+1 TO ENABLE
                  IIINT=0           !REP. PEN. FOR TABLE TO BE COMP.
                  IPPP=0
                  IIINTC=0
                  IPPPC=0
                  DO I1=KSTART,KSTOP   !BE COMPUTED
                       IIINT=IIINT+INTEREST(IM,I1)
                       IPPP=IPPP+IPRIN_PAY(IM,I1)
                       IIINTC=IIINTC+(INTEREST(IM,I1)*DIRM**(KSTOP-I1))
                       IPPPC=IPPPC+(IPRIN_PAY(IM,I1)*DIRM**(KSTOP-I1))
                  ENDDO
                  IOINTEREST(IM,I11)=IIINT
                  IOPRIN_P(IM,I11)=IPPP
                  IOC_INTEREST(IM,I11)=IIINTC
                  IOC_PRIN_P(IM,I11)=IPPPC
                  IOPRINCIPAL(IM,I11+1)=IOPRINCIPAL(IM,I11)-
     1                                  IOPRIN_P(IM,I11)-
     2                IOPRIN_REP(IM,I11+1)+IOPRIN_IN(IM,I11+1)
                  IF(IOPRINCIPAL(IM,I11+1).LT.0)IOPRINCIPAL(IM,I11+1)=0
C
C       SIMPLY ALLOCATE TO 0 ALL PRINCIPAL BALANCES FOR OPERATING
C       PERIOD AFTER THE PERIOD FOLLOWING THE COMPLETION OF A
C       FLAT MORTGAGE
                  IF(IOINTEREST(IM,I11).LE.0)THEN
                       IOPRINCIPAL(IM,I11+1)=0
                  ENDIF
                  KSTART=KSTOP+1
                  KSTOP=KSTART+L_ANN_REP-1
                ENDDO
              ENDIF
            ENDIF
C
            IF(LPERIOD.GT.LPT)LPT=LPERIOD
          ENDDO
C
C       NOW ALLOCATE REPAYMENT EXPENSES APPLICABLE FOR EACH YEAR
C
          IOSTAT=LIB$ERASE_PAGE(1,1)
          TYPE *,'         MORTGAGE EARLY REPAYMENT PENALTY'
          TYPE *,'         '
          TYPE *,'         SELECT THE METHOD OF INCLUDING'
          TYPE *,'         EARLY REPAYMENT PENALTY       '
          TYPE *,'         '
          TYPE *,'          1. NO REPAYMENT PENALTY                    '
          TYPE *,'         '
          TYPE *,'          2. STANDARD (MONTHLY) INTEREST PENALTY     '
          TYPE *,'         '
          TYPE *,'          3. USER INPUT ($) PENALTY                  '
          TYPE *,'         '
          ACCEPT *,METHR
C
          IF(METHR.EQ.1)THEN
                  DO IR=0,IPERIOD
                          IREP(IR)=0
                  ENDDO
          ELSEIF(METHR.EQ.2)THEN
                  IOSTAT=LIB$ERASE_PAGE(1,1)
                  TYPE *,'         STANDARD PENALTY = THREE MONTHS INTEREST'
                  TYPE *,'         '
                  TYPE *,'         ENTER THE NUMBER OF MONTHS PENALTY
```

```
            ACCEPT *,LPEN_DUR
C       MUST ENSURE THAT DO NOT INCLUDE NEXT PERIODS REFINANCING IN THE
C       COMPUTATION OF REPAYMENT PENALTY : LOGIC IS AS FOLLOWS
C               IF NEXT 'YEARS' IOPRIN_P IS NOT GREATER THAN 0
C               THEN THE MORTGAGE IS TABLE AND INTEREST FOR NEXT
C               YEAR IS APPLICABLE
C               ELSE MORTGAGE IS FLAT AND CURRENT YEARS INTEREST
C               CAN BE USED AS IT DOES NOT INCLUDE REFINANCE
C               IF IOPRIN_P =0 AND MORTGAGE IS TABLE THEN THIS
C               INDICATES MORTGAGE FULLY AMORTISED BY YEAR END
C
                DO IR=0,IPERIOD
                        IREPP=0
                        DO IM=1,MN
                          IF(ITYP_MOR(IM).EQ.1)THEN !MORT. TABLE AND i OK
                             IREPP=IREPP+IOINTEREST(IM,IR+1)/12*LPEN_DUR
                          ELSE                          !MORTGAGE=FLAT
                             IREPP=IREPP+IOINTEREST(IM,IR)/12*LPEN_DUR
                          ENDIF
                        ENDDO
                        IREP(IR)=IREPP
                ENDDO
        ELSEIF(METHR.EQ.3)THEN
                IOSTAT=LIB$ERASE_PAGE(1,1)
                TYPE *,'        NOTE : THERE ARE A TOTAL OF',MN,' MORTGAGES'
                TYPE *,'             '
                DO IR=1,IPERIOD
                        TYPE *,'         INPUT THE REPAYMENT PENALTY '
                        TYPE *,'         FOR ALL MORTGAGES FOR YEAR  ',IR
                        TYPE *,'             '
                        ACCEPT *,IREP(IR)
                        TYPE *,'             '
                ENDDO
        ENDIF
        ENDIF   !ENDIF FOR MORTGAGE PROMPT
C
C       END REPAYMENT MODULE
C
        RETURN
        END
C                                                                       *
C                       END SUBROUTINE ACQUIRE                          *
C***********************************************************************
C                       SUBROUTINE  IRRETURN                            *
C                                                                       *
        SUBROUTINE IRRETURN(IPERIOD,IPERIOD_D,IBAL_OP,RATE,DEVEL_P,
        1             NPER_ANN,IP,IOVERALL_BAL,X)
C
        DIMENSION IBAL_OP(0:IP),IOVERALL_BAL(0:IPERIOD_D+IP*NPER_ANN)
        LOGICAL DEVEL_P
C
        DO K=1,100
C
          XLAST=X
          X=XLAST-VALUE(IBAL_OP,IPERIOD_D,IPERIOD,X,DEVEL_P,IOVERALL_BAL,
        1NPER_ANN,IP)/DERIV(IBAL_OP,IPERIOD_D,IPERIOD,X,DEVEL_P,IOVERALL_BAL,
        1NPER_ANN,IP)
          IF(ABS(X-XLAST).LT.0.0001)GOTO 5566
        ENDDO
C
5566    RATE=X
        RETURN
        END
C
        FUNCTION VALUE(IBAL_OP,IPERIOD_D,IPERIOD,X,DEVEL_P,IOVERALL_BAL,
```

```
     1NPER_ANN,IP)
C
      DIMENSION IBAL_OP(0:IP),IOVERALL_BAL(0:IPERIOD_D+IP*NPER_ANN)
      LOGICAL DEVEL_P
C
      IF(DEVEL_P)THEN
C
         V1=0.
         DIS=1.
         DO J=0,IPERIOD_D+IP*NPER_ANN
              V1=V1+IOVERALL_BAL(J)*DIS
              DIS=DIS*X
         ENDDO
         VALUE=V1
      ELSE    !NO DEVELOPMENT PERIOD
C
         V2=0.
         DIS=1.
         DO J=0,IP
              V2=V2+IBAL_OP(J)*DIS
              DIS=DIS*X
         ENDDO
         VALUE=V2
      ENDIF
      RETURN
      END
C
      FUNCTION DERIV(IBAL_OP,IPERIOD_D,IPERIOD,X,DEVEL_P,IOVERALL_BAL,
     1NPER_ANN,IP)
C
      DIMENSION IBAL_OP(0:IP),IOVERALL_BAL(0:IPERIOD_D+IP*NPER_ANN)
      LOGICAL DEVEL_P
      IF(DEVEL_P)THEN
              V1=0.
              DIS=1.
              DO J=1,IPERIOD_D+IP*NPER_ANN
C
C                     MULTIPLY BY 1.0 TO CONVERT TO REAL FOR INCREASED
C                     STORAGE CAPACITY
C
                      V1=V1+1.0*J*IOVERALL_BAL(J)*DIS
                      DIS=DIS*X
              ENDDO
              DERIV=V1
      ELSE            !NO DEVELOPMENT PERIOD
              V2=0.
              DIS=1.
              DO J=1,IP
                      V2=V2+1.0*J*IBAL_OP(J)*DIS
                      DIS=DIS*X
              ENDDO
              DERIV=V2
      ENDIF
      RETURN
      END
C                                                                      *
C                     END SUBROUTINE IRRETURN                          *
C***********************************************************************
C                     SUBROUTINE DEVELOPMENT                           *
C                                                                      *
      SUBROUTINE DEVELOPMENT(IEQUITY,IOPRIN_IN,IOPRINCIPAL,IOINTEREST,
     1IOPRIN_P,LAND,ISTRUC,IPERIOD,IPERIOD_D,MN,IOP_EQ,IOPRIN_REP,
     1NPER_ANN,INTEREST,IPRIN_PAY,IPRIN_REP,IPRIN_IN,INCOME_D,DISC,
     1DR,IE_REP,IREP,IB_INT_P,IB_BOR,IBAL_DEV,IOC_INTEREST,IOC_PRIN_P,
     1ITOT_BINT,IB_INT_ACT_P)
```

```
      DIMENSION IDEVEL(0:150),IEQUITY(0:150),INCOME_D(0:150),IB_INT_P(150),
     1          IB_BOR(0:150),IPRIN_IN(3,150),IPRIN_PAY(3,150),
     2          INTEREST(3,150),ITOT_BINT(150),IPRINCIPAL(3,150),
     3          IB_INT_ACT_P(150),ITOT_BB(0:150),IE_CUM(0:150),
     4          IN_CUM(0:150),ID_CUM(0:150),IOPRINCIPAL(3,50),
     5          IOPRIN_P(3,50),IOINTEREST(3,50),IBAL_DEV(0:150),
     6          IOP_EQ(0:50),IOPRIN_IN(3,50),IPRIN_REP(3,150),
     7          IOPRIN_REP(3,50),IE_REP(150),IREP(0:50),IOC_INTEREST(3,50),
     8          IOC_PRIN_P(3,50)
C
      CHARACTER*131 TEXT,TEXT1,TEXT2,TEXT3,TEXT4,NTEXT,NTEXT1,
     1              NTEXT2,NTEXT3,NTEXT4,BRID*1,REPLY*1
      CHARACTER*92 TEXTS,TEXTS1,TEXTS2,TEXTS3,TEXTS4,
     1             NTEXTS,NTEXTS1,NTEXTS2,NTEXTS3,NTEXTS4,
     1             TEXTF,TEXTF1,TEXTF2,TEXTF3,TEXTF4,
     1             NTEXTF,NTEXTF1,NTEXTF2,NTEXTF3,NTEXTF4
      CHARACTER*102 TEXTM,TEXTM1,TEXTM2,TEXTM3,TEXTM4,
     1NTEXTM,NTEXTM1,NTEXTM2,NTEXTM3,NTEXTM4
      LOGICAL MORTGAGE
C
      IOSTAT=LIB$ERASE_PAGE(1,1)
      TYPE *,'         ** DEVELOPMENT PERIOD DATA  **              '
      TYPE *,'         ******************************              '
      TYPE *,'                                                     '
      TYPE *,'         INPUT THE NUMBER OF PERIODS OVER DEVELOPMENT'
      ACCEPT *,IPERIOD_D
      TYPE *,' '
      TYPE *,'         HOW MANY OF THESE PERIODS PER ANNUM?        '
      ACCEPT *,NPER_ANN
C
C     PROMPT FOR INVESTORS REQUIRED RATE OF RETURN
C
      IOSTAT=LIB$ERASE_PAGE(1,1)
      TYPE *,'         ENTER THE INVESTORS     '
      TYPE *,'         REQUIRED RATE OF RETURN '
      TYPE *,'            (DISCOUNT RATE)      '
      ACCEPT *,DISC
      DISC=DISC+1.
C     NOTE : DISC AND DR NOW TRUE DISCOUNT RATE
      DR=DISC**(1./NPER_ANN)
C
C     PROMPT AND ACCEPT DEVELOPMENT COST DATA
C
      CALL DEV(IPERIOD_D,IDEVEL,ID_CUM)
      IOSTAT=LIB$ERASE_PAGE(1,1)
      TYPE *,'         DEVELOPMENT COSTS ARE   '
      TYPE *,'         INCLUSIVE OF LAND VALUE '
      TYPE *,'                                 '
      TYPE *,'         INPUT THE LAND COST/VALUE'
      ACCEPT *,LAND
      ISTRUC=ID_CUM(IPERIOD_D)-LAND

C
C     PROMPT AND ACCEPT EQUITY INPUTS
C
      CALL EQUITY(IPERIOD_D,IEQUITY,IDEVEL)
C
C     PROMPT AND ACCEPT ANY INCOME OVER DEVELOPMENT PERIOD
C
      IOSTAT=LIB$ERASE_PAGE(1,1)
      TYPE *,' '
      TYPE *,'         DOES THE PROJECT EARN ANY      '
      TYPE *,'         INCOME OVER DEVELOPMENT PERIOD?'
      TYPE *,'                              (Y or N)  '
```

```
      ACCEPT '(A1)',REPLY
C
      IF(REPLY.EQ.'Y')THEN
         CALL INCOME(IPERIOD_D,INCOME_D,IN_CUM)
      ENDIF
C
C     PROMPT AND ACCEPT FINANCIAL DATA,IF ANY
C
      IOSTAT=LIB$ERASE_PAGE(1,1)
C
      TYPE *,' '
      TYPE *,'        DOES THE INVESTMENT INVOLVE '
      TYPE *,'        BORROWED FINANCE?:(Y or N)  '
      ACCEPT '(A1)',REPLY
      IF(REPLY.EQ.'Y')THEN
         MORTGAGE=.TRUE.
         CALL MORT(IPERIOD_D,NPER_ANN,MN,IPRINCIPAL,INTEREST,IPRIN_PAY,
     1           IPRIN_IN,IDEVEL,IEQUITY,INCOME_D,IB_INT_P,ITOT_BB,
     2           ITOT_BINT,IB_BOR,BRID,IB_INT_ACT_P,MORTGAGE,LPERIOD,
     3           L_B_PER,IOPRINCIPAL,IOPRIN_P,IOINTEREST,IPERIOD,IOPRIN_IN,
     4           IOP_EQ,IOPRIN_REP,IPRIN_REP,IE_REP,IREP,IOC_INTEREST,
     5           IOC_PRIN_P,DISC)
      ELSE
         MN=0
         BRID='N'
      ENDIF
      IE_CUM(0)=IEQUITY(0)
      DO IEQ=1,IPERIOD_D
         IE_CUM(IEQ)=IE_CUM(IEQ-1)+IEQUITY(IEQ) !IEQUITY(IEQ) MAY=0
      ENDDO
      ITOT_EQ=IE_CUM(IPERIOD_D)
C
      TEXT=' PERIOD :  EQUITY :  INCOME : BRIDGING
     1  FINANCE : MORTGAGE  ONE     : MORTGAGE  TWO     :
     2 MORTGAGE  THREE   : DEVELOP. :  CASH'
C
      TEXT1='         :         :         :                    :
     3                :                   :                        :
     3  COST    :  POSITION'
C
      TEXT2='         :         :         : CURRENT :BRIDGING :
     5INCOMING :PERIODIC :INCOMING :PERIODIC :INCOMING :PERIODIC :
     5          :
C
      TEXT3='         :         :         : BORROW. : PAYMENT :
     6  PRIN.  : PAYMENT :  PRIN.  : PAYMENT :  PRIN.  :
     7 PAYMENT :          :'
      TEXT4=':::::::::::::::::::::::::::::::::::::::
     7:::::::::::::::::::::::::::::::::::::::
     7:::::::::::::::::::::::::::::::::::::::
     7::::::::::'
C
      IF(MN.EQ.0)THEN
         IF(BRID.EQ.'N')THEN
            NTEXT=TEXT(1:9)//'     '//TEXT(10:19)//'     '//TEXT(20:29)
     8//'     '//TEXT(110:120)//'     '//TEXT(121:130)
C
            NTEXT1=TEXT1(1:9)//'     '//TEXT1(10:19)//'     '//TEXT1(20:29)
     8//'     '//TEXT1(110:120)//'     '//TEXT1(121:130)
C
            NTEXT2=TEXT2(1:9)//'     '//TEXT2(10:19)//'     '//TEXT2(20:29)
     8//'     '//TEXT2(110:120)//'     '//TEXT2(121:130)
C
            NTEXT3=TEXT3(1:9)//'     '//TEXT3(10:19)//'     '//TEXT3(20:29)
     8//'     '//TEXT3(110:120)//'     '//TEXT3(121:130)
```

```
C
      NTEXT4=TEXT4(1:9)//'::::'//TEXT4(10:19)//'::::'//TEXT4(20:29)
     8//'     '//TEXT4(110:120)//'::::'//TEXT4(121:130)
C
   ELSE
C
      NTEXT=TEXT(1:9)//'     '//TEXT(10:19)//'     '//TEXT(20:29)
     8//'     '//TEXT(30:49)//'     '//TEXT(110:120)//'     '//TEXT(121:130)
C
      NTEXT1=TEXT1(1:9)//'     '//TEXT1(10:19)//'     '//TEXT1(20:29)
     8//'     '//TEXT1(30:49)//'     '//TEXT1(110:120)//'     '
     8//TEXT1(121:130)
C
      NTEXT2=TEXT2(1:9)//'     '//TEXT2(10:19)//'     '//TEXT2(20:29)
     8//'     '//TEXT2(30:49)//'     '//TEXT2(110:120)//'     '
     8//TEXT2(121:130)
C
      NTEXT3=TEXT3(1:9)//'     '//TEXT3(10:19)//'     '//TEXT3(20:29)
     8//'     '//TEXT3(30:49)//'     '//TEXT3(110:120)//'     '
     8//TEXT3(121:130)
C
      NTEXT4=TEXT4(1:9)//'::::'//TEXT4(10:19)//'::::'//TEXT4(20:29)
     8//'::::'//TEXT4(30:49)//'::::'//TEXT4(110:120)//'::::'
     8//TEXT4(121:130)
C
   ENDIF
C
ELSEIF(MN.EQ.1)THEN
C
   IF(BRID.EQ.'N')THEN
C
      NTEXT=TEXT(1:9)//'     '//TEXT(10:19)//'     '//TEXT(20:29)
     8//'     '//TEXT(50:69)//'     '//TEXT(110:120)//'     '
     8//TEXT(121:130)
C
      NTEXT1=TEXT1(1:9)//'     '//TEXT1(10:19)//'     '//TEXT1(20:29)
     8//'     '//TEXT1(50:69)//'     '//TEXT1(110:120)//'     '
     8//TEXT1(121:130)
C
      NTEXT2=TEXT2(1:9)//'     '//TEXT2(10:19)//'     '//TEXT2(20:29)
     8//'     '//TEXT2(50:69)//'     '//TEXT2(110:120)//'     '
     8//TEXT2(121:130)
C
      NTEXT3=TEXT(1:9)//'     '//TEXT3(10:19)//'     '//TEXT3(20:29)
     8//'     '//TEXT3(50:69)//'     '//TEXT3(110:120)//'     '
     8//TEXT3(121:130)
C
      NTEXT4=TEXT4(1:9)//'::::'//TEXT4(10:19)//'::::'//TEXT4(20:29)
     8//'::::'//TEXT4(50:69)//'::::'//TEXT4(110:120)//'::::'
     8//TEXT4(121:130)
C
   ELSE
C
      NTEXT=TEXT(1:9)//'     '//TEXT(10:19)//'     '//TEXT(20:29)
     8//'     '//TEXT(30:49)//'     '//TEXT(50:69)//'     '//
     8TEXT(110:120)//'     '//TEXT(121:130)
C
      NTEXT1=TEXT1(1:9)//'     '//TEXT1(10:19)//'     '//TEXT1(20:29)
     8//'     '//TEXT1(30:49)//'     '//TEXT1(50:69)//'     '//
     8TEXT1(110:120)//'     '//TEXT1(121:130)
C
      NTEXT2=TEXT2(1:9)//'     '//TEXT2(10:19)//'     '//TEXT2(20:29)
     8//'     '//TEXT2(30:49)//'     '//TEXT2(50:69)//'     '//
     8TEXT2(110:120)//'     '//TEXT2(121:130)
C
```

```
            NTEXT3=TEXT3(1:9)//'     '//TEXT3(10:19)//'     '//TEXT3(20:29)
           8//'     '//TEXT3(30:49)//'     '//TEXT3(50:69)//'     '//
           8TEXT3(110:120)//'     '//TEXT3(121:130)
C
            NTEXT4=TEXT4(1:9)//':::::'//TEXT4(10:19)//':::::'//TEXT4(20:29)
           8//':::::'//TEXT4(30:49)//':::::'//TEXT4(50:69)//':::::'//
           8TEXT4(110:120)//':::::'//TEXT4(121:130)
C
              ENDIF
C
           ELSEIF(MN.EQ.2)THEN
C
              IF(BRID.EQ.'N')THEN
C
            NTEXT=TEXT(1:9)//'   '//TEXT(10:19)//'   '//TEXT(20:29)
           8//'   '//TEXT(50:69)//'   '//TEXT(70:89)//'   '
           8//TEXT(110:120)//'   '//TEXT(121:130)
C
            NTEXT1=TEXT1(1:9)//'   '//TEXT1(10:19)//'   '//TEXT1(20:29)
           8//'   '//TEXT1(50:69)//'   '//TEXT1(70:89)//'   '
           8//TEXT1(110:120)//'   '//TEXT1(121:130)
C
            NTEXT2=TEXT2(1:9)//'   '//TEXT2(10:19)//'   '//TEXT2(20:29)
           8//'   '//TEXT2(50:69)//'   '//TEXT2(70:89)//'   '
           8//TEXT2(110:120)//'   '//TEXT2(121:130)
C
            NTEXT3=TEXT3(1:9)//'   '//TEXT3(10:19)//'   '//TEXT3(20:29)
           8//'   '//TEXT3(50:69)//'   '//TEXT3(70:89)//'   '
           8//TEXT3(110:120)//'   '//TEXT3(121:130)

            NTEXT4=TEXT4(1:9)//':::'//TEXT4(10:19)//':::'//TEXT4(20:29)
           8//':::'//TEXT4(50:69)//':::'//TEXT4(70:89)//':::'
           8//TEXT4(110:120)//':::'//TEXT4(121:130)
C
              ELSE
C
            NTEXT=TEXT(1:9)//'   '//TEXT(10:19)//'   '//TEXT(20:29)
           8//TEXT(30:49)//'   '//TEXT(50:69)//'   '//TEXT(70:89)//'   '
           8//TEXT(110:120)//'   '//TEXT(121:130)
C
            NTEXT1=TEXT1(1:9)//'   '//TEXT1(10:19)//'   '//TEXT1(20:29)
           8//TEXT1(30:49)//'   '//TEXT1(50:69)//'   '//TEXT1(70:89)//'   '
           8//TEXT1(110:120)//'   '//TEXT1(121:130)
C
            NTEXT2=TEXT2(1:9)//'   '//TEXT2(10:19)//'   '//TEXT2(20:29)
           8//TEXT2(30:49)//'   '//TEXT2(50:69)//'   '//TEXT2(70:89)//'   '
           8//TEXT2(110:120)//'   '//TEXT2(121:130)
C
            NTEXT3=TEXT3(1:9)//'   '//TEXT3(10:19)//'   '//TEXT3(20:29)
           8//TEXT3(30:49)//'   '//TEXT3(50:69)//'   '//TEXT3(70:89)//'   '
           8//TEXT3(110:120)//'   '//TEXT3(121:130)
C
            NTEXT4=TEXT4(1:9)//':::'//TEXT4(10:19)//':::'//TEXT4(20:29)
           8//TEXT4(30:49)//':::'//TEXT4(50:69)//':::'//TEXT4(70:89)//':::'
           8//TEXT4(110:120)//':::'//TEXT4(121:130)
C
              ENDIF
C
           ELSEIF(MN.EQ.3)THEN
C
              IF(BRID.EQ.'N')THEN
C
            NTEXT=TEXT(1:9)//'  '//TEXT(10:19)//'  '//TEXT(20:29)
           8//'  '//TEXT(50:69)//'  '//TEXT(70:89)//'  '//TEXT(90:109)
           8//'  '//TEXT(110:120)//'  '//TEXT(121:130)
```

```
C
      NTEXT1=TEXT1(1:9)//' '//TEXT1(10:19)//' '//TEXT1(20:29)
     8//' '//TEXT1(50:69)//' '//TEXT1(70:89)//' '//TEXT1(90:109)
     8//' '//TEXT1(110:120)//' '//TEXT1(121:130)
C
      NTEXT2=TEXT2(1:9)//' '//TEXT2(10:19)//' '//TEXT2(20:29)
     8//' '//TEXT2(50:69)//' '//TEXT2(70:89)//' '//TEXT2(90:109)
     8//' '//TEXT2(110:120)//' '//TEXT2(121:130)
C
      NTEXT3=TEXT3(1:9)//' '//TEXT3(10:19)//' '//TEXT3(20:29)
     8//' '//TEXT3(50:69)//' '//TEXT3(70:89)//' '//TEXT3(90:109)
     8//' '//TEXT3(110:120)//' '//TEXT3(121:130)
C
      NTEXT4=TEXT4(1:9)//'::'//TEXT4(10:19)//'::'//TEXT4(20:29)
     8//'::'//TEXT4(50:69)//'::'//TEXT4(70:89)//'::'//TEXT4(90:109)
     8//'::'//TEXT4(110:120)//'::'//TEXT4(121:130)
C
   ELSE
      NTEXT=TEXT
      NTEXT1=TEXT1
      NTEXT2=TEXT2
      NTEXT3=TEXT3
      NTEXT4=TEXT4
   ENDIF
ENDIF
C
WRITE(7,99)' '
99   FORMAT('1',A1)
WRITE(7,*)'     ***DEVELOPMENT PERIOD INFORMATION***'
WRITE(7,*)'     ************************************'
WRITE(7,*)' '
WRITE(7,*)' '
WRITE(7,100)NTEXT
WRITE(7,100)NTEXT1
WRITE(7,100)NTEXT2
WRITE(7,100)NTEXT3
WRITE(7,100)NTEXT4                !ROW OF ::::::::...
100  FORMAT(A131)
C
ICASH_POS=0        !IEQUITY(0)
DO ID=0,IPERIOD_D
   IINTEREST=0
   IP_IN_TOT=0
   IP_PAY_TOT=0
   DO KD=1,MN
      IP_IN_TOT=IP_IN_TOT+IPRIN_IN(KD,ID)
      IINTEREST=IINTEREST+INTEREST(KD,ID)
      IP_PAY_TOT=IP_PAY_TOT+IPRIN_PAY(KD,ID)+IPRIN_REP(KD,ID)
   ENDDO
C
C    ANY REFINANCE WILL BE BALANCED BY IEQUITY=IPRIN_REP
C    OR SIMPLY INCREASED PRINCIPAL
C
   ICASH_POS=ICASH_POS+IEQUITY(ID)+IP_IN_TOT+INCOME_D(ID)
     1            +IB_BOR(ID)-IDEVEL(ID)-IINTEREST-IP_PAY_TOT
     2            -IB_INT_ACT_P(ID)
C
   IF(MN.EQ.0)THEN
        IF(BRID.EQ.'N')THEN
           WRITE(7,1000)ID,':',IEQUITY(ID),':',INCOME_D(ID),
     1':',IDEVEL(ID),':',ICASH_POS
1000  FORMAT(' ',2X,I3,2X,A1,5X,I8,1X,A1,5X,I8,1X,A1,6X,I8,1X,A1,
     1          7X,I8)
        ELSE
           WRITE(7,1001)ID,':',IEQUITY(ID),':',INCOME_D(ID),
```

```
     1':',IB_BOR(ID),':',IB_INT_ACT_P(ID),':',IDEVEL(ID),':',
     1ICASH_POS
1001 FORMAT(' ',2X,I3,2X,A1,5X,I8,1X,A1,5X,I8,1X,A1,5X,I8,1X,A1,
     1I8,1X,A1,6X,I8,1X,A1,7X,I8)
           ENDIF
        ELSEIF(MN.EQ.1)THEN
           IF(BRID.EQ.'N')THEN
              WRITE(7,1002)ID,':',IEQUITY(ID),':',INCOME_D(ID),
     1':',IPRIN_IN(1,ID),':',IPRIN_PAY(1,ID)+INTEREST(1,ID)+
     1IPRIN_REP(1,ID),':',IDEVEL(ID),':',ICASH_POS
1002 FORMAT(' ',2X,I3,2X,A1,5X,I8,1X,A1,5X,I8,1X,A1,5X,I8,1X,A1,
     1I8,1X,A1,6X,I8,1X,A1,7X,I8)
           ELSE
              WRITE(7,1003)ID,':',IEQUITY(ID),':',INCOME_D(ID),
     1':',IB_BOR(ID),':',IB_INT_ACT_P(ID),':',IPRIN_IN(1,ID),':',
     1IPRIN_PAY(1,ID)+INTEREST(1,ID)+IPRIN_REP(1,ID),
     1':',IDEVEL(ID),':',ICASH_POS
1003 FORMAT(' ',2X,I3,2X,A1,5X,I8,1X,A1,5X,I8,1X,A1,5X,I8,1X,A1,
     1I8,1X,A1,5X,I8,1X,A1,I8,1X,A1,6X,I8,1X,A1,7X,I8)
           ENDIF
        ELSEIF(MN.EQ.2)THEN
           IF(BRID.EQ.'N')THEN
              WRITE(7,1004)ID,':',IEQUITY(ID),':',INCOME_D(ID),
     1':',IPRIN_IN(1,ID),':',IPRIN_PAY(1,ID)+INTEREST(1,ID)+
     1IPRIN_REP(1,ID),':',IPRIN_IN(2,ID),':',IPRIN_PAY(2,ID)+
     1INTEREST(2,ID)+IPRIN_REP(2,ID),':',
     1IDEVEL(ID),':',ICASH_POS
1004 FORMAT(' ',2X,I3,2X,A1,3X,I8,1X,A1,3X,I8,1X,A1,3X,I8,1X,A1,
     1I8,1X,A1,3X,I8,1X,A1,I8,1X,A1,4X,I8,1X,A1,5X,I8)
           ELSE
              WRITE(7,1005)ID,':',IEQUITY(ID),':',INCOME_D(ID),':',
     1IB_BOR(ID),':',IB_INT_ACT_P(ID),':',IPRIN_IN(1,ID),':',
     1IPRIN_PAY(1,ID)+INTEREST(1,ID)+IPRIN_REP(1,ID),':',
     1IPRIN_IN(2,ID),':',IPRIN_PAY(2,ID)+INTEREST(2,ID)+IPRIN_REP(2,ID),
     1':',IDEVEL(ID),':',ICASH_POS
1005 FORMAT(' ',2X,I3,2X,A1,3X,I8,1X,A1,3X,I8,1X,A1,I8,1X,A1,I8,
     11X,A1,3X,I8,1X,A1,I8,1X,A1,3X,I8,1X,A1,I8,1X,A1,4X,I8,1X,
     1A1,5X,I8)
           ENDIF
        ELSEIF(MN.EQ.3)THEN
           IF(BRID.EQ.'N')THEN
              WRITE(7,1006)ID,':',IEQUITY(ID),':',INCOME_D(ID),':',
     1IPRIN_IN(1,ID),':',IPRIN_PAY(1,ID)+INTEREST(1,ID)+IPRIN_REP(1,ID),
     1':',IPRIN_IN(2,ID),':',IPRIN_PAY(2,ID)+INTEREST(2,ID)+
     1IPRIN_REP(2,ID),':',IPRIN_IN(3,ID),':',IPRIN_PAY(3,ID)+
     1INTEREST(3,ID)+IPRIN_REP(3,ID),':',
     1IDEVEL(ID),':',ICASH_POS
1006 FORMAT(' ',2X,I3,2X,A1,2X,I8,1X,A1,2X,I8,1X,A1,2X,I8,1X,A1,
     1I8,1X,A1,2X,I8,1X,A1,2X,I8,1X,A1,2X,I8,1X,A1,I8,1X,A1,2X,
     1I8,1X,A1,3X,I8)
           ELSE
              WRITE(7,1007)ID,':',IEQUITY(ID),':',INCOME_D(ID),
     1':',IB_BOR(ID),':',IB_INT_ACT_P(ID),':',IPRIN_IN(1,ID),':',
     1IPRIN_PAY(1,ID)+INTEREST(1,ID)+IPRIN_REP(1,ID),':',
     1IPRIN_IN(2,ID),':',IPRIN_PAY(2,ID)+INTEREST(2,ID)+IPRIN_REP(2,ID),
     1':',IPRIN_IN(3,ID),':',IPRIN_PAY(3,ID)+INTEREST(3,ID)+
     1IPRIN_REP(3,ID),':',IDEVEL(ID),':',ICASH_POS
1007 FORMAT(' ',2X,I3,2X,A1,I8,1X,A1,I8,1X,A1,I8,1X,A1,I8,1X,A1,
     1I8,1X,A1,I8,1X,A1,I8,1X,A1,I8,1X,A1,I8,1X,A1,I8,1X,A1,I8,
     11X,A1,2X,I8)
           ENDIF
        ENDIF
     ENDDO
C
C    THIS PROGRAM TESTS THE HEADING OUTPUT FOR SUMMATION INFORMATION
```

```
C
      TEXTS=' PERIOD :  EQUITY     INPUT      :   INCOME  OVER
      1  DEVEL. :      :  DEVELOP.     COST     ::'
C
      TEXTS1='         :                        :
      1                        :     :                          ::'
C
      TEXTS2='         :  CURRENT  :     CUMM.  :  CURRENT  :
      1     CUMM.  :      :  CURRENT  :     CUMM.  ::'
C
      TEXTS3='         :           :            :           :
      1            :     :           :           ::'
      TEXTS4=':::::::::::::::::::::::::::::::::::::::::
      1:::::::::::::::::::::::::::::::::::::::::
      1:::::::::'
C
C     NOW WRITE OUT PERTINENT SUMMATION INFORMATION
C
      WRITE(7,1111)
      WRITE(7,*)'SUMMATION    INFORMATION'
      WRITE(7,*)' '
      WRITE(7,1113)TEXTS
      WRITE(7,1113)TEXTS1
      WRITE(7,1113)TEXTS2
      WRITE(7,1113)TEXTS3
      WRITE(7,1113)TEXTS4
C
1113  FORMAT(A92)
      DO IS=0,IPERIOD_D
         WRITE(7,1100)IS,':',IEQUITY(IS),':',IE_CUM(IS),':',
      1INCOME_D(IS),':',IN_CUM(IS),':',':',IDEVEL(IS),':',
      1ID_CUM(IS),'::'
1100  FORMAT(' ',2X,I3,2X,A1,1X,I8,2X,A1,2X,I8,2X,A1,1X,I8,2X,
      1A1,2X,I8,2X,A1,5X,A1,1X,I8,2X,A1,2X,I8,2X,A2)
      ENDDO
C
      WRITE(7,*)' '
      WRITE(7,*)'TOTAL EQUITY INPUT EQUALS      :$',IE_CUM(IPERIOD_D)
      WRITE(7,*)' '
      WRITE(7,*)'TOTAL INCOME EQUALS            :$',IN_CUM(IPERIOD_D)
      WRITE(7,*)' '
      WRITE(7,*)'TOTAL DEVELOPMENT COST EQUALS  :$',ID_CUM(IPERIOD_D)
1111  FORMAT('1',A1)
C
      IF(BRID.EQ.'Y')THEN
C
      TEXTF=' PERIOD :              B R I D G I N G
      1                  F I N A N C E
      1                   ::'
C
      TEXTF1='         :
      1                                                  ::'
C
      TEXTF2='         :   CURRENT    :     CUMM.     :    CURRENT     :
      1     CUMM.      :    BRIDGING    ::'
C
      TEXTF3='         :   BORROW.    :    BORROW.    :    INTEREST    :
      1    INTEREST    :     REPAY.     ::'
C
      TEXTF4=':::::::::::::::::::::::::::::::::::::::::
      1:::::::::::::::::::::::::::::::::::::::::
      1:::::::::::'
C
      WRITE(7,1111)
      WRITE(7,1113)TEXTF
```

```
      WRITE(7,1113)TEXTF1
      WRITE(7,1113)TEXTF2
      WRITE(7,1113)TEXTF3
      WRITE(7,1113)TEXTF4
C
      DO IS=0,IPERIOD_D
         WRITE(7,1011)IS,':',IB_BOR(IS),':',ITOT_BB(IS),':',
     1IB_INT_P(IS),':',ITOT_BINT(IS),':',IB_INT_ACT_P(IS),':'
      ENDDO
C
1011  FORMAT(' ',2X,I3,2X,A1,2X,I8,4X,A1,3X,I8,4X,A1,4X,I8,4X,
     1A1,4X,I8,4X,A1,4X,I8,4X,A2)
C
      ENDIF
C
C     NOW WRITE OUT PERTINENT MORTGAGE INFORMATION
C
      IF(MN.GT.0)THEN
C
         TEXTM=' PERIOD :       MORTGAGE      ONE         :
     1       MORTGAGE      TWO          :       MORTGAGE
     1     THREE        :'
C
         TEXTM1='         :                                  :
     1                                :
     1                                :'
C
         TEXTM2='         : INCOMING :  PRIN.  :INTEREST : INCOMING :
     1  PRIN.  :INTEREST : INCOMING :  PRIN.  :INTEREST :'
C
         TEXTM3='         :   PRIN.  : PAYMENT : PAYMENT :   PRIN.  :
     1 PAYMENT :   PRIN.  : PAYMENT : PAYMENT :'
C
         TEXTM4=':::::::::::::::::::
     1:::::::::::::::::::::::::::::::::::::
     1:::::::::::::::::::::::::::::::::::::::'
1999  FORMAT(A102)
         IF(MN.EQ.1)THEN
C
            NTEXTM=TEXTM(1:40)
            NTEXTM1=TEXTM1(1:40)
            NTEXTM2=TEXTM2(1:40)
            NTEXTM3=TEXTM3(1:40)
            NTEXTM4=TEXTM4(1:40)
C
            WRITE(7,1111)
            WRITE(7,*)'   MORTGAGE  INFORMATION :: DEVELOPMENT TERM   '
            WRITE(7,*)'      '
            WRITE(7,1999)NTEXTM
            WRITE(7,1999)NTEXTM1
            WRITE(7,1999)NTEXTM2
            WRITE(7,1999)NTEXTM3
            WRITE(7,1999)NTEXTM4
C
            DO IMM=1,IPERIOD_D
                  WRITE(7,1200)IMM,':',IPRIN_IN(1,IMM),':',
     1IPRIN_PAY(1,IMM)+IPRIN_REP(1,IMM),':',INTEREST(1,IMM),':'
            ENDDO
C
            WRITE(7,*)'OUTSTANDING PRINCIPAL EQUALS :$',
     1IPRINCIPAL(1,IPERIOD_D+1)
C
1200  FORMAT(' ',2X,I3,2X,A1,1X,I8,1X,A1,I8,1X,A1,I8,1X,A1)
C
         ELSEIF(MN.EQ.2)THEN
```

```
C
            NTEXTM=TEXTM(1:71)
            NTEXTM1=TEXTM1(1:71)
            NTEXTM2=TEXTM2(1:71)
            NTEXTM3=TEXTM3(1:71)
            NTEXTM4=TEXTM4(1:71)
C
            WRITE(7,1111)
            WRITE(7,*)'   MORTGAGE  INFORMATION ::  DEVELOPMENT TERM  '
            WRITE(7,*)'                                               '
            WRITE(7,1999)NTEXTM
            WRITE(7,1999)NTEXTM1
            WRITE(7,1999)NTEXTM2
            WRITE(7,1999)NTEXTM3
            WRITE(7,1999)NTEXTM4
            DO IMM=1,IPERIOD_D
               WRITE(7,1201)IMM,':',IPRIN_IN(1,IMM),':',IPRIN_PAY(1,IMM)+
     1IPRIN_REP(1,IMM),':',INTEREST(1,IMM),':',IPRIN_IN(2,IMM),':',
     1IPRIN_PAY(2,IMM)+IPRIN_REP(2,IMM),':',
     1INTEREST(2,IMM),':'
            ENDDO
C
1201    FORMAT(' ',2X,I3,2X,A1,1X,I8,1X,A1,I8,1X,A1,I8,1X,A1,I8,1X,A1,I8,
     11X,A1,I8,1X,A1)
            WRITE(7,*)'OUTSTANDING PRINCIPAL LOAN 1 : $',
     1IPRINCIPAL(1,IPERIOD_D+1)
C
            WRITE(7,*)'OUTSTANDING PRINCIPAL LOAN 2 : $',
     1IPRINCIPAL(2,IPERIOD_D+1)
C
         ELSEIF(MN.EQ.3)THEN
C
            NTEXTM=TEXTM
            NTEXTM1=TEXTM1
            NTEXTM2=TEXTM2
            NTEXTM3=TEXTM3
            NTEXTM4=TEXTM4
C
            WRITE(7,1111)
            WRITE(7,*)'   MORTGAGE  INFORMATION ::  DEVELOPMENT TERM  '
            WRITE(7,*)'                                               '
            WRITE(7,1999)NTEXTM
            WRITE(7,1999)NTEXTM1
            WRITE(7,1999)NTEXTM2
            WRITE(7,1999)NTEXTM3
            WRITE(7,1999)NTEXTM4
C
            DO IMM=1,IPERIOD_D
               WRITE(7,1202)IMM,':',IPRIN_IN(1,IMM),':',IPRIN_PAY(1,IMM)+
     1IPRIN_REP(1,IMM),':',INTEREST(1,IMM),':',IPRIN_IN(2,IMM),':',
     1IPRIN_PAY(2,IMM)+IPRIN_REP(2,IMM),':',INTEREST(2,IMM),':',
     1IPRIN_IN(3,IMM),':',IPRIN_PAY(3,IMM)+IPRIN_REP(3,IMM),':',
     1INTEREST(3,IMM),':'
            ENDDO
C
1202    FORMAT(' ',2X,I3,2X,A1,1X,I8,1X,A1,I8,1X,A1,I8,1X,A1,1X,I8,1X,
     1A1,I8,1X,A1,I8,1X,A1,1X,I8,1X,A1,I8,1X,A1,I8,1X,A1)
C
            WRITE(7,*)'OUTSTANDING PRINCIPAL MORTGAGE 1 : $',
     1IPRINCIPAL(1,IPERIOD_D+1)
            WRITE(7,*)'OUTSTANDING PRINCIPAL MORTGAGE 2 : $',
     1IPRINCIPAL(2,IPERIOD_D+1)
            WRITE(7,*)'OUTSTANDING PRINCIPAL MORTGAGE 3 : $',
     1IPRINCIPAL(3,IPERIOD_D+1)
C
```

```
          ENDIF
        ENDIF
C
C       NOW SUM POSITIVE CASH FLOWS AND NEGATIVE CASH FLOWS
C       FOR ARRAY ABLE TO BE PASSED OVER TO IRR MODULE
C
C       IB_BOR = CURRENT PERIODS BRIDGING "PRINCIPAL" BORROWED
C       IB_INT_P     "       "        "     "INTEREST " BORROWED
C
C       NOTE : CASH FLOWS WHICH OCCUR @ BEGINNING OF PERIOD
C       MUST BE COMPOUNDED @ DR TO REPRESENT SIMILAR SUM @
C       YEAR END : DR = DISC**(1./NPER_ANN) WHERE DISC
C       =DISC+1.
        DO IRR=0,IPERIOD_D
                IBAL_DEV(IRR)=INCOME_D(IRR)+IB_BOR(IRR)+
        1          ((IPRIN_IN(1,IRR)+IPRIN_IN(2,IRR)+IPRIN_IN(3,IRR))
        1*DR)+IB_INT_P(IRR)-
        1          (IDEVEL(IRR)+INTEREST(1,IRR)+INTEREST(2,IRR)+
        1           INTEREST(3,IRR)+IPRIN_PAY(1,IRR)+IPRIN_PAY(2,IRR)+
        1           IPRIN_PAY(3,IRR)+((IPRIN_REP(1,IRR)+IPRIN_REP(2,IRR)+
        1           IPRIN_REP(3,IRR))*DR)+IB_INT_ACT_P(IRR))
        ENDDO
C       NOTE USING IPRIN_REP( ,IRR+1) AS THIS WILL EFFECTIVELY CANCEL
C            THE PRINCIPAL REPAID PORTION FOR NEXT PERIOD OF CURRENT
C            EQUITY AMOUNT
        RETURN
        END
C                                                                       *
C                       END SUBROUTINE DEVELOPMENT                      *
C***********************************************************************
C                         SUBROUTINE  EQUITY                            *
C                                                                       *
        SUBROUTINE EQUITY(IPERIOD_D,IEQUITY,IDEVEL)
C
        DIMENSION IEQUITY(0:150),IDEVEL(0:150)
C
        IOSTAT=LIB$ERASE_PAGE(1,1)
        TYPE *,' '
        TYPE *,'         **EQUITY INPUT DATA**'
        TYPE *,'         **********************'
        TYPE *,'                    '
        TYPE *,'         SELECT THE METHOD OF INCLUDING          '
        TYPE *,'         EQUITY INPUT TO THE INVESTMENT          '
        TYPE *,'         '
        TYPE *,'         1. USER INPUT ($) AMOUNT                '
        TYPE *,'         2. EQUATE EQUITY / DEVEL. COST          '
        ACCEPT *,MNM
        IF(MNM.EQ.2)THEN
           DO IE=0,IPERIOD_D
              IEQUITY(IE)=IDEVEL(IE)
           ENDDO
        ELSE
31         IOSTAT=LIB$ERASE_PAGE(1,1)
        TYPE *,'         '
        TYPE *,'         INPUT THE NUMBER OF     '
        TYPE *,'         PERIODIC EQUITY INPUTS  '
        ACCEPT *,MNE
C
        IF(MNE.GT.IPERIOD_D)THEN
                TYPE *,'         ERROR**DEVELOPMENT PERIOD EXCEEDED'
                TYPE *,' '
                TYPE *,'              **RE-INPUT DATA '
                GOTO 31
        ENDIF
C
```

```
        IOSTAT=LIB$ERASE_PAGE(1,1)
C
        DO IE=1,MNE
           TYPE *,'     EQUITY INPUT :',IE
           TYPE *,' '
           TYPE *,'     INPUT THE EQUITY AMOUNT AND PERIOD AVAILABLE '
           ACCEPT *,IAMOUNT,IEA
           IEQUITY(IEA)=IAMOUNT
        ENDDO
        ENDIF
        RETURN
        END
C                                                                       *
C                          END SUBROUTINE EQUITY                        *
C***********************************************************************
C                           SUBROUTINE  INCOME                          *
C                                                                       *
        SUBROUTINE INCOME(IPERIOD_D,INCOME_D,IN_CUM)
C
        DIMENSION INCOME_D(0:150),IN_CUM(0:150)
C
        IOSTAT=LIB$ERASE_PAGE(1,1)
C
        TYPE *,'         DATA : INCOME OVER DEVELOPMENT    '
        TYPE *,'         ******************************    '
        TYPE *,' '
        TYPE *,'         INPUT THE TOTAL NUMBER OF PERIODS '
        TYPE *,'         IN WHICH INCOME IS EARNT          '
        ACCEPT *,MNI
C
C       INCOME IS ABLE TO BE INPUT FOR PERIOD 0
C
        DO II=1,MNI
           TYPE *,' '
           TYPE *,'         INCOME INFLOW :',II
           TYPE *,' '
           TYPE *,'         INPUT THE ($) AMOUNT AND PERIOD IN   '
           TYPE *,'            WHICH THE INCOME IS EARNT         '
           TYPE *,'         NOTE : INCOME IS TO BE               '
           TYPE *,'                NET OF EXPENSES               '
           ACCEPT *,INCOM,IID
           INCOME_D(IID)=INCOM
        ENDDO
C
        IN_CUM(0)=INCOME_D(0)
C
        DO III=1,IPERIOD_D
C
           IF(INCOME_D(III).EQ.0)THEN
C
                IN_CUM(III)=IN_CUM(III-1)
C
           ELSE
C
                IN_CUM(III)=IN_CUM(III-1)+INCOME_D(III)
C
           ENDIF
C
        ENDDO
        RETURN
        END
C                                                                       *
C                        END SUBROUTINE INCOME                          *
C***********************************************************************
C                           SUBROUTINE  DEV                             *
```

```
C                                                                       *
      SUBROUTINE DEV(IPERIOD_D,IDEVEL,ID_CUM)
C
      DIMENSION IDEVEL(0:150),ID_CUM(0:150)
C
      IOSTAT=LIB$ERASE_PAGE(1,1)
C
15    TYPE *,' '
      TYPE *,'         **DEVELOPMENT COST DATA**'
      TYPE *,'         ************************'
      TYPE *,'         '
      TYPE *,'         NOTE : DEVELOPMENT COSTS ARE '
      TYPE *,'                INCLUSIVE OF LAND     '
      TYPE *,'         '
      KOUNT_P=0
25    IF(IPERIOD_D.EQ.1)THEN
         TYPE *,' '
         TYPE *,'      INPUT DEVELOPMENT        '
         TYPE *,'      COST FOR PERIOD     0    '
         ACCEPT*,IDEVEL(0)
         ID_CUM(0)=IDEVEL(0)
         TYPE *,'      INPUT DEVELOPMENT        '
         TYPE *,'      COST FOR PERIOD     1    '
         ACCEPT*,IDEVEL(1)
         ID_CUM(1)=IDEVEL(0)+IDEVEL(1)
C        RETURN
      ELSEIF(KOUNT_P.LE.IPERIOD_D)THEN
         TYPE *,' '
         TYPE *,'      INPUT THE DEVEL. COST FOR PERIOD :',KOUNT_P
         ACCEPT *,IDEVC
         TYPE *,' '
         TYPE *,'       INPUT THE NUMBER OF PERIODS '
         TYPE *,'          DEVELOPMENT COST EQUALS:  $ ',IDEVC
         ACCEPT *,MNC
         TYPE *,' '
         IF((KOUNT_P+MNC-1).GT.IPERIOD_D)THEN
            TYPE *,'    ERROR**DEVELOPMENT PERIOD EXCEEDED'
            TYPE *,' '
            TYPE *,'          **RE-INPUT DATA'
            GOTO 15
         ELSE
            DO IDC=KOUNT_P,KOUNT_P+MNC-1
                     IDEVEL(IDC)=IDEVC
            ENDDO
         ENDIF
         KOUNT_P=KOUNT_P+MNC
         IF(KOUNT_P.GT.IPERIOD_D)THEN
              ID_CUM(0)=IDEVEL(0)
              DO IDI=1,IPERIOD_D
                     ID_CUM(IDI)=ID_CUM(IDI-1)+IDEVEL(IDI)
              ENDDO
              RETURN
         ELSE
            GOTO 25
         ENDIF
      ENDIF
      END
C                                                                       *
C                          END SUBROUTINE DEV                           *
C***********************************************************************
C                           SUBROUTINE  MORT                            *
C                                                                       *
      SUBROUTINE MORT(IPERIOD_D,NPER_ANN,MN,IPRINCIPAL,INTEREST,IPRIN_PAY,
     1          IPRIN_IN,IDEVEL,IEQUITY,INCOME_D,IB_INT_P,ITOT_BB,ITOT_BINT,
     2          IB_BOR,BRID,IB_INT_ACT_P,MORTGAGE,LPERIOD,L_B_PER,
```

```
     3          IOPRINCIPAL,IOPRIN_P,IOINTEREST,IPERIOD,IOPRIN_IN,IOP_EQ,
     4          IOPRIN_REP,IPRIN_REP,IE_REP,IREP,IOC_INTEREST,
     5          IOC_PRIN_P,DISC)
C
     DIMENSION IPRINCIPAL(3,150),INTEREST(3,150),IPRIN_PAY(3,150),
     1         IPRIN_IN(3,150),IDEVEL(0:150),IEQUITY(0:150),INCOME_D(0:150),
     2         IB_INT_P(150),ITOT_BINT(150),IB_BOR(0:150),
     3         IB_INT_ACT_P(150),ITOT_BB(0:150),IOPRIN_P(3,50),
     4         IOINTEREST(3,50),
     4         IOPRINCIPAL(3,50),IOP_EQ(0:50),IOPRIN_IN(3,50),
     5         IOPRIN_REP(3,50),IPRIN_REP(3,150),IE_REP(150),IREP(0:50),
     6         IOC_INTEREST(3,50),IOC_PRIN_P(3,50),ITYP_MOR(3)
C
     CHARACTER TYPEM*1,BRID*1,ANSWER*1,ANSWER1*1
     LOGICAL MORTGAGE
C
     IOSTAT=LIB$ERASE_PAGE(1,1)
C
C    PROMPT FOR AND ACCEPT MORTGAGE FINANCE
C
     TYPE *,' '
     TYPE *,'         DOES THE INVESTMENT INVOLVE'
     TYPE *,'         MORTGAGE FINANCE? (Y or N)'
     ACCEPT '(A1)',REPLYM
C
     IF(REPLYM.EQ.'N')THEN
        MN=0
        IOSTAT=LIB$ERASE_PAGE(1,1)
        MORTGAGE=.FALSE.
        TYPE *,' '
        TYPE *,'          DOES THE INVESTMENT INVOLVE '
        TYPE *,'          BRIDGING FINANCE? (Y or N)  '
        ACCEPT '(A1)',BRID
        IF(BRID.EQ.'Y')THEN
           CALL BRIDGE(IPERIOD_D,NPER_ANN,IDEVEL,IEQUITY,INCOME_D,
     3       IB_INT_P,ITOT_BB,ITOT_BINT,IB_BOR,BRID,IB_INT_ACT_P,
     3       MORTGAGE,L_B_PER,IFIR_MORT_1)
        ENDIF
C
        RETURN
     ENDIF
C
     IOSTAT=LIB$ERASE_PAGE(1,1)
C
     TYPE *,' '
     TYPE *,'         MORTGAGE FINANCE DATA'
     TYPE *,'         **********************'
     TYPE *,' '
     TYPE *,'         INPUT THE NUMBER OF MORTGAGES'
     TYPE *,'         TAKEN OVER DEVELOPMENT PERIOD'
     ACCEPT *,MN
C
     WRITE(7,*)' '
     WRITE(7,*)' '
     WRITE(7,*)'      MORTGAGE  INFORMATION (DEVELOPMENT)      '
C
     LPT=0
C
     ITOTAL_PRIN=0
     DO IM=1,MN
        ITYP_MOR(IM)=0
        IOSTAT=LIB$ERASE_PAGE(1,1)
        TYPE *,' '
        TYPE *,'      MORTGAGE :',IM
        TYPE *,' '
```

```
      TYPE *,'     IN WHICH PERIOD IS MORTGAGE',IM,' FINANCE AVAILABLE'
      ACCEPT *,IFIR_MORT
C
      TYPE *,' '
      TYPE*,'      INPUT THE MORTGAGE TYPE :TABLE(T) FLAT(F)'
      ACCEPT '(A1)',TYPEM
      TYPE *,' '
      TYPE *,'     INPUT THE MORTGAGE :PRINCIPAL           '
      TYPE *,'                        :LOAN TERM(YEARS)    '
      TYPE *,'                        :INTEREST(DECIMAL)   '
      ACCEPT *,LPRIN,LTERM,TINT
      ITOTAL_PRIN=ITOTAL_PRIN+LPRIN
      IPRIN_IN(IM,IFIR_MORT)=LPRIN
      TYPE *,' '
      TYPE *,'     INPUT THE NUMBER OF REPAYMENTS PER ANNUM'
      ACCEPT *,L_ANN_REP
      ITOT_PAY=L_ANN_REP*LTERM
      NO_PER_PAY=NPER_ANN/L_ANN_REP
C
      WRITE(7,*)'     ***************************************'
      WRITE(7,*)' '
      WRITE(7,*)'     MORTGAGE                  :  ',IM
      WRITE(7,*)' '
      IF(TYPEM.EQ.'T')THEN
      WRITE(7,*)'     TYPE OF MORTGAGE          :         TABLE'
      ELSE
      WRITE(7,*)'     TYPE OF MORTGAGE          :          FLAT'
      ENDIF
      WRITE(7,*)' '
      WRITE(7,*)'     PRINCIPAL                 : $',LPRIN
      WRITE(7,*)' '
      WRITE(7,*)'     LOAN TERM (YEARS)         :  ',LTERM
      WRITE(7,*)' '
      WRITE(7,*)'     INTEREST  RATE (ANNUAL)   :   ',TINT
      WRITE(7,*)' '
      WRITE(7,*)'     NO. ANNUAL REPAYMENTS     :  ',L_ANN_REP
      WRITE(7,*)' '
      WRITE(7,*)'     PERIOD MORTGAGE INCOMING  :  ',IFIR_MORT
C
         RINT=TINT/L_ANN_REP
C
C     ALTHOUGH TRUE LOAN PERIOD WILL EXCEED THE FOLLOWING
C     MEASURE IE LPERIOD,LPERIOD SIMPLY PREVENTS THE PROGRAM
C     COMPUTING LOAN PAYMENTS PAST THE COMPLETION OF THE
C     OPERATING PERIOD AND HENCE OF NO USE TO THE ANALYSIS
C
      LPERIOD=(IFIR_MORT-1)+IPERIOD_D+((IPERIOD+1)*NPER_ANN)

      IF(LTERM*NPER_ANN.LT.LPERIOD)THEN
            LPERIOD=(IFIR_MORT-1)+LTERM*NPER_ANN
      ELSE
            LPERIOD=LPERIOD
      ENDIF
C
       IF(TYPEM.EQ.'T')THEN !TABLE MORTGAGE
C
          ITYP_MOR(IM)=1
          FACTOR=RINT/(1-(1/((1+RINT)**ITOT_PAY)))
          IPAYMENT=NINT(FACTOR*LPRIN)
C
C     ALLOCATE PRIN. TO ARRAY FOR PERIODS UP TO FIRST PRIN. PAYMENT
C
          DO K1=IFIR_MORT,IFIR_MORT+NO_PER_PAY-1
            IPRINCIPAL(IM,K1)=LPRIN
          ENDDO
```

```
C
            IPBAL=LPRIN
            DO JJ=IFIR_MORT+NO_PER_PAY-1,LPERIOD,NO_PER_PAY
C
               INTEREST(IM,JJ)=NINT(RINT*IPRINCIPAL(IM,JJ))
               IPRIN_PAY(IM,JJ)=IPAYMENT-INTEREST(IM,JJ)
               IPBAL=IPBAL-IPRIN_PAY(IM,JJ)
C
C              NOW ALLOCATE REDUCED PRINCIPAL TO ARRAY POSITIONS
C
               IF(JJ+NO_PER_PAY.LE.LPERIOD)THEN
                      DO K1=JJ+1,JJ+NO_PER_PAY
                             IPRINCIPAL(IM,K1)=IPBAL
                      ENDDO
               ELSE
                      DO K1=JJ+1,LPERIOD
                             IPRINCIPAL(IM,K1)=IPBAL
                      ENDDO
               ENDIF
C
            ENDDO
            IPRINCIPAL(IM,LPERIOD+1)=IPRINCIPAL(IM,LPERIOD)
     1                              -IPRIN_PAY(IM,LPERIOD)
            IF(IPRINCIPAL(IM,LPERIOD+1).LT.0)IPRINCIPAL(IM,LPERIOD+1)=0
C
         ELSE                          !FLAT MORTGAGE
            IPAYMENT=NINT(RINT*LPRIN)
            DO JJ=IFIR_MORT+NO_PER_PAY-1,LPERIOD,NO_PER_PAY
                  INTEREST(IM,JJ)=IPAYMENT
            ENDDO
            DO JJ=IFIR_MORT,LPERIOD+1
                  IPRINCIPAL(IM,JJ)=LPRIN
            ENDDO
         ENDIF
C
C        NOW PROMPT FOR REFINANCING OF FLAT MORTGAGES OVER THE
C        OPERATING PERIOD : ONLY CATER FOR FLAT MORTGAGE REFINANCE
C        AT THIS STAGE
C
            IF(TYPEM.EQ.'F')THEN
               IOSTAT=LIB$ERASE_PAGE(1,1)
               TYPE *,'                                          '
               TYPE *,'  WILL THIS MORTGAGE BE REFINANCED        '
               TYPE *,'         DURING THE INVESTMENT PERIOD     '
               TYPE *,'           (ENTER Y OR N)                 '
               ACCEPT '(A1)',ANSWER
               IF(ANSWER.EQ.'Y')THEN
                  IOSTAT=LIB$ERASE_PAGE(1,1)
                  TYPE *,'
                  TYPE *,'        REFINANCING  DATA : MORTGAGE ',IM
                  TYPE *,'
                  TYPE *,'        WILL THE MORTGAGE BE REFINANCED DURING THE '
                  TYPE *,'                          :DEVELOPMENT PERIOD (D)   '
                  TYPE *,'                          :OPERATING   PERIOD (O)   '
                  TYPE *,'                              (ENTER D OR O)        '
                  ACCEPT '(A1)',ANSWER1
                  IF(ANSWER1.EQ.'D')THEN     !REFINANCED DEVEL. PERIOD
                     IOSTAT=LIB$ERASE_PAGE(1,1)
                     TYPE *,'     REFINANCE DATA : DEVELOPMENT PERIOD'
                     TYPE *,'
                     TYPE *,'     NOTE :REFINANCING ASSUMED TO '
                     TYPE *,'           TAKE PLACE AT BEGINNING'
                     TYPE *,'           OF THE PERIOD SPECIFIED'
                     TYPE *,'     ENTER THE PERIOD IN WHICH    '
                     TYPE *,'     THE MORTGAGE IS REFINANCED   '
```

```
                TYPE *,'     '
                ACCEPT *,IPRE
                TYPE *,'     '
                TYPE *,'     OUTSTANDING PRINCIPAL AT REFINANCE EQUALS $',
     1IPRINCIPAL(IM,IPRE)
          TYPE *,'          '
          TYPE *,'          '
          TYPE *,'          ENTER THE :PRINCIPAL SUM ($)              '
          TYPE *,'                    :NEW INTEREST RATE (ANNUAL)     '
          TYPE *,'                    :NEW LOAN TERM (YEARS)          '
          TYPE *,'                    :NO. OF ANNUAL PAYMENTS         '
          ACCEPT *,LPRIN1,TINT,LTERM,L_ANN_REP
C
     WRITE(7,*)'     '
     WRITE(7,*)'     REFINANCE    DATA           '
     WRITE(7,*)'     '
     WRITE(7,*)'     PERIOD  REFINANCED       :  ',IPRE
     WRITE(7,*)'     '
     WRITE(7,*)'        PRINCIPAL  SUM           : $',LPRIN1
     WRITE(7,*)'     '
     WRITE(7,*)'     NEW ANNUAL INTEREST RATE :   ',TINT
     WRITE(7,*)'     '
     WRITE(7,*)'     NEW  LOAN  TERM          :  ',LTERM
     WRITE(7,*)'     '
     WRITE(7,*)'     NO. ANNUAL PAYMENTS      :  ',L_ANN_REP
          NO_PER_PAY=NPER_ANN/L_ANN_REP
          RINT=TINT/L_ANN_REP
C
C    ALLOCATE ALL OLD INTEREST PAYMENTS TO 0
C
             DO JJ=IPRE,LPERIOD+2 !ARBITRARY HIGH NO.
                INTEREST(IM,JJ)=0
                IPRINCIPAL(IM,JJ)=0
             ENDDO
C
          LPERIOD=IPRE-1+LTERM*NPER_ANN
          IF(IPERIOD_D+IPERIOD*NPER_ANN.LT.LPERIOD)THEN
                LPERIOD=IPERIOD_D+IPERIOD*NPER_ANN
          ENDIF
          IPAYMENT=NINT(RINT*LPRIN1)
C
          DO JJ=IPRE+NO_PER_PAY-1,LPERIOD,NO_PER_PAY
                INTEREST(IM,JJ)=IPAYMENT
          ENDDO
          DO JJ=IPRE,LPERIOD+1
                IPRINCIPAL(IM,JJ)=LPRIN1
          ENDDO
C    IF NEW PRINCIPAL .LT. INITIAL PRIN. THEN THE DIFFERENCE
C    IS COMPRISED AS EQUITY WHICH MUST BE TREATED AS A NORMAL
C    EQUITY INPUT : BECAUSE REFINANCING OCCURS AT THE START OF
C    THE PERIOD,THIS IS EFFECTIVELY THE SAME AS THE END OF THE
C    PREVIOUS PERIOD FOR THE EQUITY INPUT(AS INCOME/EQUITY etc.
C    ARE ASSUMED TO FLOW IN AT THE PERIOD END
C
C    SIMILARLY REPAYMENT OF PRINCIPAL WOULD EFFECTIVELY
C    TAKE PLACE AT THE END OF THE PREVIOUS PERIOD RATHER
C    THAN AT THE END OF THE CURRENT PERIOD UNDER THE
C    ASSUMPTION THAT PAYMENTS ARE MADE AT PERIOD END
C
             IF(LPRIN1.LT.LPRIN)THEN     !DIFFERENCE=EQUITY
                IEQUITY(IPRE)=IEQUITY(IPRE)+(LPRIN-LPRIN1)
                IE_REP(IPRE)=IE_REP(IPRE)+(LPRIN-LPRIN1)
                IPRIN_REP(IM,IPRE)=(LPRIN-LPRIN1)
             ELSE          !REFINANCED A LARGER PRINCIPAL
                IPRIN_IN(IM,IPRE)=IPRIN_IN(IM,IPRE)+(LPRIN1-LPRIN)
```

```
                TYPE *,'     '
                ACCEPT *,IPRE
                TYPE *,'     '
                TYPE *,'     OUTSTANDING PRINCIPAL AT REFINANCE EQUALS $',
     1IPRINCIPAL(IM,IPRE)
                TYPE *,'     '
                TYPE *,'     '
                TYPE *,'     ENTER THE :PRINCIPAL SUM ($)          '
                TYPE *,'               :NEW INTEREST RATE (ANNUAL)  '
                TYPE *,'               :NEW LOAN TERM (YEARS)       '
                TYPE *,'               :NO. OF ANNUAL PAYMENTS      '
                ACCEPT *,LPRIN1,TINT,LTERM,L_ANN_REP
C
      WRITE(7,*)'     '
      WRITE(7,*)'     REFINANCE    DATA          '
      WRITE(7,*)'     '
      WRITE(7,*)'     PERIOD  REFINANCED       :  ',IPRE
      WRITE(7,*)'     '
      WRITE(7,*)'        PRINCIPAL  SUM          : $',LPRIN1
      WRITE(7,*)'     '
      WRITE(7,*)'     NEW ANNUAL INTEREST RATE :   ',TINT
      WRITE(7,*)'     '
      WRITE(7,*)'     NEW  LOAN  TERM          :  ',LTERM
      WRITE(7,*)'     '
      WRITE(7,*)'     NO. ANNUAL PAYMENTS      :  ',L_ANN_REP
                NO_PER_PAY=NPER_ANN/L_ANN_REP
                RINT=TINT/L_ANN_REP
C
C     ALLOCATE ALL OLD INTEREST PAYMENTS TO 0
C
                   DO JJ=IPRE,LPERIOD+2 !ARBITRARY HIGH NO.
                      INTEREST(IM,JJ)=0
                      IPRINCIPAL(IM,JJ)=0
                   ENDDO
C
                LPERIOD=IPRE-1+LTERM*NPER_ANN
                IF(IPERIOD_D+IPERIOD*NPER_ANN.LT.LPERIOD)THEN
                      LPERIOD=IPERIOD_D+IPERIOD*NPER_ANN
                ENDIF
                IPAYMENT=NINT(RINT*LPRIN1)
C
                DO JJ=IPRE+NO_PER_PAY-1,LPERIOD,NO_PER_PAY
                      INTEREST(IM,JJ)=IPAYMENT
                ENDDO
                DO JJ=IPRE,LPERIOD+1
                      IPRINCIPAL(IM,JJ)=LPRIN1
                ENDDO
C     IF NEW PRINCIPAL .LT. INITIAL PRIN. THEN THE DIFFERENCE
C     IS COMPRISED AS EQUITY WHICH MUST BE TREATED AS A NORMAL
C     EQUITY INPUT : BECAUSE REFINANCING OCCURS AT THE START OF
C     THE PERIOD,THIS IS EFFECTIVELY THE SAME AS THE END OF THE
C     PREVIOUS PERIOD FOR THE EQUITY INPUT(AS INCOME/EQUITY etc.
C     ARE ASSUMED TO FLOW IN AT THE PERIOD END
C
C     SIMILARLY REPAYMENT OF PRINCIPAL WOULD EFFECTIVELY
C     TAKE PLACE AT THE END OF THE PREVIOUS PERIOD RATHER
C     THAN AT THE END OF THE CURRENT PERIOD UNDER THE
C     ASSUMPTION THAT PAYMENTS ARE MADE AT PERIOD END
C
                   IF(LPRIN1.LT.LPRIN)THEN     !DIFFERENCE=EQUITY
                      IEQUITY(IPRE)=IEQUITY(IPRE)+(LPRIN-LPRIN1)
                      IE_REP(IPRE)=IE_REP(IPRE)+(LPRIN-LPRIN1)
                      IPRIN_REP(IM,IPRE)=(LPRIN-LPRIN1)
                   ELSE          !REFINANCED A LARGER PRINCIPAL
                      IPRIN_IN(IM,IPRE)=IPRIN_IN(IM,IPRE)+(LPRIN1-LPRIN)
```

```
            ENDDO
C       IF LPRIN1 &LPRIN DIFFER THEN DIFFERENCE EITHER EQUITY
C       OR ADDITIONAL PRINCIPAL INPUT
                IF(LPRIN1.LT.LPRIN)THEN  !EQUITY INPUT
                    IOP_EQ(IYR)=IOP_EQ(IYR)+(LPRIN-LPRIN1)
                    IOPRIN_REP(IM,IYR)=(LPRIN-LPRIN1)
                ELSE       !ADDITIONAL PRINCIPAL BORROWED
                    IOPRIN_IN(IM,IYR)=LPRIN1-LPRIN
                ENDIF
              ENDIF
           ENDIF
        ENDIF
C
C       NOW COMPUTE MORTGAGE PAYMENTS FOR MORTGAGES CARRING OVER TO
C       OPERATING PERIOD
C
           KOUNT=IPERIOD_D
           KSTART=IPERIOD_D+1
           KSTOP=IPERIOD_D+NPER_ANN
           IOPRINCIPAL(IM,1)=IPRINCIPAL(IM,IPERIOD_D+1)
           DIRM=DISC**(1./NPER_ANN)
           IF(IOPRINCIPAL(IM,1).GT.0)THEN
C
                DO I11=1,IPERIOD+1 !+1 TO ENABLE REP. PEN. TO BE
                   IIINT=0         !COMPUTED FOR LAST YEAR FOR
                   IPPP=0          !TABLE MORTGAGES
                   IIINTC=0
                   IPPPC=0
                   DO I1=KSTART,KSTOP
                        IIINT=IIINT+INTEREST(IM,I1)
                        IPPP=IPPP+IPRIN_PAY(IM,I1)
                        IIINTC=IIINTC+(INTEREST(IM,I1)*DIRM**(KSTOP-I1))
                        IPPPC=IPPPC+(IPRIN_PAY(IM,I1)*DIRM**(KSTOP-I1))
                   ENDDO
                   IOINTEREST(IM,I11)=IIINT
                   IOPRIN_P(IM,I11)=IOPRIN_P(IM,I11)+IPPP
                   IOC_INTEREST(IM,I11)=IIINTC
                   IOC_PRIN_P(IM,I11)=IPPPC
                   IOPRINCIPAL(IM,I11+1)=IOPRINCIPAL(IM,I11)-IPPP-
     1                  IOPRIN_REP(IM,I11+1)+IOPRIN_IN(IM,I11+1)
C
C       SIMPLY ALLOCATE TO 0 ALL PRINCIPAL BALANCES FOR OPERATING
C       PERIOD AFTER THE PERIOD FOLLOWING THE COMPLETION OF A
C       FLAT MORTGAGE
C
                   IF(IOINTEREST(IM,I11).LE.0)THEN
                        IOPRINCIPAL(IM,I11+1)=0
                   ENDIF
                   IF(IOPRINCIPAL(IM,I11).LT.0)IOPRINCIPAL(IM,I11)=0
                   IF(IOPRINCIPAL(IM,I11+1).LT.0)IOPRINCIPAL(IM,I11+1)=0
                   KSTART=KSTOP+1
                   KSTOP=KSTART+NPER_ANN-1
                   KOUNT=KOUNT+NPER_ANN
              ENDDO
           ENDIF
           IF(LPERIOD.GT.LPT)LPT=LPERIOD
        ENDDO
C
C       NOW ALLOCATE REPAYMENT EXPENSES APPLICABLE FOR EACH YEAR
C
        IOSTAT=LIB$ERASE_PAGE(1,1)
        TYPE *,'         MORTGAGE EARLY REPAYMENT PENALTY'
        TYPE *,'         '
        TYPE *,'         SELECT THE METHOD OF INCLUDING'
        TYPE *,'         EARLY REPAYMENT PENALTY        '
```

```
      TYPE *,'          '
      TYPE *,'           1. NO REPAYMENT PENALTY                    '
      TYPE *,'          '
      TYPE *,'           2. STANDARD (MONTHLY) INTEREST PENALTY     '
      TYPE *,'          '
      TYPE *,'           3. USER INPUT ($) PENALTY                  '
      TYPE *,'          '
      ACCEPT *,METHR
C
      IF(METHR.EQ.1)THEN
              DO IR=0,IPERIOD
                      IREP(IR)=0
              ENDDO
      ELSEIF(METHR.EQ.2)THEN
              IOSTAT=LIB$ERASE_PAGE(1,1)
              TYPE *,'          STANDARD PENALTY = THREE MONTHS INTEREST'
              TYPE *,'          '
              TYPE *,'          ENTER THE NUMBER OF MONTHS PENALTY       '
              ACCEPT *,LPEN_DUR
C
C     FIRSTLY COMPUTE PENALTY FOR YEAR 0

              DO IM=1,MN
                 IF(ITYP_MOR(IM).EQ.1)THEN    !TABLE MORT AND INT OK
                      IREPP=IREPP+IOINTEREST(IM,1)/12*LPEN_DUR
                 ELSE                         !FLAT MORTGAGE
C     FLAT MORTGAGE WHICH MAY HAVE BEEN REFINANCED : REFINANCED
C     INTEREST NOT APPLICABLE THEREFORE...
                      DO IJ=IPERIOD_D,IPERIOD_D-NPER_ANN+1,-1
                         INTR=INTR+INTEREST(IM,IJ)
                      ENDDO
                      IREPP=IREPP+INTR/12*LPEN_DUR
                 ENDIF
              ENDDO
              TYPE *,'          IF MORTGAGE AVAILABLE OR                 '
              TYPE *,'          REFINANCED AT LEAST ONE YEAR             '
              TYPE *,'          PRIOR TO DEVELOPMENT PERIOD              '
              TYPE *,'          END,THEN REPAYMENT PENALTY               '
              TYPE *,'          FOR DEVELOPMENT PERIOD END EQUALS $ ',IREPP
              TYPE *,'          '
              TYPE *,'          IS THIS AMOUNT CORRECT   (Y OR N)        '
              ACCEPT '(A1)',ANSWER
              IF(ANSWER.EQ.'Y')THEN
                 IREP(0)=IREPP
              ELSE
                 TYPE *,'       '
                 TYPE *,'       INPUT THE REPAYMENT PENALTY FOR YEAR 0 '
                 ACCEPT *,IREP(0)
              ENDIF
C     NOW REMAINING YEARS
C     MUST ENSURE THAT DO NOT INCLUDE NEXT PERIODS REFINANCING IN THE
C     COMPUTATION OF REPAYMENT PENALTY : LOGIC IS AS FOLLOWS
C             IF NEXT 'YEARS' IOPRIN_P IS NOT GREATER THAN 0
C             THEN THE MOFTGAGE IS TABLE AND INTEREST FOR NEXT
C             YEAR IS APPLICABLE
C             ELSE MORTGAGE IS FLAT AND CURRENT YEARS INTEREST
C             CAN BE USED AS IT DOES NOT INCLUDE REFINANCE
C             IF IOPRIN_P =0 AND MORTGAGE IS TABLE THEN THIS
C             INDICATES MORTGAGE FULLY AMORTISED BY YEAR END
C
              DO IR=1,IPERIOD
                      IREPP=0
                      DO IM=1,MN
                        IF(ITYP_MOR(IM).EQ.1)THEN !TABLE MORT.
                           IREPP=IREPP+IOINTEREST(IM,IR+1)/12*LPEN_DUR
```

```
                        ELSE                          !FLAT MORT.
                           IREPP=IREPP+IOINTEREST(IM,IR)/12*LPEN_DUR
                        ENDIF
                     ENDDO
                     IREP(IR)=IREPP
               ENDDO
         ELSEIF(METHR.EQ.3)THEN
               IOSTAT=LIB$ERASE_PAGE(1,1)
               TYPE *,'        NOTE : THERE ARE A TOTAL OF',MN,' MORTGAGES'
               TYPE *,'             '
               DO IR=0,IPERIOD
                     TYPE *,'         INPUT THE REPAYMENT PENALTY '
                     TYPE *,'         FOR ALL MORTGAGES FOR YEAR  ',IR
                     TYPE *,'                                     '
                     ACCEPT *,IREP(IR)
                     TYPE *,'                                     '
               ENDDO
         ENDIF
C
         IOSTAT=LIB$ERASE_PAGE(1,1)
         TYPE *,'         DOES THE INVESTMENT INVOLVE '
         TYPE *,'         BRIDGING FINANCE? (Y or N)  '
         ACCEPT '(A1)',BRID
         IF(BRID.EQ.'Y')THEN
            CALL BRIDGE(IPERIOD_D,NPER_ANN,IDEVEL,IEQUITY,INCOME_D,
         3       IB_INT_P,ITOT_BB,ITOT_BINT,IB_BOR,BRID,IB_INT_ACT_P,
         4       MORTGAGE,L_B_PER,IFIR_MORT_1)
         ENDIF

         RETURN
         END
C                                                                              *
C                        END SUBROUTINE MORT                                   *
C*******************************************************************************
C                         SUBROUTINE BRIDGE                                    *
C                                                                              *
         SUBROUTINE BRIDGE(IPERIOD_D,NPER_ANN,IDEVEL,IEQUITY,INCOME_D,
         1          IB_INT_P,ITOT_BB,ITOT_BINT,IB_BOR,BRID,IB_INT_ACT_P,
         2          MORTGAGE,L_B_PER,IFIR_MORT_1)
C
         DIMENSION IDEVEL(0:150),IEQUITY(0:150),INCOME_D(0:150),IB_INT_P(150),
         1         ITOT_BINT(150),IB_BOR(0:150),IB_INT_ACT_P(150),
         1         ITOT_BB(0:150)
C
         CHARACTER BRID*1
         LOGICAL MORTGAGE
C
         IOSTAT=LIB$ERASE_PAGE(1,1)
C
         TYPE *,'  '
         TYPE *,'         **BRIDGING FINANCE DATA**'
         TYPE *,'  '
         TYPE *,'         INPUT THE MAXIMUM ($) AMOUNT'
         TYPE *,'         OF BRIDGING FINANCE AVAILABLE'
         ACCEPT *,IB_MAX
         TYPE *,'  '
         TYPE *,'         INPUT THE ANNUAL INTEREST RATE (DECIMAL)'
         ACCEPT *,BINT
         TYPE *,'  '
         TYPE *,'         INPUT THE EARLIEST PERIOD'
         TYPE *,'         BRIDGING FINANCE IS AVAILABLE'
         ACCEPT *,IB_EARLY
         TYPE *,'  '
         TYPE *,'         INPUT THE PERIOD BRIDGING   '
         TYPE *,'         FINANCE MUST BE REPAID      '
```

```
      ACCEPT *,IB_P_MAX
C
      WRITE(7,*)'        ****************************************'
      WRITE(7,*)'     BRIDGING  FINANCE DATA'
      WRITE(7,*)' '
      WRITE(7,*)'     MAXIMUM ($) AVAILABLE          :',IB_MAX
      WRITE(7,*)' '
      WRITE(7,*)'     INTEREST  RATE (ANNUAL)        : ',BINT
      WRITE(7,*)' '
      WRITE(7,*)'     EARLIEST PERIOD AVAILABLE      :',IB_EARLY
      WRITE(7,*)' '
      WRITE(7,*)'     PERIOD   B.F.  REPAID          :',IB_P_MAX
C
      IF(MORTGAGE)THEN
         IFIR_MORT_1=IFIR_MORT_1
      ELSE
         IFIR_MORT_1=IB_P_MAX
      ENDIF
C
      RINTB=BINT/NPER_ANN
C
      IF(IB_P_MAX.GT.IPERIOD_D)THEN
         L_B_PER=IPERIOD_D
      ELSE
         L_B_PER=IB_P_MAX
      ENDIF
C
      ITOT_BB(0)=0
      ICASH_BAL=0
      LEFT_B=IB_MAX
C
C     IEQUITY(IIB) NOT ABLE TO CONTAIN AN EQUITY INPUT VIA REFINANCING
C
      DO IIB=0,L_B_PER
C
            ICASH_BAL=ICASH_BAL+IEQUITY(IIB)+INCOME_D(IIB)
     1                -IDEVEL(IIB)
C
        IF(IIB.GE.IB_EARLY)THEN
C
          IF(ICASH_BAL.LT.0)THEN
C
            IF(LEFT_B.GT.0)THEN
C
              IF(LEFT_B.GT.-(ICASH_BAL))THEN
                 IB_BOR(IIB)=-ICASH_BAL
              ELSE
                 IB_BOR(IIB)=LEFT_B
              ENDIF
C
              LEFT_B=LEFT_B-IB_BOR(IIB)
              IB_INT_P(IIB)=ITOT_BB(IIB-1)*RINTB
              ITOT_BINT(IIB)=ITOT_BINT(IIB-1)+IB_INT_P(IIB)
              ITOT_BB(IIB)=ITOT_BB(IIB-1)+IB_BOR(IIB)+IB_INT_P(IIB)
C
            ELSE
              DO ICB=IIB,IB_P_MAX
                 IB_BOR(ICB)=0
                 IB_INT_P(ICB)=ITOT_BB(ICB-1)*RINTB
                 ITOT_BINT(ICB)=ITOT_BINT(ICB-1)+IB_INT_P(ICB)
                 ITOT_BB(ICB)=ITOT_BB(ICB-1)+IB_INT_P(ICB)
              ENDDO
              GOTO 5000   !NO BRID. FIN. LEFT
            ENDIF
C
```

```
            ELSE
C
                IB_BOR(IIB)=0
                IB_INT_P(IIB)=ITOT_BB(IIB-1)*RINTB
                ITOT_BINT(IIB)=ITOT_BINT(IIB-1)+IB_INT_P(IIB)
                ITOT_BB(IIB)=ITOT_BB(IIB-1)+IB_INT_P(ITB)
C
            ENDIF
C
          ENDIF
C
          ICASH_BAL=ICASH_BAL+IB_BOR(IIB)
C
        ENDDO
C
C       THEORETICALLY WILL NOT BORROW THE FINAL PERIOD
C       BRIDGING FINANCE AS BORROW THE B.F. ON LAST DAY
C       OF PERIOD AND THE INCOMING MORTGAGE/INCOME/EQUITY etc.
C       WILL COVER THE CASH DEFICIT;NOTE MORTGAGE WILL
C       BE INCOMING ON FIRST DAY OF THE NEXT PERIOD AND
C       THIS IS EFFECTIVELY THE SAME AS THE LAST DAY OF THE CURRENT PERIOD
C
5000    ITOT_BB(IB_P_MAX)=ITOT_BB(IB_P_MAX)-IB_BOR(IB_P_MAX)
        IB_BOR(IB_P_MAX)=0
C
        IB_INT_ACT_P(IB_P_MAX)=ITOT_BB(IB_P_MAX)
C
        RETURN
        END
C                                                                              *
C                     END SUBROUTINE BRIDGE                                    *
C                     ---------------------                                    *
C                                                                              *
C                      PROGRAM        ENDS                                     *
C            ********************************************                      *
C                                                                              *
C******************************************************************************
```

APPENDIX 3

Model Evaluation Examples

The following two examples examine the accuracy of the computations and results provided by the investment model. They compare the model output against manually computed results for two individual property investments. Example one provides a comparison of results for an investment involving the purchase of an existing parcel of real estate. Example two provides an evaluation of the results provided by the model for an investment involving the development of an urban property.

Chapter four provides a full discussion on the relationships and methods underlying the computation of the items outlined below.

EXAMPLE ONE : PROPERTY PURCHASE

The following data represent the property purchase details, the operating period and investment liquidation data for investment example one.

-purchase price	$ 475000	
-estimated land value	$ 127000	
-initial equity input	$ 225000	
-initial mortgage finance	$ 250000	(refer below)
-investors marginal tax rate	45 %	
-investors required rate of return	17 %	
-analysis term	6 years	

-mortgage data : Mortgage One

-table, $ 150000, 20 years, 15 % p.a.
-two annual repayments.

: Mortgage Two

-flat, $ 100000, 3 years, 15 % p.a.
-four annual payments.
-refinanced year four
($ 130000, 10 years, 15 % p.a., four pay. p.a.).

-capital improvements :

- $ 30000 year four, financed by mortgage capital, improvement increases the potential sale price of the property (as at the start of the year).

-potential gross income :

- years 1-3 $ 65200
- years 4-6 $ 79500
- rental paid monthly in advance.

-occupancy rate 90 %

-operating expense ratio 12 %
(operating expenses paid every two months in arrears).

-depreciation -no "increased" first year allowance.
-no accelerated allowance.
-ordinary depreciation, cost price basis, 2.5 % pa.

-selling expenses consist of legal fees only, at scale rates.

-repayment penalty consists of three months interest charge.

-property value trend estimate, 7 % compound appreciation p.a..

1. Gross Income Nominal potential gross income for each year is outlined above. The following computations examine the routine developed within the model for converting annual nominal gross income to an equivalent year end (Y.E.E.) income figure. The manual computations for operating year one are illustrated as an example below.

Example : Operating year one.

Nominal Income $ 65200/12 = 5433 paid monthly in advance.

Investors compound factor (at 17 %)

= (((1.17)**(1./12))**N)

= (1.0131696)**N

where N = number of months compound

Month	Nominal	Factor	Y.E.E
1	5433	1.16999	6356
2	5433	1.15479	6274
3	5433	1.13978	6191
4	5433	1.12496	6112
5	5433	1.11034	6032
6	5433	1.09591	5953
7	5433	1.08166	5877
8	5433	1.06760	5800
9	5433	1.05372	5724
10	5433	1.04003	5650
11	5433	1.02651	5576
12	5433	1.01369	5504
	Nominal $ 65200	Year End Equivalent $ 71049	

Gross income comparison : Model/manual year end equivalent computations.

Operating Year	Nominal	Manual	Model Output
1	65200	71049	71049
2	65200	71049	71049
3	65200	71049	71049
4	79500	86640	86640
5	79500	86640	86640
6	79500	86640	86640

Correct.

This comparison indicates that the section of the model computing, for each operating year, the year end equivalent gross income figure is programmed and performing as intended. Each of the various methods of inputing nominal gross income into the model were tested. In each case the nominal and year end equivalent gross income figures were accepted and/or computed correctly by the model.

2. Effective Gross Income (E.G.I.)

Year	Pot. Gross Income		Occ.	Effective Gross Income			
				Manual		Model	
	Nominal	Y.E.E.	Rate	Nominal	Y.E.E.	Nominal	Y.E.E
1	65200	71049	.9	58680	63944	58680	63944
2	65200	71049	.9	58680	63944	58680	63944
3	65200	71049	.9	58680	63944	58680	63944
4	79500	86640	.9	71550	77976	71550	77976
5	79500	86640	.9	71550	77976	71550	77976
6	79500	86640	.9	71550	77976	71550	77976

Correct.

3. Operating Expenses (OP. EXP.)

Nominal.

Year	Effective Gross Income	Operating Expense Ratio	Operating Expenses	
			Manual	Model
1	58680	.12	7042	7042
2	58680	.12	7042	7042
3	58680	.12	7042	7042
4	71550	.12	8586	8586
5	71550	.12	8586	8586
6	71550	.12	8586	8586

Correct.

Year End Equivalent.

The following computations illustrate the procedure used to compute annual operating expenses as an equivalent year end sum. Operating year one provides an example illustration. Note : Operating expenses are paid every second month in arrears.

Operating year one : compound rate = (((1.17)**(1./6))**N).

= (1.0265127)**N

where N = number of months compound.

: $ 7042/6 = $ 1173 every second month in arrears.

Payment	Nominal	Factor	Year End Equivalent
1	1173	1.13978	1336
2	1173	1.11034	1302
3	1173	1.08166	1268
4	1173	1.05372	1236
5	1173	1.02651	1204
6	1173	1.00000	1173
	----		----
Nominal $ 7042		Year End Equivalent $ 7519	

Comparison : Manual verses model Y.E.E. operating expense figures.

Year	Year End Equivalent	
	Manual	Model
1	7519	7519
2	7519	7519
3	7519	7519
4	9172	9172
5	9172	9172
6	9172	9172

Correct.

4. Net Operating Income (N.O.I.)

Nominal.

Year	E.G.I.	Op. Exp.	Net Operating Income	
			Manual	Model
1	58680	7042	51638	51638
2	58680	7042	51638	51638
3	58680	7042	51638	51638
4	71550	8586	62964	62964
5	71550	8586	62964	62964
6	71550	8586	62964	62964

Correct.

Year end equivalent.

Year	E.G.I.	Op. Exp.	Net Operating Income	
			Manual	Model
1	63944	7519	56425	56425
2	63944	7519	56425	56425
3	63944	7519	56425	56425
4	77976	9172	68804	68804
5	77976	9172	68804	68804
6	77976	9172	68804	68804

Correct.

5. Debt Servicing

Mortgage One : Table, $ 150000, 20 years, 15 % p.a., 2 repayments p.a..

-periodic interest .15/2 = 7.5 %

-total repayment "periods", 20 * 2 = 40

-factor = (.075/(1-((1./(1.075**40))))

= .0794003

-periodic payment .0794003 * $ 150000 = $ 11910 semi-anually in arrears.

-interest portion of periodic payment equals outstanding principal * periodic interest rate (.075).

Manual computations : Operating period repayment schedule.

Year	Payment	Outstanding Principal	Interest Payment	Principal Payment	Total Payment	Annual Payment
1	1	150000	11250	660	11910	
	2	149340	11201	709	11910	
			22451	1369		23820
2	1	148631	11147	763	11910	
	2	147868	11090	820	11910	
			22237	1583		23820
3	1	147048	11029	881	11910	
	2	146166	10963	947	11910	
			21992	1828		23820
4	1	145220	10892	1018	11910	
	2	144202	10815	1095	11910	
			21707	2113		23820
5	1	143107	10733	1177	11910	
	2	141930	10645	1265	11910	
			21378	2442		23820
6	1	140665	10550	1360	11910	
	2	139305	10448	1462	11910	
			20998	2822		23820

Outstanding principal $ 137843 (139305-1462)

Summary Mortgage One.

Year	Annual Int.	Annual Prin.	Cummulative Principal	Total Annual Payment	Outstanding Mortgage Balance
1	22451	1369	1369	23820	148631
2	22237	1583	2952	23820	147048
3	21992	1828	4780	23820	145220
4	21707	2113	6893	23820	143107
5	21378	2442	9335	23820	140665
6	20998	2822	12157	23820	137843

Mortgage Two : Flat, $ 100000, 15 % p.a., 3 years, 4 repayments p.a., refinanced year four to $ 130000, 15 % p.a.,10 years, 4 repayments p.a..

Periodic interest payment .15/4 = .0375, .0375 * 100000 = 3750

Upon refinance .15/4 = .0375, .0375 * 130000 = 4875

Operating period mortgage repayment schedule : Mortgage Two

Year	Payment	Outstanding Principal	Interest Payment	Annual Payment
1	1	100000	3750	
	2	100000	3750	
	3	100000	3750	
	4	100000	3750	
				15000
2	1	100000	3750	
	2	100000	3750	
	3	100000	3750	
	4	100000	3750	
				15000
3	1	100000	3750	
	2	100000	3750	
	3	100000	3750	
	4	100000	3750	
				15000
4	1	130000	4875	
	2	130000	4875	
	3	130000	4875	
	4	130000	4875	
				19500
5	1	130000	4875	
	2	130000	4875	
	3	130000	4875	
	4	130000	4875	
				19500
6	1	130000	4875	
	2	130000	4875	
	3	130000	4875	
	4	130000	4875	
				19500

Summary Mortgage Two.

Year	Annual Interest	Total Annual Payment	Outstanding Mortgage Balance
1	15000	15000	100000
2	15000	15000	100000
3	15000	15000	100000
4	19500	19500	130000
5	19500	19500	130000
6	19500	19500	130000

Outstanding principal $ 130000.

Summary Total Annual Debt Service.

Year	Mortgage One			Mortgage Two		Total Debt Service			
	Ann. Int.	Ann. Prin.	Outst. Prin.	Ann. Int.	Out. Mort.	Int. Pay.	Prin. Pay.	Tot. Ann. Pay.	Out. Mort. Bal.
1	22451	1369	148631	15000	100000	37451	1369	38820	248631
2	22237	1583	147048	15000	100000	37237	1583	38820	247048
3	21992	1828	145220	15000	100000	36992	1828	38820	245220
4	21707	2113	143107	19500	130000	41207	2113	43320	273107
5	21378	2442	140665	19500	130000	40878	2442	43320	270665
6	20998	2822	137843	19500	130000	40498	2822	43320	267843

Comparison : Manual verses model debt service computations.

Year	Annual Interest Payment		Annual Principal Payment		Total Debt Service		Outst. Mortgage Balance	
	Manual	Model	Manual	Model	Manual	Model	Manual	Model
1	37451	37451	1369	1369	38820	38820	248631	248631
2	37237	37237	1583	1583	38820	38820	247048	247048
3	36992	36992	1828	1828	38820	38820	245220	245220
4	41207	41207	2113	2113	43320	43320	273107	273107
5	40878	40878	2442	2442	43320	43320	270665	270665
6	40498	40498	2822	2822	43320	43320	267843	267843

Correct.

Various combinations of mortgage parameters (for up to three separate mortgages) were submitted to the model. A comparison of the repayment schedules produced by the model against those computed manually, indicated the mortgage finance section of the model was programmed and performing as intended. This procedure was carried out for both property purchase and property development investments.

The present value analysis provided by the model requires, for each operating year, a year end equivalent total annual debt service figure to be computed. This involves compounding to the year end, the periodic installments made over the year for each mortgage. The following computations illustrate the procedure used to produce an equivalent year end debt service figure; operating year one is used as an example.

Operating year one.

Mortgage One : (refer above for repayment schedule computations).

: periodic payment = $ 11910 semi-annually in arrears.

: compound rate = ((1.17)**(1./2)**N).

= (1.0816654)**N

where N = number of "periods" compound.

Payment No.	Payment $	Compound Factor	Year End Equivalent $
1	11910	(1.0816654)**1	12882
2	11910	(1.0816654)**0	11910
	-----		-----
Nominal $	23820	Year End Equivalent $	24792

Mortgage Two : (refer above for repayment schedule computations).

: periodic payment = $ 3750 paid quarterly in arrears.

: compound factor = ((1.17)**(1./4)**N)

= (1.0400314)**N

Payment No.	Payment $	Compound Factor	Year End Equivalent $
1	3750	(1.0400314)**3	4218
2	3750	(1.0400314)**2	4055
3	3750	(1.0400314)**1	3900
4	3750	(1.0400314)**0	3750
	----		----
Nominal $	15000	Year End Equivalent $	15923

Total year end equivalent (operating year one).

Mortgage One		24792
Mortgage Two		15923

Total	$	40715

Comparision : Manual verses model computations.

Year	Nominal Debt Service	Year End Equivalent Manual	Model
1	38820	40715	40715
2	38820	40715	40715
3	38820	40715	40715
4	43320	45494	45494
5	43320	45494	45494
6	43320	45494	45494

Correct.

6. Cash Throw off to Equity. (C.T.O.E.) The analysis computes this item in both nominal and year end equivalent dollar terms.

Nominal.

Year	NOI	Total Annual Debt Service	Nominal C.T.O.E. Manual	Model
1	51638	38820	12818	12818
2	51638	38820	12818	12818
3	51638	38820	12818	12818
4	62964	43320	19644	19644
5	62964	43320	19644	19644
6	62964	43320	19644	19644

Correct.

Year End Equivalent.

Year	NOI	Y.E.E. Annual Debt Service	Y.E.E. Manual	C.T.O.E. Model
1	56425	40715	15710	15710
2	56425	40715	15710	15710
3	56425	40715	15710	15710
4	68804	45494	23310	23310
5	68804	45494	23310	23310
6	68804	45494	23310	23310

Correct.

7. Capital Improvements. The model correctly incorporates and records the single capital improvement made to this example property; $ 30000 at the start of year four, financed by mortgage capital, improvement increases the value of the property as at the year start; the value added by the improvement appreciates over the year along with the rest of the property.

Various methods of financing capital improvements were tested. In situations where improvements were financed by equity capital, the model correctly increases the equity invested in the project by the amount of the improvement and discounts this to derive the present value of the equity input to the investment.

8. Depreciation Allowance.

Method : cost price.
: 2.5 % p.a..
: historical cost of the structure = $348000 (475000-127000) increased by $ 30000 in year four.

Year	Cost Price	Rate	Annual Depreciation Manual	Model
1	348000	.025	8700	8700
2	348000	.025	8700	8700
3	348000	.025	8700	8700
4	378000	.025	9450	9450
5	378000	.025	9450	9450
6	378000	.025	9450	9450

Correct.

Each of the methods of computing annual depreciation were tested. For each set of input data, the output provided by the model conformed to results computed manually.

9. Book Value of the Structure.

Year	Book Value Open Manual	Model	Annual Depn.	Book Value Close Manual	Model
1	348000	348000	8700	339300	339300
2	339300	339300	8700	330600	330600
3	330600	330600	8700	321900	321900
	(321900+30000 = 351900)				
4	351900	351900	9450	342450	342450
5	342450	342450	9450	333000	333000
6	333000	333000	9450	323550	323550

Correct.

10. Sum Tax Deductibles. Normal operating expenses have been previously included as an expense in deriving net operating income for each operating year; the sum of the tax deductible items is therefore able to include annual depreciation and any interest on mortgage capital that is able to be claimed. This example investment is able to claim interest as a tax deducible expense.

Year	Annual Interest	Annual Depreciation	Sum Tax Deductibles Manual	Model
1	37451	8700	46151	46151
2	37237	8700	45937	45937
3	36992	8700	45692	45692
4	41207	9450	50657	50657
5	40878	9450	50328	50328
6	40498	9450	49948	49948

Correct.

11. Taxable Income. Taxable income is computed by deducting the sum of the tax deductible items from the net operating income generated in each operating year, using nominal dollar values for these items.

Year	NOI	Sum Tax Deductibles	Taxable Income Manual	Model
1	51638	46151	5487	5487
2	51638	45937	5701	5701
3	51638	45692	5946	5946
4	62964	50657	12307	12307
5	62964	50328	12636	12636
6	62964	49948	13016	13016

Correct.

12. Income Tax/Tax Shelter. Taxable income is positive for each of the six operating years. The investment is therefore liable for income tax in each of these years. The investors marginal tax rate is 45 %.

Year	Taxable Income	Tax Rate	Income Tax Manual	Income Tax Model	Tax Shelter Manual	Tax Shelter Model
1	5487	.45	2469	2469	0	0
2	5701	.45	2565	2565	0	0
3	5946	.45	2675	2675	0	0
4	12307	.45	5538	5538	0	0
5	12636	.45	5686	5686	0	0
6	13016	.45	5857	5857	0	0

Correct.

Data representing a hypothetical investment which generated tax shelter in the early years of the investment's life were run through the model in an attempt to check the accuracy of the tax shelter computations. A comparison of the computations and results provided by the model, with the results derived manually, indicated the model correctly computes annual tax shelter for each year in which taxable income is negative.

13. After Tax Cash Flow. (A.T.C.F.) The after tax cash flow is computed by combining C.T.O.E. with income tax/tax shelter for each operating year.

Year	Nominal C.T.O.E.	Income Tax/ Tax Shelter	Nominal A.T.C.F. Manual	Model
1	12818	(2469)	10349	10349
2	12818	(2565)	10253	10253
3	12818	(2675)	10143	10143
4	19644	(5538)	14106	14106
5	19644	(5686)	13958	13958
6	19644	(5857)	13787	13787

Correct.

The discounting procedure incorporated within the model, requires the A.T.C.F. figure to be computed as a year end equivalent sum for each operating year. The following table illustrates the comparison of the Y.E.E. sum computed manually against the sum calculated by the model.

Note : Income tax/tax shelter are assessed at the year end.

Year	Y.E.E. C.T.O.E.	Income Tax/ Tax Shelter	Y.E.E. A.T.C.F. Manual	Model
1	15710	(2469)	13241	13241
2	15710	(2565)	13145	13145
3	15710	(2675)	13035	13035
4	23310	(5538)	17772	17772
5	23310	(5686)	17624	17624
6	23310	(5857)	17453	17453

Correct.

14. Discounted After Tax Cash Flow. (Disc. A.T.C.F.) The following table illustrates the comparison of the discounted A.T.C.F. (as at the beginning of the investment), for each operating year.

Discount factor = (1./(1.17)**N)
= (.8547006)**N
where = number of years of discount.

Year	Disc. Factor	Y.E.E. A.T.C.F.	Disc. A.T.C.F. Manual	Model
1	(.8547006)**1	13241	11317	11317
2	(.8547006)**2	13145	9602	9602
3	(.8547006)**3	13035	8138	8138
4	(.8547006)**4	17772	9484	9484
5	(.8547006)**5	17624	8038	8038
6	(.8547006)**6	17453	6803	6803

Correct.

15. Disc. A.T.C.F/Present Value Equity. The investment used for this evaluation example involves a single equity input ($ 225000). Because it is invested at the start of the investment period, this sum represents both the nominal and the present value of the total equity invested over the entire investment period.

Year	Disc. A.T.C.F.	P.V. Equity	Disc. A.T.C.F./P.V. Equity Manual	Model
1	11317	225000	.050	.050
2	9602	225000	.043	.043
3	8138	225000	.036	.036
4	9484	225000	.042	.042
5	8038	225000	.036	.036
6	6803	225000	.030	.030

Correct.

16. Cummulative Disc. A.T.C.F.

Year	Disc. A.T.C.F.	Cummulative Disc. A.T.C.F Manual	Model
1	11317	11317	11317
2	9602	20919	20919
3	8138	29057	29057
4	9484	38541	38541
5	8038	46579	46579
6	6803	53382	53382

Correct.

In each of the above tests, the results provided by the model conform to those computed manually.

Example one continued.

Investment Liquidation Section

17. Estimated Selling Price. The annual appreciation rate for the example investment has been estimated to be 7 % compound. The following table illustrates a comparison of the selling price computed by the model for each year of the operating period, against the estimate of the sale price computed manually.

Note : capital improvement ($ 30000) added at the start of year four.
: initial property value = $ 475000.
: compound factor = (1.07)**N
where N = number of years compound.

Year	Previous Years Selling Price	Appreciation Rate	Estimated Selling Price Manual	Model
1	475000	1.07	508250	508250
2	508250	1.07	543827	543827
3	543827	1.07	581894	581894
4	581894			
	+ 30000	(capital improvement)		
	611894	1.07	654726	654726
5	654726	1.07	700556	700556
6	700556	1.07	749594	749594

Correct.

The various methods of incorporating the estimated sale price for each operating year end were tested. In each case the model correctly accepted or computed the sale price estimate. Estimates computed by the model under annual depreciation and stable market conditions conformed to those computed manually.

18. Selling Expenses. The expenses incurred in the sale of the example property comprise legal expenses only. The following scale rates apply to the consideration paid for the property.

Under	$ 50000	Nil
First	$ 50000	1.0 %
Next	$ 50000	1.5 %
Balance Above	$ 100000	2.0 %

Example : Operating year one, sale price = $ 508250

: 50000	* .01	=	500
: 50000	* .015	=	750
:(508250 - 100000)	* .02	=	8165

	Selling Expenses	$	9415

The following table contrasts the manually computed expenses with those produced by the model.

Year	Sale Price	Selling Expenses	
		Manual	Model
1	508250	9415	9415
2	543827	10126	10126
3	581894	10887	10887
4	654726	12344	12344
5	700556	13261	13261
6	749594	14241	14241

Correct.

The selling expense figures developed within the model were compared to manually calculated figures for each combination of selling expenses that are possible, ie real estate commission only, legal fees only, commission and legal fees. In each case, the model provided an accurate

selling expense figure. Where selling expenses were input by the analyst as a lump sum figure, the model correctly accepted and incorporated the figure in the overall analysis.

19. Repayment Penalty. The early repayment of mortgage finance with respect to this particular investment incurs a penalty of three months interest charge. It should be noted that the penalty is computed on the interest that would have been paid had the mortgage not been repaid, ie it is computed on the following year's interest. The computations take no account of interest payment changes which result from mortgage refinance in the following year; obviously refinance would not take place if the mortgage is repaid.

Year	Following Years Interest		Early repayment Penalty Manual	Model
1	37237 /12 * 3	=	9309	9309
2	36992 /12 * 3	=	9246	9246
3	41207			
	less 4500 (30000 * .15, ie interest resulting from refinance)			
	36707 /12 * 3	=	9174	9174
4	40878 /12 * 3	=	10218	10218
5	40498 /12 * 3	=	10122	10122
6	40058 /12 * 3	=	10014	10014

Correct.

The model correctly recorded and incorporated the annual repayment penalty where a single lump ($) sum input by the analyst represented the early repayment penalty on mortgage finance for each operating year.

20. Amount Realised on Sale. (A. R. O. S.) The amount realised on sale represents the estimated sale price less selling expenses and any early repayment penalty incurred.

Year	Est. Sell. Price	Selling Expenses	Repayment Penalty	A. R. O. S. Manual	A. R. O. S. Model
1	508250	9415	9309	489526	489526
2	543827	10126	9246	524455	524455
3	581894	10887	9174	561833	561833
4	654726	12344	10218	632164	632164
5	700556	13261	10122	677173	677173
6	749594	14241	10014	725339	725339

Correct.

21. Book Value of the Property (close). The (closing) book value of the property represents the addition of the book value of the structure (closing) and the historical land value.

Year	Book Value Structure	Est. Land Value	Book Value Property Manual	Book Value Property Model
1	339300	127000	466300	466300
2	330600	127000	457600	457600
3	321900	127000	448900	448900
4	342450	127000	469450	469450
5	333000	127000	460000	460000
6	323550	127000	450550	450550

Correct.

22. Capital Gain. Capital gain is a measure of the dollar value of the amount realised on the sale of the property over and above the closing book value of the property, in the year of sale. It should be noted that depreciation is not able to be claimed in the year the property is sold;

the model computes two capital gain figures for each year. The first excludes the "current" years depreciation in the computation of the closing book value of the property, ie the book value as at the start of the year is used. The second capital gain figure is computed using the closing book value of the property, ie the "current" years depreciation allowance is included in the book value of the property.

Year	A.R.O.S.	Excl. "current" Depn.			Incl. "current" Depn.		
		B.V. Ppty	Capital Gain Manual	Model	B.V. Ppty	Capital Gain Manual	Model
1	489526	475000	14526	14526	466300	23226	23226
2	524455	466300	58155	58155	457600	66855	66855
3	561833	457600	104233	104233	448900	112933	112933
4	632164	478900	153264	153264	469450	162714	162714
5	677173	469450	207723	207723	460000	217173	217173
6	725339	460000	265339	265339	450550	274789	274789
			Correct.			Correct.	

23. Equity Reversion. The amount reverting to the investor from the sale of the property is computed by deducting any unpaid mortgage balance from the amount realised on sale (refer above for the computation of the unpaid mortgage balance).

Year	A.R.O.S.	Unpaid Mortgage Balance	Equity Reversion	
			Manual	Model
1	489526	248631	240895	240895
2	524455	247048	277407	277407
3	561833	245220	316613	316613
4	632164	273107	359057	359057
5	677173	270665	406508	406508
6	725339	267843	457496	457496
				Correct.

24. Discounted Equity Reversion. The present value of the amount reverting to the investor is computed by applying the annual discount factor to the nominal equity reversion figure for each year.

Year	Equity Reversion	Discount Factor	Discounted Equity Reversion Manual	Model
1	240895	.854700	205893	205893
2	277407	.730513	202649	202649
3	316613	.624370	197683	197683
4	359057	.533650	191610	191610
5	406508	.456111	185412	185412
6	457496	.389838	178349	178349

Correct.

25. Total Discounted Return. This informational figure is computed by adding the cummulative discounted after tax cash flow to the discounted equity reversion, for each operating year. The cummulative discounted after tax cash flow computed for each year includes the "cash advantage" arising from the current years depreciation allowance, ie the marginal tax rate multiplied by the annual depreciation allowance. Because depreciation is unable to be claimed in the year the property is sold, the (present value of the) cash advantage arising from the "current" years depreciation allowance is deducted from the cummulative discounted after tax cash flow carried over to the liquidation analysis (for the purposes of calculating the total discounted return) for each year.

Year	Cumm. Disc. A.T.C.F		Cash Advantage From Depn.		Discount Factor		Cumm. Disc.A.T.C.F. Carried Over
1	11317	-	(8700 * .45	*	.8547009)	=	7970
2	20919	-	(8700 * .45	*	.7305136)	=	18059
3	29057	-	(8700 * .45	*	.6243706)	=	26612
4	38541	-	(9450 * .45	*	.5336500)	=	36271
5	46579	-	(9450 * .45	*	.4561110)	=	44639
6	53382	-	(9450 * .45	*	.3898386)	=	51723

Comparison : Manual verses model output.

Year	Cumm. Disc. A.T.C.F. Carried Over	Disc. Equity Reversion	Total Disc. Return	
			Manual	Model
1	7970	205893	213863	213863
2	18059	202649	220708	220708
3	26612	197683	224295	224295
4	36271	191610	227881	227881
5	44639	185412	230051	230051
6	51723	178349	230072	230072

Correct.

26. Total Return to Equity. This percentage figure represents the total discounted return over the discounted or present value of the equity invested in the project to the end of each operating year. As outlined above the present value of equity capital equals $ 225000 for each operating year.

Year	Total Disc. Return	Present Value Equity	Total Return to Equity	
			Manual	Model
1	213863	225000	.951	.951
2	220708	225000	.981	.981
3	224295	225000	.997	.997
4	227881	225000	1.013	1.013
5	230051	225000	1.022	1.022
6	230072	225000	1.023	1.023

Correct.

27. Internal Rate of Return (IRR). The IRR is computed by experimenting with various rates of discount in an attempt to find the rate which when applied to the benefits and the costs incurred over the life of the investment, provides a net present value of zero. The following provides an illustration of the manual check on the IRR computed by the model for the sixth operating year of this example investment. A net cash balance has been manually computed for each operating year (refer chapter four) being the difference between the benefits or the income, and the costs or expenses for each year. Because the discounting procedure discounts cash items from the year end, year end equivalent figures are used where applicable.

To enable the IRR computed for year six to reflect the merits of selling the property in that year, the net cash balance figure for year six is increased by the net proceeds (equity reversion) less the nominal "cash advantage" arising from the depreciation allowance that would have been claimed for year six had the property not sold, ie ($ 9450 * .45).

Yearly net cash balance figures :

Year	0	(225000) (purchase price less mortgage finance).
	1	13241
	2	13144
	3	13035
	4	17771
	5	17623
	6	470695 = (17452 + 457496 - (.45 * 9450)

The model computed an IRR of 17.49 % for operating year six. The discount factor based on this rate of return is computed as :

$$(1./1.1749)^{**}N$$

$$= (.8511362)^{**}N$$

where N = number of years of discount.

Year	Net Cash Balance	Disc. Factor	Disc. Net Cash Balance
0	(225000)	1.0000000	(225000)
1	13241	.8511362	11270
2	13144	.7244329	9522
3	13035	.6165911	8037
4	17771	.5248030	9326
5	17623	.4466789	7872
6	470695	.3801846	178951
		Net Present Value $	(22)

The net present value à 17 %, 17.49 % (above) and 18 % were computed as a check on the validity of the IRR produced by the model.

			$
Net present value	à	17.00 % =	5073
Net present value	à	17.49 % =	(22)
Net present value	à	18.00 % =	(5177)

It appears that while the IRR computed by the model does not provide a net present value equal to zero, the computed rate is an accurate approximation to the true IRR.

28. Net Present Value (NPV) The NPV for each year is computed by discounting (at the investors discount rate) and summing the costs and benefits arising from the investment. As for the IRR computations, the model discounts a net cash balance figure for each year in preference to discounting individual costs and benefits. The investors discount (interest) rate is 17 %. In checking the IRR computation for year six (above) the NPV at 17 % was computed manually to be $ 5073. The model provided a NPV of $ 5073 for a six year holding period. The following table

compares the NPV computed by the model for each holding period against NPV figures calculated manually.

Year	Net Present Value	
	Manual	Model
1	(11135)	(11135)
2	(4290)	(4290)
3	(701)	(701)
4	2884	2884
5	5054	5054
6	5073	5073

Correct.

29. Investment Value. The investment value represents, at the completion of each operating year, the sum of :

- the present value of all mortgage finance invested to the end of the "current" operating year.
- the total discounted return computed for the property for the "current" year.

The investment property used in this evaluation example involves the following mortgage finance :

- initial finance of $ 2500000 at the time of purchase.
- $ 30000 additonal capital at the beginning of year four.

The present value of mortgage finance invested to the end of each operating year is computed as follows :

Year	Present Value
1	250000
2	250000
3	250000

4 - with an investors discount rate of 17 % P.a.,
the present value of $ 30000 à the start
of year four (end of year three) equals :

30000 * (1./1.17)**3) = 18731

plus initial capital + 250000

268731

4	268731
5	268731
6	268731

Comparison : Manual verses model.

Year	Present Value Mortgage Fin.	Total Disc. Return	Investment Value Manual	Model
1	250000	213863	463863	463863
2	250000	220707	470707	470707
3	250000	224294	474294	474294
4	268731	227880	496611	496611
5	268731	230050	498781	498781
6	268731	230072	498803	498803

Correct.

The above results, coupled with the comprehensive evaluation procedures carried out during the development of the computer program of the model, indicate that the acquisition, operating period and liquidation modules of the model are programmed and performing as intended.

The following discussion provides an example of the evaluation of the computations and output results provided by the model for an investment involving the development of an urban investment property.

EXAMPLE TWO : PROPERTY DEVELOPMENT INVESTMENT

The model concentrates on the following areas of analysis for investments involving the development of urban real estate.

- development term analysis.
- develop and sell option.
- operating/liquidation analysis.

The verification exercise illustrated above concentrated on a property purchase investment example in examining the accuracy of the computations and results provided by the acquisition, the operating and the liquidation modules. They were found to be programmed and operating as intended. This section of the evaluation procedure attempts to investigate the sections of the model which have been developed to apply to investments involving the development of urban property. The following discussion compares the results provided by the model to those computed manually for the development investment example outlined below.

Investment Data :

- total number of development periods : 17
- number of these periods per annum : 12
  ie monthly analysis.

- total development cost : $ 376500
- estimated land value : $ 75000
- investors required rate of return : 17 %

(investment liquidation data are outlined below).

The cost of development is paid as follows :

Development Period	Cost	
0	75000	ie land
1	40000	
2	37000	
3	20000	
4	14500	
5	14500	
6	14500	
7	14500	
8	14500	
9	14500	
10	14500	
11	14500	
12	14500	
13	14500	
14	14500	
15	14500	
16	14500	
17	16000	

Total Development Cost	$ 376500	

- income over development, $ 20000 incoming in period one.
- equity capital invested consists of a single input of $ 150000 in development period zero, ie the beginning of the investment.

Mortgage data :

Mortgage one : table, $ 85000, term 20 years, 14 % p.a., three payments p.a., mortgage borrowed (incoming) period seven.

Mortgage two : flat, $ 80000, five months, 15 % p.a., four interest payments p.a., mortgage borrowed period nine.

Refinanced period 14 -
: $ 141000 (total), 12 years, 15 %, four interest payments p.a.

Bridging finance data :

- maximum finance available $ 120000
- annual interest rate 18 %
- finance available period one
- finance to be repaid period seven

The model provides a financial summation analysis over development (outlined in chapter four). The following discussion illustrates the computation of the items which are incorporated in this analysis. Where applicable, the output provided by the model is compared to the results calculated manually.

Cash Item	Item Total	
	Manual	Model
Cummulative Development Cost	376500	376500
Cummulative Income over Development	20000	20000
Cummulative Equity Invested over Development	150000	150000

Correct.

1. Mortgage Schedules over Development.

Mortgage One : table,$ 85000, 20 years, 14 %, 3 repayments p.a.

: periodic interest .14/3 = .0466667.

: total repayment installments 20 * 3 = 60 total.

: amortisation factor
= (.0466667/(1-(1./(1.0466667**60))))
= .0498995

: payment, .0498995 * 85000 = $ 4241, paid every fourth period (month) in arrears.

Repayment Schedule (computed manually).

(Note : Mortgage borrowed (incoming) period seven.)

Period	Outstanding Principal	Interest Rate	Interest Payment	Principal Payment	Total Payment
0	0	0	0	0	0
1					
7	85000	0	0	0	0
8	85000	0	0	0	0
9	85000	0	0	0	0
10	85000	.0466667	3967	274	4241
11	84726	0	0	0	0
12	84726	0	0	0	0
13	84726	0	0	0	0
14	84726	.0466667	3954	287	4241
15	84439	0	0	0	0
16	84439	0	0	0	0
17	84439	0	0	0	0

Outstanding mortgage balance $ 84439

Comparison : Manual computations verses model output.

Period	Interest Paid		Principal Paid		Outstanding Principal	
	Manual	Model	Manual	Model	Manual	Model
0	0	0	0	0	0	0
1	....					
	....					
6	....					
7	0	0	0	0	85000	85000
8	0	0	0	0	85000	85000
9	0	0	0	0	85000	85000
10	3967	3967	274	274	84726	84726
11	0	0	0	0	84726	84726
12	0	0	0	0	84726	84726
13	0	0	0	0	84726	84726
14	3954	3954	287	287	84439	84439
15	0	0	0	0	84439	84439
16	0	0	0	0	84439	84439
17	0	0	0	0	84439	84439

Correct.

Mortgage Two : flat, $ 80000, 15 % p.a., term five months, four payments p.a., borrowed (incoming) period nine.

Refinanced period 14,

: $ 141000, 15 % p.a., term 12 years, four pay. p.a..

: periodic interest .15/4 = .0375

: initial interest payment

.0375 * 80000 = $ 3000 paid quarterly in arrears.

: post refinance interest payment

.0375 * 141000 = $ 5288 paid quarterly in arrears.

Comparison : Manual verses model computations.

Period	Interest Payment		Outstanding Principal	
	Manual	Model	Manual	Model
0	0	0	0	0
1				
....				
8				
9	0	0	80000	80000
10	0	0	80000	80000
11	3000	3000	80000	80000
12	0	0	80000	80000
13	0	0	80000	80000
14	0	0	141000	141000
15	0	0	141000	141000
16	5288	5288	141000	141000
17	0	0	141000	141000

Correct.

Outstanding mortgage balance $ 141000.

Note : refinancing in period 14 effectively excludes the interest payment that would have been made in that period. It should be noted that this is not a realistic situation however the computations are for illustrative purposes only.

The model correctly computes and records the outstanding balance for each mortgage at the completion of the development term.

2. Bridging Finance. Maximum of $ 120000, 18 % p.a., available period one, repaid period seven.

Bridging finance is treated as a normal "overdraft" facility in that only the sum required to meet a "deficit" in funds for any period is borrowed. The following computations produce the closing cash balance exclusive of bridging finance, for each development period. It is from this closing cash balance that the bridging finance requirement is computed. It

should be noted that the inclusion of bridging finance would reduce any deficit closing cash balance to zero. Therefore, in periods where the closing cash balance is negative (ie deficit), the opening cash balance for the following period is taken as zero to illustate the computation of bridging finance.

Per.	Cash Pos. Open	Equity for Period (+)	Income for Period (+)	Mortgage One Prin. Borr. (+)	Mortgage One Period Pay. (-)	Mortgage Two Prin. Borr. (+)	Mortgage Two Period Pay. (-)	Devel. Cost (-)	Cash Pos. Close
0	0	150000	0	0	0	0	0	75000	75000
1	75000	0	20000	0	0	0	0	40000	55000
2	55000	0	0	0	0	0	0	37000	18000
3	18000	0	0	0	0	0	0	20000	(2000)
4	0	0	0	0	0	0	0	14500	(14500)
5	0	0	0	0	0	0	0	14500	(14500)
6	0	0	0	0	0	0	0	14500	(14500)
7	0	0	0	85000	0	0	0	14500	70500
8	...								

The deficit closing cash positions (periods 3,4,5 & 6) indicate that bridging finance is required as follows :

Period	Bridging Finance Requirement	
	Manual	Model
0	0	0
1	0	0
2	0	0
3	2000	2000
4	14500	14500
5	14500	14500
6	14500	14500
7	0	0
8 ...		

Correct

Because principal (mortgage one) is available at the beginning of period seven, no bridging finance is required for that period.

Bridging finance repayment schedule :

Note : Development period cash flows "occur" at the end of each period. Bridging finance is therefore borrowed at the period end. Interest begins to accrue over the following and all subsequent periods until the finance is repaid. Although interest is "computed" for each period, in reality it is not paid until cummulative principal and interest is repaid as a single lump sum (at the end of period seven). For this reason, interest is calculated on a compound basis; the interest computed for period three for example, is added to the "principal" upon which interest for period four is computed. Total "principal" and interest is then repaid as a single lump sum. Mortgage one principal ensures that no bridging finance is required for period seven. Because cummulative bridging finance is repaid at the end of period seven, interest on the cummulative sum is computed for the seventh period.

: periodic interest (note : twelve development periods p.a.)

=> .18 % /12 = .015 % per period.

Manual computations.

Period	Current Borrow.	Current Interest	Cummulative Borrowings Prin. + Int.	Cummulative Interest	Bridging Finance Repayment
0	0	0	0	0	0
1	0	0	0	0	0
2	0	0	0	0	0
3	2000	0	2000	0	0
	2000 * .015 = 30				
	2000 + 30 + 14500 =16530				
4	14500	30	16530	30	0
	16530 * .015 = 247				
	247 + 30 = 277				
	16530 + 14500 = 31030				
	31030 + 247 = 31277				
5	14500	247	31277	277	0
	31277 * .015 = 469				
	469 + 277 = 746				
	31277 + 14500 = 45777				
	45777 + 469 + 46246				
6	14500	469	46246	746	0
	46246 * .015 = 693				
	746 + 693 = 1439				
	46246 + 0 + 693 = 46939 (cummulative prin. and interest).				
7	0	693	46939	1439	46939

Model Computations.

Period	Current Borrow.	Current Interest	Cummulative Borrowings Prin. + Int.	Cummulative Interest	Bridging Finance Repayment
0	0	0	0	0	0
1	0	0	0	0	0
2	0	0	0	0	0
3	2000	0	2000	0	0
4	14500	30	16530	30	0
5	14500	247	31277	277	0
6	14500	469	46246	746	0
7	0	693	46939	1439	46939

These figures conform to the manually computed bridging finance schedule illustrated above. This indicates the routine computing bridging finance is programmed and working as intended.

A number of trial development investments, each incorporating a different set of bridging finance parameters, were run through the model in an attempt to examine the accuracy of the computations under differing constraints and repayment requirements. In each case the computations and output provided by the model conformed to those computed manually.

The financial "status" analysis completed for the development term is only concerned with the magnitude and the timing of the actual receipts and payments occurring over the development term. The following items illustrate the actual "receipts" and payments over development with respect to bridging finance.

Period	"Receipt"	Payment
0	0	0
1	0	0
2	0	0
3	2000	0
4	14500	0
5	14500	0
6	14500	0
7	0	46939
8	0	0
9		

The following tables (overleaf) enable a comparison of the results of the financial status analysis provided by the model, against a financial summary derived from manual computations. The results developed by the model conform to those calculated by hand.

Manual Computations : Financial Status Analysis

Period	Opening Cash Balance	Equity Input (+ve)	Income over Devel. (+ve)	Bridging Finance Current Borrow. (+ve)	Repay. (-ve)	Mortgage One Borr. Prin. (+ve)	Period Pay. (-ve)	Mortgage Two Borr. Prin. (+ve)	Period Pay. (-ve)	Development Cost (-ve)	Cash Position (Close)
0	0	150000	0	0	0	0	0	0	0	75000	75000
1	75000	0	20000	0	0	0	0	0	0	40000	55000
2	55000	0	0	0	0	0	0	0	0	37000	18000
3	18000	0	0	2000	0	0	0	0	0	20000	0
4	0	0	0	14500	0	0	0	0	0	14500	0
5	0	0	0	14500	0	0	0	0	0	14500	0
6	0	0	0	14500	0	0	0	0	0	14500	0
7	0	0	0	0	46939	85000	0	0	0	14500	23561
8	23561	0	0	0	0	0	0	0	0	14500	9061
9	9061	0	0	0	0	0	0	80000	0	14500	74561
10	74561	0	0	0	0	0	4241	0	0	14500	55820
11	55820	0	0	0	0	0	0	0	3000	14500	38320
12	38320	0	0	0	0	0	0	0	0	14500	23820
13	23820	0	0	0	0	0	0	0	0	14500	9320
14	9320	0	0	0	0	0	4241	61000	0	14500	51579
15	51579	0	0	0	0	0	0	0	0	14500	37079
16	37079	0	0	0	0	0	0	0	5288	14500	17291
17	17291	0	0	0	0	0	0	0	0	16000	1291

Model Computations : Financial Status Analysis

Period	Opening Cash Balance	Equity Input (+ve)	Income over Devel. (+ve)	Bridging Finance Current Borrow. (+ve)	Repay. (-ve)	Mortgage One Borr. Prin. (+ve)	Period Pay. (-ve)	Mortgage Two Borr. Prin. (+ve)	Period Pay. (-ve)	Development Cost (-ve)	Cash Position (Close)
0	0	150000	0	0	0	0	0	0	0	75000	75000
1	75000	0	20000	0	0	0	0	0	0	40000	55000
2	55000	0	0	0	0	0	0	0	0	37000	18000
3	18000	0	0	2000	0	0	0	0	0	20000	0
4	0	0	0	14500	0	0	0	0	0	14500	0
5	0	0	0	14500	0	0	0	0	0	14500	0
6	0	0	0	14500	0	0	0	0	0	14500	0
7	0	0	0	0	46939	85000	0	0	0	14500	23561
8	23561	0	0	0	0	0	0	0	0	14500	9061
9	9061	0	0	0	0	0	0	80000	0	14500	74561
10	74561	0	0	0	0	0	4241	0	0	14500	55820
11	55820	0	0	0	0	0	0	0	3000	14500	38320
12	38320	0	0	0	0	0	0	0	0	14500	23820
13	23820	0	0	0	0	0	0	0	0	14500	9320
14	9320	0	0	0	0	0	4241	61000	0	14500	51579
15	51579	0	0	0	0	0	0	0	0	14500	37079
16	37079	0	0	0	0	0	0	0	5288	14500	17291
17	17291	0	0	0	0	0	0	0	0	16000	1291

Note : Ideally, investors would arrange finance to ensure that funds are not idle over the development term, ie minimum closing cash balance for each development period. The allocation of investment funds for the above example is inefficient however the example is for illustrative purposes only.

The tests and comparisons outlined above, indicate that the model is correctly computing and incorporating the cash items which combine to represent the development of the property. A number of complete sets of input data, each representing a different hypothetical development, were submitted to the model. For each data set, the accuracy of the computations and results provided by the model was supported by those computed manually.

The following discussion attempts to examine the accuracy of the computations underlying the analysis of income/taxation over development. An evaluation of the calculations investigating the feasibility of the develop and sell option is included.

3. Income/Taxation over Development.

The development analysis provided by the model incorporates any income or taxation that may be applicable over the development term of the investment. In most property development situations, the project is not likely to generate a significant amount of income over the development term. Because of this, the investment is more likely to generate tax shelter, than be liable for income tax over the entire or a portion of the development term. Because taxation is assessed annually, this analysis is based on an annual and an overall or summation basis. Results are computed in nominal (actual) and in discounted or present value dollar terms.

Note : The development term comprises 17 development periods, consisting of 12 per annum. This indicates a development term duration of one year and five months.

: Interest is able to be claimed as a tax deductible expense.

: The analyst is able to specify, for each development (tax) year, any additional (lump ($) sum) tax deductible items. The investment used in this example does not qualify for any additional tax deductions.

: Income earnt over development is net of any expenses incurred in the generation of the income.

: Interest paid on bridging finance is able to be claimed as an expense for tax purposes.

: The period discount factor over the development term is computed as (1./(1.17)**(1./12)**N)

= (.9870015)**N

where N = the number of periods discount.

(a) Development "Year" One

Income. - $ 20000 period one

- present value : $ 20000 * (.9870015**1)

= $ 19740

Tax Deductible Items.

Interest (refer mortgage schedules above).

Nominal : Mortgage One : $ 3967 paid end of period 10
Mortgage Two : $ 3000 paid end of period 11
Bridging Fin.: $ 1439 paid end of period 7

Nominal $ 8406

Present Value : 1439 * (.9870015)**7 = 1313
3967 * (.9870015)**10 = 3480
3000 * (.9870015)**11 = 2597

Present Value Interest Payment $ 7390

Principal Repayment (excluding bridging finance).

Nominal : Mortgage One : $ 274 end period 10

Present Value $ 274 * (.9870015)**10 = $ 240.

Income Tax/Tax Shelter

Nominal (assessed end of period 12).

	Net Income	$ 20000	
less	Tax Ded. Items	$ 8406	(nominal interest)
	Taxable Income	$ 11594	
	Tax Rate	.45	
	Nominal Income Tax	$ 5217	

Present Value Tax : 5217 * (.9870015)**12 = $ 4459

(b) Development "Year" Two.

Income Nil.

Tax Deductible Items.

Interest.

Nominal : Mortgage One $ 3954 paid at the end of period 14
Mortgage Two $ 5288 paid at the end of period 16

Nominal $ 9242

Present Value : 3954 * (.9870015)**14 = 3290
5288 * (.9870015)**16 = 4289

Present Value Interest Payment $ 7579

Principal Repayment.

Nominal : Mortgage One $ 287 paid at the end of period 14

Present Value : 287 * (.9870015)**14 = $ 239

Income Tax/Tax Shelter.

Nominal Income	$ 0	
less Tax Ded. Items	$ 9242	(nominal interest)
Taxable Income	$ (9242)	
Tax Rate	.45	
Nominal Tax Shelter	$ 4158	

Present Value : Although development of the property is completed at the end of period 17, the taxation liability for the last development "year" (consisting of five months), will not be assessed until the end of that "year", ie hypothetically until the end of "period" 24. Therefore the nominal tax shelter is discounted over 24 periods in computing the present value as at the start of development.

4158 * (.9870015)**24 = $ 3037

Nominal tax shelter	$ 4158
Present value tax shelter	$ 3037

Summary

	Year One	Year Two	Total Manual	Total Model
Income : Nominal	20000	0	20000	20000
: Present Value	19740	0	19740	19740
Interest				
: Nominal	8406	9242	17648	17648
: Present Value	7390	7579	14969	14969
Principal Repayment				
: Nominal	274	287	561	561
: Present Value	240	239	479	479
Income Tax				
: Nominal	5217	0	5217	5217
: Present Value	4459	0	4459	4459
Tax Shelter				
: Nominal	0	4158	4158	4158
: Present Value	0	3037	3037	3037

Correct.

It should be noted that because the tax liability is likely to vary from year to year, it is possible in a development situation spanning a number of years, for the project to generate tax shelter and also be liable for income tax over the development term.

4. Cash "Throw-off" to Equity (C.T.O.E.)

(The computations of the following items are illustrated above).

Nominal :	Manual	Model
Income	$ 20000	20000
less Interest Paid	$ 17648	17648
less Principal Paid	$ 561	561
Cash throw-off to Equity	$ 1791	$ 1791

Correct.

Present Value :	Manual	Model
Income	$ 19740	19740
less Interest Paid	$ 14969	14969
less Principal Paid	$ 479	479
Cash throw-off to Equity	$ 4292	$ 4292

Correct.

5. After Tax Cash Flow. This item is computed by combining the cash throw-off to equity figure with income tax (negative) and/or tax shelter (positive). The following table compares the computations provided by the model with those completed maually.

	C.T.O.E.	Income Tax	Tax Shelter	After Tax Cash Flow	
				Manual	Model
Nominal	1791	(5217)	4158	732	732
Present Val.	4292	(4459)	3037	2870	2870

Correct.

The above tests and comparisons indicate that the income/taxation section of the model is programmed and performing as intended.

It should be noted that the discounted or present value of the after tax cash flow over development is carried over to the operating period of the investment as the "opening" cummulative discounted after tax cash flow figure.

The following discussion attempts to examine the accuracy of the computations investigating the feasibility of disposing of the property at the completion of development.

6. Liquidation Analysis (Develop and Sell Option).

Liquidation data : Estimated selling price $ 440000

: Selling expenses comprise conveyance fee only.

-first $ 50000 * .01 = 500

-next $ 50000 * .015 = 750

-balance (440000-100000) * .02 = 6800

Total selling expense $ 8050

: repayment penalty equals three months interest.

-interest over operating year one = $ 32930

-repayment penalty =(32930/12) * 3 = $ 8232

: unpaid mortgage balance equals $ 225439
(refer above for the computation of this figure).

Comparison : Manual verses model analysis.

Note : periodic discount factor = (.9870015)**N
where N = number of periods discount.

	Manual	Model
(a) Est. Selling Price	440000	440000
less Selling Expenses	8050	8050
less Repayment Penalty	8232	8232
(b) Amount Realised on Sale	423718	423718
less Unpaid Mortgage Balance	225439	225439
(c) Equity Reversion	198279	198279
(.9870015)**17 = .8005776		
* .8005776 * .8005776		
(d) Discounted Equity Rev.	158737	158737

Correct.

(e) Total Discounted Return. The discounted value of the total return available to the investor from the develop and sell option is computed by combining the present value of the after tax cash flow over the development term with the discounted equity reversion.

	Manual	Model
Disc. After Tax Cash Flow	2870	2870
Disc. Equity Reversion	158737	158737
Total Discounted Return $	161607	161607

Correct.

(f) Total Discounted Return/Present Value Equity (T.D.R./P.V. Equity).
Note : Present value of equity invested = $ 150000.

	Manual	Model
Total Disc. Return	161607	161607
Present Value Equity	150000	150000
T.D.R./P.V. Equity	1.07738	1.07738

Correct.

(g) Internal Rate of Return (IRR). The model computed an IRR of 29.09230 % for the develop and sell option. An investigation of the nature of the cash flows over development indicated that multiple solutions for the IRR are possible. The model correctly defined that multiple roots may be a problem and displayed a warning message to that effect.

The following table computes the net present value of the nominal net cash balances (computed manually; refer chapter four) for each period over the development term, based on a discount rate of 29.09230 %; the periodic discount factor equals :

(1./(1.2909230 ** (1./12) **N))

= (.978945**N)

where N = number of periods discount

Period	Nominal Cash Balance	Discount Factor	Discounted Cash Balance
0	(75000)	1.000000	(75000)
1	(20000)	.978945	(19578)
2	(37000)	.958333	(35458)
3	(18000)	.938155	(16886)
4	30	.918402	27
5	247	.899065	222
6	469	.880136	413
7	25373	.861604	21861
8	(14500)	.843463	(12230)
9	66553	.825704	54953
10	(18741)	.808319	(15149)
11	(17500)	.791300	(13848)
12	(19717)	.774639	(15273)
13	(14500)	.758329	(10995)
14	43062	.742363	31967
15	(14500)	.726732	(10537)
16	(19788)	.711431	(14077)
17	186437	.696452	129591
		Net Present Value	$ 3

Although multiple solutions are possible, the model correctly computes the rate of discount or the internal rate of return, providing a net present value of approximately zero. A 29 % rate of return appears to be realistic for the cash flows comprising this example development

investment. This section of the model can be relied on as programmed and performing as intended.

(h) Net Present Value (NPV)

The model computed a NPV of $ 18026 for the develop and sell option. The following table illustrates the manual computation of the NPV based on the net cash balance figures computed manually (outlined above) for each development period, and the investors discount rate.

Discount Rate = (1./(1.17)**(1./12))** N
= (.9870015 ** N)

Period	Nominal Cash Balance	Discount Factor	Discounted Cash Balance
0	(75000)	1.000000	(75000)
1	(20000)	.987001	(19740)
2	(37000)	.974172	(36044)
3	(18000)	.961509	(17307)
4	30	.949011	28
5	247	.936675	231
6	469	.924500	433
7	25373	.912483	23152
8	(14500)	.900622	(13059)
9	66553	.888915	59160
10	(18741)	.877361	(16443)
11	(17500)	.865957	(15154)
12	(19717)	.854700	(16852)
13	(14500)	.843591	(12232)
14	43062	.832625	35854
15	(14500)	.821803	(11916)
16	(19788)	.811120	(16050)
17	186437	.800577	148965
		Net Present Value Manual	$ 18026
		Net Present Value Model	$ 18026

The above computations and comparison indicates the model computes a correct NPV for develop and sell investment options.

(i) Investment Value. The investment value is computed by adding the total discounted return to the discounted or present value of all mortgage finance invested in the property over the development term.

Mortgage Finance : $ 85000 start of period 7 (end period 6).
: $ 80000 start of period 9 (end period 8).
: $ 61000 start of period 14 (end period 13).

: discount factor = (1./(1.17)**(1./12)**N)

= (.9870015**N)

where N = number of periods discount.

- 85000 * (.9870015**6)	=	78582
- 80000 * (.9870015**8)	=	72049
- 61000 * (.9870015**13)	=	51459

Present Value Mortgage Finance	$	202090

Comparison : Manual verses model computations.

		Manual	Model
Total Discounted Return		161607	161607
Present Val. Mort. Finance		202090	202090
Investment Value	$	363697	363697

Correct.

Because the investment value is dependent upon the output figures provided by the preceeding sections of the development term module,

aggreement between the investment value computed by the model and the value derived manually, indicates that the development module is programmed and performing as intended. This is supported by each of the above tests and comparisons.

This section of the evaluation procedure was completed by an investigation of the results provided by the model for the operating period of the example investment. The results were again contrasted to those computed manually from the same development term and operating period data. The accuracy of the computations provided by the model was supported by those produced manually. This, together with the favorable results of the above tests and comparisons, indicates that the model can be confidentially relied on to perform an accurate analysis of an investment involving the development of an urban property.