A Programming Approach For Determining The Optimal Media Mix In Promoting The Tasmanian Tourist Industry

by

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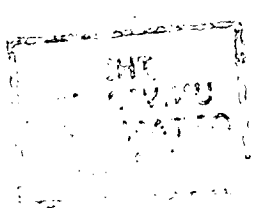

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This dissertation represents my own original work and contains no material which has already been published or otherwise used by me, and to the best of my knowledge it contains no copy or paraphrases of material previously written by another person or authority, except where due acknowledgement is made.

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CHAPTER 1

INTRODUCTION

The growth of tourism and its increasing importance to the Tasmanian economy have seen the tourist industry become increasingly interested in the application and adaptation of modern management methods to the areas of tourist marketing and promotion. Although about 50 per cent of the interstate tourist travel is organised by travel agents and package tour operators, the intrastate tourist travel is virtually free from such middlemen. Such advertising and promotional campaigns could be designed to inform Tasmanians about the holiday attractions that are available within the state and the travel requirements that could assist them in choosing a suitable destination outside the immediate region in which they live.

This study will make use of linear and integer programming techniques to determine the optimal media mix for advertising and promotional campaigns designed to motivate Tasmanians to travel within their own state rather than spend their holidays on the mainland of Australia or overseas.

For this purpose the state population will be divided into three advertising market segments. This will not only facilitate the use of programming techniques but will also make it possible to differentiate between the various advertising and promotional messages that would be required to encourage intrastate holiday attraction in

other segments. It should be kept in mind that Tasmanian travel agents are not geared towards providing package tours which encourage intrastate travel, and a designed advertising campaign would play an important role in directing the industry's thinking along such lines. The effectiveness of the campaign will be maximized by the determination of an optimal media mix that is specifically directed at both the travel industry and the people of Tasmania.

1.1 The Objective of the Study

The main objective of this study is to examine the use of media mix techniques in promoting the Tasmanian tourist industry to people within the state. A review of programming media planning techniques will be carried out in relation to the industry, in order to assist their applicability to pre-defined market segments. It is anticipated that the market will be segmented mainly in terms of geographic and media usage. An attempt will be made to match various media vehicles with advertising market segments.

1.2 The Significance of the Industry

Over the past ten years, the Tasmanian tourist industry has continued to grow. The number of visitors to the state has been increasing each year. In 1981 307,000 adult visitors were recorded, and they spent an estimated $175 million. The industry directly employs over 310 people, in addition to others employed in tourist-related

industries, and is ranked fifth among all industries in the state. This reflects the importance of the tourist industry to the state economy.

> Tourism is the state's fifth biggest industry and contributes $244.9 million a year to the state's economy. Tourism in Tasmania employs a total of 16,000 people or 9.6 per cent of the work force".[1]

1.3 How the Study Proceeds

The issues to be focussed on are:

(a) The objective of the study and the importance of the tourist industry to the state.

(b) Marketing objectives of the Tourist Department and the steps taken to meet these objectives.

(c) Segmentation of the state's population into advertising market segments and determining the major commercial media in the various segments.

(d) A review of advertising programming techniques exemplifiable with the state.

(e) Development, formulation and estimation of the optimal media mix for each region.

The study begins by specifying the objectives above. It is hoped that the study will be able to determine the optimal media mix to be used for advertising in the various advertising market segments in order to promote intrastate tourism. The importance of the tourist industry to the state's economy is also discussed in this chapter.

Chapter 2 reviews the various marketing objectives of the state's tourist industry and the steps to be taken by

the Tourist Department to meet these stated objectives. Also in this chapter the Commonwealth Government's role in tourism within and outside Australia is discussed.

Chapter 3 discusses the segmentation of the state population into advertising market segments on the basis of geographic, media use and lifestyles. An attempt is made in this chapter to match advertising market segments with media.

Chapter 4 reviews a set of optimising approaches to the problem of media selection exemplifiable with the various regions. Chapters 5 and 6 are the data input and model formulation, and development chapters respectively. Chapter 5 discusses in detail how the input data were derived and the assumptions made. In Chapter 6 the linear programming model is formulated, developed and evaluated.

The final chapter presents the major findings and gives some recommendations

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Reference for Chapter 1

1. The Examiner, 20 September 1983, p.12.

CHAPTER 2

2.1 Historical Background of the Tourist Industry

Within fifty years of the European settlement in the early nineteenth century there was a regular tourist traffic in Tasmania which by 1870 had reached a substantial level. An Englishman, Anthony Trollope visited the state at this time and had this view about Hobart:

> Hobart Town, they say, is kept alive by visitors who flock to it for the summer months from the other colonies.[1]

During the period 1870-1890, the framework of the Tasmanian railway system was laid. This linked Hobart with Launceston, Queenstown, Zeehan and Strahan. Branch lines reached Scottsdale in the north-east and penetrated the Derwent Valley. This development therefore promoted more travel to various parts of the state.

The effect of all this tourist activity led to the formation of the Tasmanian Tourist Association in 1893. Within a short time the Association had opened an information centre - housed together with the Tasmanian Museum and Art Gallery. Similar associations were established in other parts of the state. The Northern Tasmanian Tourist Association was founded in Launceston, while similar associations were established in Burnie and Devonport as well.

Between 1870 and 1913 the organisation and administration of the state tourist activity was run by

the Tasmanian Tourist Association. In 1914 a commission of enquiry was set up to look into some of the problems that were facing the Association in relation to its function of administering the state tourist industry. The same year the Tourist Department was transferred to the Railway Department and a branch was created within the Railway Department to be responsible for tourism. This branch was headed by Emmelt Temple Evelyn as the first director of the tourist industry.

The industry suffered a great set-back during the two world wars but at the end of the second world war Tasmanian tourist offices were opened in Melbourne, Brisbane, Adelaide, Sydney and Perth. In 1971 the Department went through a major re-organisation and became part of the State Public Service.

Since the establishment of the Tasmanian Tourist Association in 1893, the industry has grown from what was purely a private organisation into one of the state's major industries.

2.2 The Objectives of the Industry

The objectives of the Tasmanian tourist industry have changed substantially since it was first established as a private organisation called the 'Tasmanian Tourist Association'. These changes have occurred as a result of the need to meet the goals set by both the State Government and the people of Tasmania.

In reviewing the present objectives of the Tasmanian tourist industry, the following will be considered:

1. general objectives;
2. strategies for meeting the general objectives;
3. marketing objectives; and
4. steps taken to meet the marketing objectives.

2.2.1 General objectives:

In 1978 a committee was set up by the Department to formulate a set of objectives for the industry and to recommend strategies through which these objectives might be achieved. This strategic plan was considered necessary for the development of an economically viable tourist industry for the state.

The objectives, stated below, were put forward by the Department. It is expected that by meeting these objectives the industry will not only achieve the goals that both the government and people of Tasmania expect from the industry, but will also be able to compete favourably with other state tourist industries in the country. These objectives take into account the need not only for a viable tourist industry but also for the co-operation, co-ordination and co-alignment of all the various establishments that make up the Tasmanian tourist industry.

Objectives of the Department of Tourism:[2]

(a) To develop an economically viable tourist industry which would be self-supporting in the long term.
(b) To integrate the tourist industry with other forms of development within Tasmania, and to co-ordinate this

development so as to fully utilise the state's economic resources, subject to constraints implied by the other objectives.

(c) To develop a tourist industry that is based on the leisure needs of Tasmanian residents as well as those of interstate and overseas visitors.

(d) To develop a tourist industry that is compatible with the Tasmanian socio-economic life style, and with government policy in relation to the protection and preservation of the state's natural and man-made heritage.

(e) To develop a tourist industry that seeks to build a balanced distribution of tourism development, with a view to maximising the regional and sub-regional benefits of tourism activity.

(f) By developmental, promotional and other appropriate means, seek not only to increase tourism from outside the state, but also to extend the duration of stay, encourage repeated visits, and increase the level of travel activity during 'off season' periods.

2.2.2 Strategies for meeting these objectives:

The Department of Tourism outlined various strategies to enable the industry to achieve the objectives stated above. These strategies range from political and economic to social and informal.

One such strategy is applied through political officials and other appropriate political channels within the different levels of governments, both Commonwealth and State.

Research and development into problems facing the industry was put forward as a major tactical tool for achieving the industry's objectives. It was hoped that through research, promotion and other appropriate means, a better understanding of the significance of the industry to the public and private sectors would be achieved. These groups, although beneficiaries from the tourism activity, do not see themselves as part of that industry. Also, research could assist in ensuring that resources are utilised in the most cost-effective way.

The Tourist Department was of the opinion that if it received adequate finance, it could devise a strategy that would not only stimulate both the public and private tourist sectors, but would also provide the opportunity for recreational development within the state. In addition, in recognition of the important role played by accommodation in the industry, the Tourist Department felt that an accommodation improvement program would also assist greatly in meeting the objectives of the industry.

It was also considered that for the tourist industry to achieve its objectives there should be consultation and co-operation with land management, social betterment and environmental organisations. This was expected to encourage better utilisation of the state's land resources in that it would incorporate visitors' usage and help meet the leisure needs of the Tasmanian public.

Similarly it was thought that the attainment of the objectives would be facilitated by establishing a liaison office within the Departments of Education, National Parks

and Wildlife, Health and Environment, Lands, Forestry, the Transport Commission and the Department of Main Roads.

An important element of any strategy was felt to be a close working relationship with the Australian Tourist Commission (ATC). This was considered to be a necessary, but not sufficient, step to take in order to ensure that the state received equitable treatment in the Commission's promotional programs.

Promotional and advertising campaigns for travellers to the state and within the state are regarded as being of major significance in the development of a strategy, as they can be directed specifically at increasing the volume of travel by visitors from both outside Australia and from the mainland, as well as by Tasmanians within the State.

Besides the achievement of the industry's general objectives, a strategic plan may act as a guideline for the development of other targets and policy instruments that the Department might consider necessary for the development of a viable tourist industry.

2.2.3 Marketing objectives:

The role of marketing in a service industry like tourism is very important. Sales promotion and advertising campaigns represent an important component in any marketing strategy. Because of the position of the state in relation to the rest of the country, Tasmania is disadvantaged in its interstate travel market. The physical barrier posed by Bass Strait necessitates travel by sea or air. In the past, the state's winter season was

regarded as disadvantageous to the Tasmanian tourist market during the cooler winter months (which is the 'off season'). Recently the Department has been advertising Tasmania as a winter holiday resort.

The industry's marketing objectives take these shortcomings into consideration and are used to devise strategies that will meet the stated objectives.

These objectives have been divided into two broad categories:

(a) primary objectives, and

(b) secondary objectives.

The purpose of these marketing objectives is for the Tasmanian Tourist Department not only to understand the needs of the tourist (both within and outside Tasmania), but also to provide the services that will enable the industry to meet these stated objectives.

The primary marketing objectives are of a higher priority than the secondary marketing objectives. The Department of Tourism considers non-resident tourists as representing a very significant factor for the existence of a viable tourist industry. It also takes into consideration the various tourist seasons - e.g. 'off' and 'shoulder' periods. During each season the Department hopes to increase interstate travel by over 10 per cent.

The secondary marketing objectives, though lower in priority, are of no less significance. They consider Tasmania's domestic tourist markets, encouraging Tasmanians to holiday at home. It is also hoped that through meeting the secondary objectives, the number of

overseas visitors to the State will increase, thereby increasing the Tasmanian share of the Australian international travel market.

(a) Primary marketing objectives:[3] The primary objectives of the Tourist Department are aimed at two separate groups of tourist: those persons who have not visited Tasmania before, and those persons who have visited the State at least once. This latter group is encouraged to make repeated visits.

The primary objectives are:

1. To increase the overall number of visits by non-residents to the state by 7.5 per cent per annum by encouraging (i) first-time visits; and (ii) repeat visits.
2. To increase the level of travel activity during (i) 'off-peak' period by 10 per cent; and (ii) 'shoulder' periods.
3. To increase visitor spending by encouraging (i) extended duration of stay; and (ii) greater daily spending.

(b) Secondary marketing objectives:

4. To encourage more Tasmanians to holiday within the state.
5. To achieve a larger proportion of the Australian international travel market.
6. To maximise Tasmania's image strengths and minimise its perceived deficiencies within and outside the state.

2.2.4 Steps taken to meet these marketing objectives

The tourist industry has changed its marketing approach significantly over recent years in order to achieve both the primary and the secondary objectives outlined above. Prior to these changes, promotional campaigns were mainly designed for autumn and spring seasons. In 1981, for the first time, the state was advertised as a winter holiday destination. This was aimed at increasing tourist travel for both inter- and intra-state tourists, so that more travelling would be generated during the winter 'off-season'. About the same time there was a significant change in promotional and advertising campaigns, as a result of which more emphasis was placed on encouraging Tasmanians to holiday within their own state. It was hoped that this would encourage a large proportion of those Tasmanians who usually travel interstate or overseas, to take their holidays at home, thereby contributing to the growth of the state economy. This new strategy has wide support and it was aimed at all Tasmanians. With its success it was hoped to establish a significant intra-state tourist market.

The tourism industry is especially important in the more economically disadvantaged regions of the state. Any adverse effect on the tourism industry as a whole can have a drastic effect on small entrepreneurs who make up a large proportion of the industry. There arises the need to promote both inter- and intra-state tourist travel to maintain the expected volume of tourists who travel around the state each year. Another relevant fact that supports

more intra-state promotional and advertising campaigns is the fact that Tasmanians are the nations's greatest travellers outside their state in terms of interstate trips per population. Between July 1982 and June 1983, 1,754,000 interstate trips were made by Tasmanians, outside their state. (Source: Domestic Travel in Australia, July 1982 - June 1983. Appendix VII.) This showed an increase of 4.6 per cent over the same period in 1981-1982. Throughout 1982-1983, 255,000 trips were made by visitors to the state. These trips resulted in a total of 2,570,000 nights spent in Tasmania. There was a 23.9 per cent fall in the number of visitors to the state over 1981-1982.[4]

It is generally felt that, with a well designed advertising campaign which is carefully implemented and controlled, the potential intra-state market in Tasmania could be generated to a level sufficiently large enough to support a profitable tourist industry. For this reason attention needs to be directed toward what constitutes a well designed advertising campaign, the important design features of which include the objectives, the message, and the media through which the message is to be directed to the market. The objectives have already been discussed, and the nature of the message is outside the scope of this thesis.

The other step taken by the industry recently to achieve some of its objectives was promotion in overseas markets. Although the promotion of overseas visitors to Australia is the specific domain of the Commonwealth

Government, the Tourist Department for the first time in March 1981, sponsored the visit of a task force to New Zealand to promote the Hobart-Christchurch airlink. The New Zealand market is a significant part of the industry's market.

Advertising: Advertising accounted for more than 70 per cent of the total marketing expenditure on tourism in the 1980-1981 fiscal year. The 1980 spring campaign cost the Department about $395,000 while the winter campaign for 1981 - the most costly advertising campaign undertaken by the industry - cost about $400,000.[5]

Recently, a significant proportion of the industry's advertising budget has been allocated to promoting Tasmania as a tourist destination in New Zealand. An extensive campaign was carried out in New Zealand, and in Australia, to promote the new Hobart-Christchurch air service. It is estimated that $100,000 was devoted to the campaign before the service even began.

> In all, the total expenditure on the New Zealand market accounted for nearly 13 per cent of the Department's marketing budget during 1980-1981.[6]

During the past five years the Department has also gone into co-operative advertising with the private sector. While co-operative advertising forms a very small part of the Department's advertising strategy, if implemented efficiently it can be very effective.

Promotions: The Tourist Department's Bureaux in all the

major centres in Australia and New Zealand have been implementing a promotional campaign aimed at increasing travel to the state, while the bureaux in Tasmania have promoted travel within the state. The Tourist Department provided about $176,000 to its interstate bureaux for advertising and promotion in 1982-1983, and this was supplemented by $100,000 received from the Department.[7] A major part of this sum was used to pay for travel agents' window displays and promotional activities in each bureau region.

Literature: Recently the tourist industry has been producing brochures in order to inform customers (both in the state and outside it) about Tasmania and the various holiday packages that are available. The Department produced the following brochures during 1982-1983:

- This is Tasmania.
- Tasmanian Travelways.
- Hobart street maps.
- Launceston Street Map.
- Burnie & Devonport street map.
- Tasmania, Look At Us Now.

The total cost of publications for 1982-1983 was about $348,000. It should be mentioned that the overall use of brochures rose by about 20 per cent between 1980 and 1981. The importance of brochures is reflected in a recent survey carried out by Mario E. Di Falco, Robert J. Gawlik, Timothy J.T. Stops, and Paul D. Williamson in 1982

on "An assessment of the expectations and experiences of visitors to the Tasmanian Peninsula, in particular the Port Arthur historic site."[8]. One of the questions asked in the survey was aimed at determining the major factor which influenced each respondent's decision to visit the state. About 18.3 per cent of those questioned said that they were influenced by travel literature.

Public relations and publicity: Through public relations and publicity the Tourist Department endeavours to make Tasmania better known at home and abroad. This may be achieved by closely associating itself with international organisations and by conducting and attending conventions related to travel and its related industries. In 1980 and 1981 the Department participated in a large number of conventions and industry activities.

The tourism industry also produces an information paper entitled "Tasbureau News", which carries information about the industry, its plans and achievements. The cost of public relations activities in 1982-1983 totalled approximately $55,000. In the industry's 1980-1981 report of the year, writing on the importance of public relations to the Department, the following comments were made:

> The benefits of each of these activities are intangible and not quantifiable. However, the Department's participation enabled Tasmania to be identified in influential national and international forums by establishing and perpetuating working relationships.[9]

2.3 The Role of the Commonwealth Government

The Commonwealth Government of Australia under the constitution is responsible for matters concerning transport, overseas trade, foreign affairs and immigration among others. These responsibilities are relevant to both domestic and overseas tourism. In particular the domestic tourist market is strongly influenced by policies concerning the treasury, labour, education, the media, urban and regional development, the environment and conservation. It is the role of the federal Department of Tourism and Recreation to ensure that these various departments co-operate with the Government in order to achieve the Commonwealth Government's goals and policies at the federal level.

> It is the task of the Department of Tourism and Recreation to ensure that the 'Tourism Factor' be recognised and accepted in all Federal Government policy decisions.[10]

Below is a list of Commonwealth departments and an outline of their functions as they influence tourism, It shows the various responsibilities of the Federal Government in each department. This listing is from a research study published by the Committee for Economic Development of Australia in 1974, under the direction of Edelmann and Grey.[11]

Department	Field of action concerning tourism
1. Foreign Affairs	Mutual interchange of visitors, restrictions on visitor stay (if necessary), points of contact for Australians travelling abroad, potential basis for rescue operations for stranded tourists, etc.

2.	Overseas Trade	Viewing incoming tourism as an export commodity; policies to encourage and develop that export should be comparable with other export products.
3.	Treasury	Provision of funds to State Governments for developmental and promotional activities within Australia; provision of funds to the Australian Tourist Commission for marketing and promotional activities abroad; development of policies to encourage tourism development by the private sector.
4.	Customs	Provision of services at seaports and airports; responsibility for a major public relations exercise at the point of entry for tourists.
5.	Media	Cooperation with the Australian Tourist Commission, national carrier, overseas offices in the promotion of Australia abroad; provision of services and facilities for promotional activities.
6.	Labour	Policies affecting industrial relationships within the tourist industry.
7.	Urban & Regional Development	Interest in the conservation of historic sites, buildings and areas within our cities. Controls major funds and is capable of adding substantially to the tourist industry infrastructure.
8.	Transport & Civil Aviation	All policies relating to air fares, landing rights, carrier frequencies, charter policies, reciprocal rights, national railway systems, national roads systems, coastal shipping services.
9.	Education	Provision of tourist industry oriented courses at the tertiary level.
10.	Works	Development of infrastructure - airports, air terminals, shipping facilities.
11.	Aboriginal Affairs	Provision of policies affecting aboriginal reserves, involvement of aboriginals in tourism, aboriginal historic sites.
12.	Immigration & Health	Provision of facilitation with respect to passports, visas and other entry requirements of foreign visitors.
13.	Environment & Conservation	Preservation of balance between reasonable development and sound conservation policies.

14.	External Territories	Responsibility for certain tourist destinations (e.g. Norfolk Island).

As in most government establishments, the role of the government has been increasing. Recently the Commonwealth Government has taken up the function of promoting domestic tourism. The objective of this campaign is to encourage Australians to holiday at home rather than go abroad. It is hoped that this new campaign will complement and also support the various State Government promotional programs. It should be pointed out that though the major role of the Federal Government is in the promotion of overseas tourism, it has an equally significant role to play in the domestic arm of the tourism industry.

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CHAPTER 3

MARKET SEGMENTATION

This chapter reviews market segmentation; in particular its meaning and role to the firm will be discussed, together with the bases used for market segmentation. Also, Tasmania's population will be segmented into homogeneous advertising market segments so as to facilitate the use of a linear programming (L.P.) approach in media selection for promoting tourist travel by Tasmanians within their state.

Market segmentation has long been considered one of the fundamental concepts of marketing. It provides the firm with guidelines for its marketing strategy and resource allocation among markets. In general, markets are heterogeneous which means that customers are faced with different constraints, needs and incentives. Products in such a market compete with one another imperfectly in satisfying customer needs. In such situations market segmentation is concerned with the development of products so as to meet consumers' requirements and the producers' as well.

Market segmentation can be viewed in two different ways - theoretical and strategic. "As a theory, market segmentation is the grouping of potential customers into sets that are homogeneous in response to some elements of market mix."[1]

From this definition a segmented market is viewed as

exhibiting homogeneous characteristics which permit the identification, and eventually the fulfilment of specific consumer needs, thereby resulting in greater profit for the firm than would otherwise be the case. Hence, the emphasis is on group identification on the basis of some particular characteristic. This could range from some well defined geographical region to some attitude or perception, and this could present a measurement problem. Whatever the group's common denominator is, the resulting segment shows a high degree of homogeneity with respect to that basic characteristic.

The strategic definition of market segmentation is "the allocation of marketing resources, given a heterogeneous customer population".[2] This definition also recognises that the various segments are homogeneous and have a common characteristic; this allows for a refinement of market strategy. It will be seen that there is an association in both definitions. The theoretical definition takes into account the identification of a common characteristic in each market segment and then classifies these individuals into their appropriate segments. On the other hand, the strategic definition involves the development of marketing strategy for the various segments in the market, that is allocating market resources to each segment according to their respective needs.

3.1 Reasons for Market Segmentation

Since the pioneering Wendell Smith article[3], market segmentation has become a dominant issue in market literature and practice. Many reasons have been advanced by marketers for dividing their markets into homogeneous sets. Basically these reasons all fall into one of the following categories:

(a) To improve the marketing program for existing products.

(b) To develop new products.

The first reason for segmentation analysis takes into account existing markets by attempting to identify customer needs so that services rendered would meet consumers' expectations. Hence the role of the marketing manager is to identify the various homogeneous groups together with their needs, and to determine whether it is possible for his firm to profitably meet these needs, using existing products.

The second reason for segmentation is advanced on the grounds of introducing a new product into the market. Here the marketer segments the market so that he can determine the sales potential of the new product within the various market segments. The difference between these two reasons lies in the fact that with the first case, the existing market was segmented due to poor market performance so that the resulting segmentation would meet the needs of the various groups in the market, while in the second case, segmentation was carried out to provide a service which was not in existence before.

3.2 The Role of Market Segmentation

Today, market segmentation plays several key roles in assisting marketing personnel in meeting objectives. A sound market objective should be based on the knowledge of how the needs of these segments which produce most customers for the firm's brand, differ from the needs of segments which produce the largest number of customers for competitive brands. The importance of market segmentation can be seen when it is realized that the most pragmatic way of segmenting any market becomes the standard for almost all the firm's evaluations for strategic purposes. Knowledge about the firm's market segments can be used:

(a) to appraise competition's strengths and vulnerabilities;

(b) to plan its product line development;

(c) to determine its advertising and selling strategy; and

(d) to set precise marketing objectives, against which performance can be evaluated most effectively.

Through market segmentation, firms can decide how to allocate resources for a more effective marketing effort. In Tasmania for example, with about 45% of the population living in the southern segment, 30% in the northern segment, and about 25% in the north-west, it would be advisable to allocate more to promoting and advertising domestic travel in the south than in the other two segments. (This is based on Section 3.6.) Besides the efficient and economic allocation of the marketing effort, a well segmented market directs the firm to design an

adequate product line that truly parallels the demands in different market segments. A homogeneous market acts as a signal to the marketing personnel. Marketers can detect the first sign of any major trend in a swiftly changing market, thereby giving them time to take advantage of the situation. Knowledge about market segments is useful when choosing advertising media and when determining the proportion of the budget that should be allocated to the various segments. With well defined and segmented markets, an optimal media mix can be determined which satisfies the advertising and marketing objectives.

3.3 Basis for Market Segmentation

To facilitate optimal media-mix planning it is helpful to examine the various bases which may be used to determine market segments. Once these have been reviewed, discussion will concentrate on those bases which might be significant in segmenting the Tasmanian markets for advertising purposes.

3.3.1 Geographic segmentation

Historically, perhaps the first type of market segmentation to exist was geographic segmentation. Small manufacturers who wished to limit their investments, or whose distribution channels were not large enough to cover their entire potential market segment, had to concentrate on areas in which their product could be sold. With geographic segmentation, the entire market is divided on a regional basis, into electoral divisions, cities, or

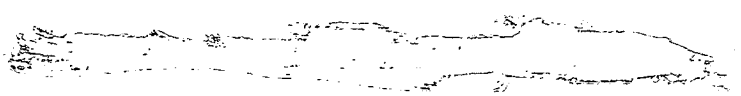
countries, depending upon the potential market. Alternatively, geographic segmentation could be based upon climatic characteristics or population density.

3.3.2 Demographic segmentation

As the number of brands and product lines increased, a second basis of segmentation - demographic segmentation - became popular. Demographic variables include age, sex, income, occupation, education, family life cycle (marital status and the age of children), family size, social class, race and religion. Demographic segmentation is achieved by aggregating individuals with similar demographic characteristics thereby generating a homogeneous segment. Demographic variables are among the most often used for customer segmentation.

3.3.3 Psychographic segmentation

Psychographic segmentation takes into account the life-styles of people. Here life-style refers to the particular consumption behaviour of individuals or their attitude to both work and play, as well as to how they react to advertising. Consumers within a market segment may have different values and attitudes, as well as different living patterns. It is the business of the marketer to group these various individuals into segments that enable the development of an advertising and promotion strategy.



3.3.4 Consumption segmentation

This is based primarily on consumer 'loyalty' to a particular brand of product, the market being segmented on a 'user' basis. In a very simple form the market is segmented into non-users, past users, potential users, new users, and regular users of the product. Alternatively markets may be segmented into three groups: light, medium, and heavy user groups of the product.

3.3.5 Benefit segmentation

Another form of segmentation is based upon the use of causal factors rather than descriptive factors. This is referred to as 'benefit segmentation', and the assumption underlying this approach is that the benefits which people seek in terms of a product 'cause' them to behave in a particular fashion. These benefits therefore are considered to reflect the true market segment more closely. It is generally agreed that the benefits individuals seek from a product represent a more accurate measure of their behaviour than do demographic characteristics or consumption behaviour.

3.3.6 Media use as a basis for segmentation

This form of segmentation is very common with advertisers. In this case, any region with the same media outlets are grouped together as one advertising market segment. The media outlets in a particular segment are unique, and differ from those of other segments. A 'market-segment' in this regard can be defined as

representing relevant groups with respect to their media usage. This means that for segmentation to have any benefit, the various market segments should respond in different degrees to promotion and the media. For these differences in promotion and media use to be of any significance, the advertising copy, the media vehicle, and the distribution of promotional literature should be different for each segment.

3.4 Multivariate Statistical Techniques

Before concluding this section on the bases for market segmentation, it will be proper to mention that there are statistical tools used for segmentation. Two of these statistical tools are cluster analysis and discriminant analysis. Cluster analysis is the process whereby objects or individuals that are close to one another in terms of a pre-specified measure are aggregated according to some set of criteria. The objective of the analysis is to produce homogeneous segments of entities from a heterogeneous market.

Discriminant analysis is a multivariate technique by which individuals (or objects) are grouped together because they have observable attributes which serve to discriminate between these groups. It identifies those discriminant variables which maximise the degree of homogeneity within each group and the differences between the groups. From this a linear discriminant function can be derived to distinguish between the groups. The objective of the analysis is to group individuals (or

objects) into two or more groups on the basis of several observable variables.

3.5 Inadequacy of a Single Base

Having considered the various bases for market segmentation, it becomes apparent that there is no single basis that is adequate for market grouping. In contrast to the theory of segmentation, which implies that there is a single best basis for segmenting markets, the range and variety of market decisions suggest that an attempt to use any single parameter for segmentation (such as media use) for all market decisions may lead to an incorrect marketing strategy. Fran and Massey (1975) contend that the:

> crucial criterion for determining the desirability of segmenting a market along a particular dimension is whether different sub-markets have different elasticities with respect to the price and promotion policies of the firm.[4]

Most marketers adopt some form of market segmentation framework in order to focus their planning effort on a particular market target. It seems that there is no agreement on the appropriate basis for segmentation. Most marketers explore a variety of bases before selecting one.

3.6 Segmentation of Tasmania

The need for segmentation as a method for strategic purposes presupposes that the market for a particular product is composed of segments of customers with different needs. Given such an underlying assumption, it

becomes apparent that when endeavouring to promote travel by Tasmanians within their state, differences in the needs of people should be recognized.

So one approach to this problem is to use the state's population distribution. The state's population tends to centre around the urban areas - Hobart, Launceston, Devonport and Burnie. This kind of population distribution suggests that segmentation should be made on a regional basis, that is, geographic segmentation. A region here refers to an area which is larger than the local government area, and smaller than the state.

Segmenting the state on this basis, three distinct regional segments become apparent - the Southern, Northern and North-West regions. The Southern region is made up of Hobart, Glenorchy, Brighton, Kingborough, New Norfolk and Sorell. It also includes other southern local government areas which have Hobart as their urban focus. The Northern segment includes Launceston, St Leonards, Evandale, Westbury, Beaconsfield and those local government areas which have Launceston as their main city. The North-West segment comprises Devonport, Burnie, Penguin, Ulverstone, Latrobe and part of the municipalities of Wynyard.

This concern for regionalisation arose in part from the belief that some activities of government are most efficiently and effectively planned, co-ordinated and administered at a level intermediate to those of the state and local government. Even though administration is not a basis for segmenting an advertising market, here

administrative factors favour such a regional segmentation.

Besides the administrative significance of these segments, there are other factors that support segmenting the state's population along the above lines. The media outlets within each segment are not only closely identified with that segment, but differ to a varying degree between the three segments. Where a medium outlet can be identified with more than one segment (such as TNT9), the impact is assumed to be of little relevance. Since there is a degree of variation between the regions in their media usage, there is the consequent need to promote a campaign through the various media outlets that serve each particular segment. It is likely that the three segments will vary in their sensitivity to the industry's (Tourist Industry) promotional campaign. People within a particular segment may not wish to travel around their own region. This may be because they have already visited most of the local tourist areas or that they are more interested in areas outside their own region. Therefore segmenting the state into the above segments will not only help meet the objectives of this study, but will also form a suitable basis for developing a promotional campaign. This form of segmentation also highlights the importance of the social and economic activities within each region. Each of these districts exhibits a high degree of social and economic intra-regional behaviour and common parochial interests.

While the attitudes of the people within each region are fairly similar, those between the regions differ quite significantly. Even competition between these three regions supports such segmentation. At present there is a keen competition between the south and the north over where the state's international airport should be situated. This same rivalry is more clearly seen in sea transportation. The state has a number of ports capable of accommodating overseas vessels: the ports of Hobart, Launceston, Devonport and Burnie. Each port has its own administrative body that has jurisdiction over the affairs of the ports.

Lastly in support for segmenting the state population along these lines, it should be mentioned that both the ABS and the Australian Telecom use similar segmentation bases. It is hoped that in carrying out this study the population in the various segments and their respective demographic variables will be based on the current ABS Census of Population and Housing conducted in June 1981.

3.7 Benefit of this Segmentation

By dividing the state into these three segments for the purposes of advertising tourism, this advantage will be derived - for each segment there will be a particular advertising strategy and message designed to encourage people to visit other areas of the state. This means that measures of sensitivity of different market segments to advertising can be used to develop an appropriate marketing strategy for each region.

Segmenting the state's population along these lines, facilitates the development of advertising messages which inform people about tourist attractions in other segments. This will help to promote travel from one segment to another. With such segmentation, the industry can determine how best to allocate its resources among the various markets. Finally, segmenting the domestic tourist market will provide management with information on the absolute and relative performances of each segment and the different marketing strategies being used.

3.8 Matching Advertising Market Segment with Media

Having segmented the state's population into three advertising segments - the south, north and north-west, it is appropriate to determine the various commercial media vehicles which have audiences that typify or represent, as closely as possible, each advertising market.

With a limited number of local newspapers and controlled radio and television broadcasting systems, the three segments constitute a workable format for the application of a systematic media selection program. Since one of the objectives of segmentation is to find media vehicles that have an audience construct similar to that of the advertising market, it follows that only those commercial media vehicles that meet this requirement will be used to carry any Tasmanian intrastate promotional and advertising campaign. The better the matching process the more effective will be the use of resources in promoting

messages to the target audience, in this case the people of Tasmania.

In the three advertising market segments developed for the state's domestic tourist travel promotion, each segment has a set of appropriate commercial media vehicles that is best suited to obtain the maximum exposure level in that segment.

The following media vehicles have been identified and are considered to be the most efficient in terms of exposure levels.

Southern Segment

1. Tasmanian Television (TVT6)
2. Mercury newspaper
3. Tasmanian Mail newspaper
4. 7HO radio
5. 7HT radio
6. Direct mail

Northern Segment

1. Northern Television
2. Examiner newspaper
3. Tasmanian Mail newspaper
4. 7EX radio
5. 7LA radio
6. Direct mail

North-West Segment

1. Advocate newspaper
2. Tasmanian Mail newspaper

3. 7BU radio
4. 7QT radio
5. Direct mail

For the purposes of minimizing the inevitable degree of overlap in television audiences between the north and the north-west segments, the television audience in the state will be segmented into two advertising segments - the south and the north. This leaves the north-west segment with only five advertising media outlets. In addition, since the circulation of the Tasmanian Mail is based on all three advertising regions, it will be regarded as a separate newspaper in each segment.

Direct marketing will be used as a medium for promoting intra-state travel within Tasmania. The data for this computation will be based on the number of occupied private dwellings in the regions. This will exclude caravans and house boats as well as improvised homes and dwellings attached to non-dwellings. This information will be derived from the ABS Census of Population and Housing, conducted in June 1981 - giving the characteristics of the population and dwelling in local government areas, Tasmania.

References for Chapter 3

1. Lilier, G.L. & Kotler, P. Market Decision Making: A Model-building Approach.
2. Lilier, G.L. & Kotler, page 290.
3. Smith, W.: "Product Differentiation and Market Segmentation as Alternative Marketing Strategies", Journal of Marketing, Vol. 20 No.3, July 1956, pages 3-8.
4. Lilier, G.L. & Kotler, P. Market Decision Making: A Model-building Approach, page 295.

CHAPTER 4

REVIEW OF PROGRAMMING TECHNIQUES

This chapter discusses the various optimizing approaches in media selection. The aim of this advertising model review is to select the most appropriate quantitative approach for media schedule modelling for Tasmania, in promoting the state's domestic tourist market.

The four mathematical optimizing approaches are:

1. Linear programming.
2. Decision programming.
3. Dynamic programming.
4. Integer-goal programming.

4.1 Linear Programming

Linear programming is a mathematical technique that has been developed to aid decision makers in their task of maximising or minimising a linear objective function which is subject to a set of linear constraints. In linear programming the maximization or minimization of some variable is referred to as the objective of the problem, while the linear constraints limit the degree to which the desired objective can be achieved. An example could be the budget allocated for advertising in various media. To maximise exposure in these various media the problem will be constrained first by the size of the budget, then by number of available media, cost per insertion in each medium and the number of people that different media are

exposed to.

A linear program is said to be in standard form when all the constraints are modelled as equalities and if an initial basic feasible solution is known. In a matrix notation, the standard form is:

$$\text{To optimise:} \quad z = cx \tag{4.1}$$

$$\text{Subject to:} \quad Ax = b \tag{4.2}$$

$$\text{With:} \quad x \geq 0 \tag{4.3}$$

In 4.1 to 4.3 above, x is a column vector of unknowns, including all slack, surplus, or artificial variables; c is the row vector of 'prices'; A is the matrix of coefficients in the linear constraints; and b is the column vector on the right hand side of the constraint equations. If an identity matrix can be formed from the column vectors of A, which in turn are associated with variables which collectively constitute some vector x_o, then an initial basic feasible solution can be formed. This will be given by $x_o = b$, which means that all the other variables in x which are not included in x_o, the non-basic variables, are assigned zero values. In a detailed form the model will be represented as:

$$\text{Max } F(X_1, X_2, \ldots X_n) = C_1X_1 + C_2X_2 + \ldots + C_nX_n$$

Subject to:

$$\begin{aligned}
a_{11}X_1 + a_{12}X_2 + \ldots + a_{1n}X_n &\leq b_1 \\
a_{21}X_1 + a_{22}X_2 + \ldots + a_{2n}X_n &\leq b_2 \\
a_{31}X_1 + a_{32}X_2 + \ldots + a_{3n}X_n &\leq b_3 \\
\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\
\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\
a_{m1}X_1 + a_{m2}X_2 + \ldots + a_{mn}X_n &\leq b_m
\end{aligned}$$

$$X_1 \geq 0,\ X_2 \geq 0 \ldots\ldots X_n \geq 0$$

4.1.1 The linear programming model

For over two decades marketing executives have collaborated with mathematicians and quantitative methods professionals in order to develop models for solving various marketing problems. One of these areas of investigation involves media selection: which could be viewed as a process of designing a course of action that shows how various media, advertising time and space, can be used to achieve pre-specified marketing objectives. During the early 1960s there was great interest in the use of mathematical methods for determining the optimal combination of those media that were available to carry an advertisement to a specific target audience. This optimal combination of media is referred to as the media mix. Some of the first models developed in this area used linear programming (L.P.) techniques to allocate advertising budgets to various media outlets, and in so doing determine the optimal 'media mix'. The section which follows will demonstrate how linear programming can be applied to this media mix problem.

In advertising, a media planner has a wide range of alternatives from which to choose, yet various constraints exist which limit the number and the type of media which are suitable. These constraints include matters such as the size of the advertising budget, market characteristics, and the relative effectiveness of various media in a particular market.

4.1.2 Institutional constraints

Let N_i (i = 1, 2, . . n) be the number of times that the ith advertising medium is used during some specified period. For example, N_i might indicate the number of insertions in medium i per year. N_i will vary from one medium to another so that, for example N_1 could denote the number of full page insertions in the Mercury [1] each year, while N_2 could denote the number of full page insertions in the Tasmanian Mail [2] over the same period of time. The number of issues or exposures during any defined period of an advertising campaign is taken into consideration in the form of a constraint. Since the Mercury is a daily paper, in a period of one year there will be 312 issues at the most, therefore N_1 cannot exceed 312, or:

$$N_1 \leq 312 \qquad (4.4)$$

The Tasmanian Mail will have 49 issues in a period of one year, and so:

$$N_2 \leq 49 \qquad (4.5)$$

Suppose N_3 is the number of times a 20 second commercial is telecast just prior to 'Sixty Minutes'.[3] Being a weekly television program, there will be no more than 52 telecasts over a period of one year, so:

$$N_3 \leq 52 \qquad (4.6)$$

In general, N_i cannot exceed the maximum number of times it is possible to use the particular medium in the period under consideration.

4.1.3 Budget constraint

The budget constraint reflects the total amount to be spent on advertising for a specific period.

Let C_i be the cost per insertion of using medium i, and M the total amount allocated for advertising during the campaign period, then the budget constraint will be:

$$C_1N_1 + C_2N_2 + \ldots + C_nN_n \leq M \qquad (4.7)$$

4.1.4 Subjective constraints

Subjective constraints are based upon the "conceptual" experience of the media planner.

> Within the framework of this model one is free to impose subjective constraints which reflect management's or the agency's conception of the limits to be placed on the media program.[4]

The planner may decide to limit the number of insertions before the 6.30 p.m. television news on Friday (N_4) to a total of 16 for the campaign period of one year, because he intuitively thinks that, from his experience, a significant proportion of the target audience do not have their evening meal at home on Fridays. So,

$$N_4 \leq 16 \qquad (4.8)$$

Alternatively, the media planner may want to increase advertising in the Mercury and the Tasmanian Mail on public holidays to a total of 25 over the campaign period. From the planner's experience the target audience spend more time reading the paper during holidays than on a normal working day. So,

$$N_5 \leq 25 \qquad (4.9)$$

In some instances subjective constraints may be based

upon the incorrect judgement of the media planner. However, they play a useful role in the initial development of the media mix model and can be subjected to sensitivity analysis at a later stage.

4.1.5 Objective function

The objective function in a media mix linear programming model maximises the effectiveness of exposures. The objective is not to maximise the number of readers, viewers or listeners, but to maximise a weighted average of the number of exposures in the media appropriate to the target market concerned. In so doing the objective function must take into consideration not only the important characteristics of that market, but also their relative importance.

Let us assume in a market research project associated with a magazine medium that the following are assessed to be the characteristics of four target markets[5] and the weights which reflect their relative importance.

TABLE 4.1

Target Market	Relative Importance
Age (18-35)	.50
Income ($8000+)	.25
Metropolitan location	.15
Family with children (1-6)	.10
Total	1.00

Table 4.1 tells us that 50 per cent of the first target market is made up of people within the age range 18-35 years; 25 per cent of the market has an income of

$8,000 and above; 15 per cent of the population live in an urban area; and 10 per cent of the target market are families with anywhere from one to six children.

Now assume that the data below represent the percentage of each market segment which are estimated to read the magazine in question:

TABLE 4.2

Market Segment	Percentage readership
Age (18-35)	60%
Income ($8000+)	33%
Metropolitan location	70%
Family with children (1-6)	50%

From the above Table 4.2, 60 per cent of people within the target market aged between 18 and 35 years are readers of the magazine which is being considered, among the same readers 33 per cent of them have an annual income of $8,000 or above, with 70 per cent of the readership living in urban areas and 50 per cent of readers having one to six children.

Assuming that 80,000 people are reached by medium i, then in order to determine the effective readership of medium i, the total potential readership is multiplied by the weighted average percentage of readers:

$$(0.6 \times 0.5) + (0.25 \times 0.33) + (0.15 \times 0.70) + (0.10 \times 0.50) = 0.538 \qquad (4.10)$$

This weighted average, denoted by b_i, will always be between zero and unity. The effective readership of medium i, which is denoted by e_i, is found by multiplying 0.538 by the number of people reached by medium i. The effective readership of medium i is therefore:

$$0.538 \times 80{,}000 = 43{,}040 \qquad (4.11)$$

With the effective readership for medium i denoted by e_i, and the total readership for medium i by r_i, then the preliminary form of the objective function for the linear programming media mix model is:

$$\text{Max } Z = e_1 r_1 N_1 + e_2 r_2 N_2 + \ldots + e_n r_n N_n \qquad (4.12)$$

The appropriateness of the medium in question to produce successful advertising readership should not be overlooked. For example, in order to promote tourism by advertising it would be more appropriate to use a tourist oriented magazine to carry the message, than a hardware magazine which is not related to either travel or holiday environments. Such appropriateness is referred to as the external characteristic of a medium, and this must also be taken into account in the model.

On the basis of appropriateness of editorial a potential weight is assigned to the medium. Suppose the media planner, based on his own experience, decides that a 20 per cent weight should be given for media reach and appropriateness. This should be reflected in the objective function of the model. Let q_i be the number assigned to medium i for reach and appropriateness, where:

$$0 \leq q_i \leq 20 \qquad (4.13)$$

The final objective function will now be:

$$\text{Max } Z = q_1 e_1 r_{1N} + q_2 e_2 r_2 N_2 + \ldots + q_n e_n r_n N_n \qquad (4.14)$$

4.1.6 Limitation of the model

The success of the linear programming model in determining the optimal media mix is very much limited by

the following factors:

(a) Linear programming fails to take account of the possibility that repeated exposures have a diminishing marginal effect.

(b) The model assumes a constant exposure cost in each medium and does not take account of discounts for repeated exposures.

(c) The linear programming model does not take certain aspects of time into consideration. No account is taken of when advertisements should be exposed, or over what period of time.

(d) The model does not consider the problem of audience duplication. Audience overlapping is not a problem within the model.

(e) The model makes use of data that are unreliable or difficult to obtain, such as measures which reflect the rate of medium effectiveness.

Underlying all these limitations is the fundamental unreality of assuming linearity. In the context of our problem discounts are a non-linear function of audience duplication.

4.2 Decision Programming

In order to overcome some of the above problems inherent in the use of linear programming in media selection, a new technique called decision programming was developed by Zangwill[6] in 1965. Decision programming determines the optimal media mix without the many limitations associated with linear programming. The model

is formulated in terms of code variables, which take on the values of one and zero only, depending upon whether a particular 'selection' is in the media mix or not. In addition, the model also takes account of discounts which may be available as the number of insertions or duplications increases.

In Zangwill's decision model, the word 'selection' refers to a specific advertising medium such as a particular radio program, newspaper, or magazine. Within a particular medium there may be several alternatives from which to choose. For example whether to sponsor a television commercial for 24 weeks, or for some other period of time. In the case of the newspaper medium it may involve choosing between running an advertisement for 2 weeks in a half page size, assuming the paper is a daily paper, or running a full page advertisement for only a week.

For the purposes of exposition let us assume that for a particular programme, there are four possible sponsoring periods, 24 weeks, 38 weeks, 48 weeks and 52 weeks. The question arises as to which of the four periods should be selected.

Let X_{ij} denote the ith decision variable related to the jth medium. In the above example X_{11} would therefore be concerned with 24 weeks of sponsoring on some particular television program, X_{12} would denote 38 weeks of advertising on the same television program, and so on. The value of 1 for X_{11} would indicate that the 24 weeks sponsoring alternative has been selected for the

particular television program. The other variables X_{12} to X_{14} will take on the value 0. The equation for the four choices is stated below:

$$\sum_{j=1}^{4} X_{ij} = 1 \qquad (4.15)$$

$$X_{ij} = (0 \text{ or } 1) \text{ for all } j \qquad (4.16)$$

$$i = 1, 2, 3, 4 \qquad (4.17)$$

i = the media vehicles being considered.

Only one of the four alternatives can be selected.

The fact that a particular medium may not be suitable is accounted for by the use of slack variables. If the program is not suitable for sponsoring the particular television advertisement, it will be denoted by X_{10}, which plays the role of a slack variable. The decision programming constraint equations will then be:

$$\sum_{j=0}^{4} X_{1j} = 1 \qquad (4.18)$$

$$X_{1j} = (0 \text{ or } 1) \text{ for all } j \qquad (4.19)$$

$$j = 1, 2, 3, 4 \qquad (4.20)$$

j = the number of options in each medium.

In the case of the newspaper medium (The Mercury - a daily paper) there could exist several options. The first option may be a full-page daily advertisement, the second option a half-page weekly advertisement, and a third option a full-page monthly advertisement; each alternative pertaining to some planned period.

Let X_{21} denote the first option variable associated with the newspaper (The Mercury) medium, that is running a full-page advertisement in some newspaper every day for the planned period. X_{22} will denote the second option, a weekly advertisement, and so on. Again a slack variable X_{20} is included for the same reasons X_{10} is in the first constraint. Therefore the constraint equations for the second medium will be:

$$\sum_{j=0}^{3} X_{2j} = 1 \qquad (4.21)$$

$$X_{2j} = (0 \text{ or } 1) \text{ for all } j \qquad (4.22)$$

$$j = 0, 1, 2, 3. \qquad (4.23)$$

4.2.1 The budget constraint

It is assumed that all advertising costs for any medium i are known. The cost of option j in medium i is denoted by C_{ij}, which incorporates any discounts arising from multiple insertions or duplications. The budget constraint restricts the total expenditure on the selected options to be no greater than the total budget B.

$$\sum_{ij} a_{ij} X_{ij} \leq B \qquad (4.24)$$

Here the sum is over all possible selections and choices.

4.2.2 The objective function

The objective function in the decision programming model is formed in two stages. The first stage takes account of a particular selection and its effectiveness rating, denoted by R_{ij}. If R_{ij} denotes the effective rate

for the jth option in the ith medium, then the effective rate of medium i will be given by:

$$\sum_{j=i}^{n_i} R_{ij} X_{ij} \qquad (4.25)$$

where n_i is the number of available options in medium i. The rate of effectiveness R_{ij} is based on the assumption that there is no audience duplication.

The second stage of the objective function considers the combined effectiveness for the selections which are overlapping. To determine this decrease in combined effectiveness between medium i choice j and medium h choice k within the media mix, let this decrease in media effectiveness be denoted by $r(ij)(hk)$.

"This number is added to the objective function through a term written as $-X_{ij}\, r(ij)(hk) X_{hk}$". [7] This number is zero if X_{ij} and X_{hk} are not selected. The model can now be written as:

$$\sum_{ij} X_{ij} R_{ij} - \sum_{ijhk} X_{ij}\, r(ij)(hk) X_{hk}$$

subject to:

$$\sum_{j} X_{ij} = 1 \qquad \text{for } i = 1, 2, \ldots I$$

where there are I selections.

The budget constraint is:

$$\sum_{ij} C_{ij} X_{ij} \leq B$$

$$\text{All } X_{ij} = (0 \text{ or } 1).$$

4.2.3 Limitations of decision programming

There are two main limitations to the use of the decision programming model for determining the optimal media mix. First, it requires an integer programming algorithm, which is inefficient from a computer point of view. It limits the total number of choices and selections that the computer can handle. Secondly, it is very difficult to determine estimates of the decrease in the effectiveness rate resulting from audience overlapping.

4.3 Dynamic Programming

Besides the main mathematical optimizing techniques to media selection problems, - linear, decision and integer goals programming - there is another optimizing technique called dynamic programming.

Dynamic programming is a technique for problem solving that allows the decomposition of one large mathematical model, which in its original form is difficult to solve. Typically, dynamic programming solves the problem in stages with each stage involving an optimizing variable. This is the maximum profit or allocation that can be obtained in any given stage. It should be pointed out this recurrence relationship is the main principle of dynamic programming and is known as the principal of optimality. The optimal variables at each stage are linked through recursive computation in such a way that a feasible optimal result to the whole problem is reached at the final stage. The final result to the

problem is generally optimal and this may be at the first or last stage depending on the direction of computation (forward or backward recursive computation). Through the use of recursive computations the complex mathematical problem can be solved in stages. Because of this stage-to-stage computation dynamic programming is sometimes called multistage programming.

The objective of the program is to maximize:

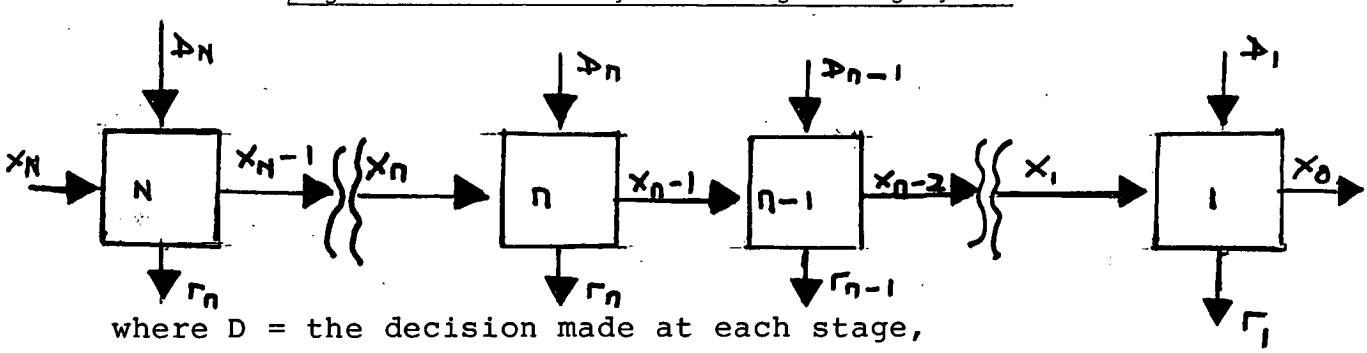
$$\sum_{i=1}^{n} R_i \qquad (4.26)$$

where $R_i = f(s_i \; d_i)$ (4.27)

R_i denotes the reward of the process in stage i. Equation (4.27) states that the reward is a function of the process at stage i and the decision made at stage i. The optimal decision is determined at each stage, by selecting the optimal decision in the nth stage and then working backwards to select the next optimal decision in the next stage (n - 1). In so doing the program reduces the number of stages that are examined.

Figure 4.1 shows a simple dynamic programming system, a serial system in which the output of one stage becomes the input for the next.

Figure 4.1: Serial Dynamic Programming System



where D = the decision made at each stage,

X = the input for a stage that gives all relevant inputs to the box
r = the reward of combining decisions at stage n with X_n inputs.
n = number of stages.

Each box represents a stage in the decision process. In general stage n (n = 1, 2, . . . , N) is any N stage system. D is the decision made at each stage that controls the variables. X is the input for a stage that gives all relevant inputs to the box. Therefore the input for stage n is the output from stage (n - 1), with r denoting the reward for combining D_n decisions at stage n with X_n inputs. Though the dynamic programming technique has been used in medium selection, it does have features that limit its use for practical application. Among others, these are some of its limitations:

(a) Dynamic programming is limited to the carry-over operations from one stage to another. If the variable exceeds five or six the problem becomes unmanageable.

(b) The dynamic programming algorithm quickly expands beyond the limits of the computer if several market segments are considered.

(c) The program does not take into account discounts arising from multiple insertions and package advertisement buying.

(d) Dynamic programming can consider only one type of medium, for example magazines.

The basic problem with dynamic programming models for medium selection is that the present computers that are available are too simple, so they do not have the storage

capacity to handle a large figure problem which is often associated with media mix problems.

4.4 Integer Goal Programming

4.4.1 Goal programming

Most decision problems are characterized by multiple goals or objectives rather than a single goal. Sometimes these goals are complementary, but more often than not, they are conflicting.

Goal programming is a technique used for analysing decision problems that involve multiple objectives. The formulation of goal programming is similar to the formulation of linear programming. All the objectives of the decision maker, say the media planner, must be specified and ranked in order of importance, so that goals with a higher priority are considered before the lower priority goals.

The basic concept of goal programming involves weighting the set of goals before incorporating them into the model. Unlike the linear programming technique where the aim of the program is either to maximise or minimise some objective function, goal programming minimises the absolute deviations among the goals. These deviational variables can be either positive or negative. The objective is then one of minimising these deviations within the ranking structure already assigned to them. The general goal programming model can be expressed as follows:

$$\text{Minimise } Z = \sum_{i=1}^{m} w_i \ (d_i^+ + d_i^-)$$

subject to:

$$\sum_{j=1}^{n} a_{ij} X_j + d_i^- - d_i^+ = b_i \quad \text{for all } i$$

$$X_j,\ d_i^-,\ d_i^+ \geq 0 \quad \text{for all } i,\ j$$

X_j denotes the jth decision variable, w_i denotes the weight attached to the ith goal and d_i and d_i denote the degree of underachievement or overachievement of the goals respectively.

d_i^- = underachievement of target goal i

(that is, the amount by which the actual goal will exceed the target).

It is not possible to have both underachievement and overachievement of a goal at the same time; either one or both of the variables will be equal to zero, which implies that:

$$d_i^- \cdot d_i^+ = 0$$

The non-negativity requirement applies to all the variables as it does in the linear programming model.

$$d_i^-,\ d_i^+ \geq 0$$

Media selection problems by goal programming are limited in their ability to generate integer results. In many cases the decision variables are discrete and experience has indicated that where inputs are indivisible, the goal programming approach does not allow for an integer solution. This could yield suboptimal results.

4.4.2 Integer goal programming

In this section the advantages of goal programming will be combined with the integer programming approach to determine the optimal media mix for a problem using artificial data. Allowance will be made for quantity discounts, decay effect arising from the wearing of an advertisement, over a period of time.

The Model: integer goal programming Table 4.3 contains artificial data simply to illustrate the use of an integer goal programming model in selecting the optimal media mix. In the first column are the 11 media vehicles to be considered in the model, the single insertion cost of each of which is given in the second column.

Columns 3, 4 and 5 are various income groups in this particular target market. Here the segmentation of the market is based on the income of the people in the advertising region. Income group A represents persons who receive an annual income of $16,000 to $26,000. The second income group are individuals whose annual income ranges between $26,000 and $30,000, and the third group are persons whose annual income exceeds $30,000.

The next three columns consider segments D, E and F. These three market segments are based on geographic location of the people in the target regions. For the purposes of illustration it is assumed that there are three such geographic areas in the target region. Column 9 shows the total number of persons exposed to the various media. Column 10 shows the number of persons who earn

$35,000 and above. The last column considers persons with an annual income of $24,000 to $34,000.

TABLE 4.3

PERTINENT INFORMATION ON AVAILABLE MEDIA

Media Vehicle 1	Cost Per Single Insertion 2	Income Group A $16000-26000 A 3	Income Group B $26000-30000 B 4	Income Group C $30000+ C 5	Market Segment D D 6	Market Segment E E 7	Market Segment F F 8	Persons Exposed 9	Persons with Income over $35000 G 10	Persons with Income between $24000-34000 H 11
X_1	$300	13000	4000	8000	20000	26000	6000	145000	8500	5600
X_2	$450	7000	12000	3000	15000	30000	18000	100000	3200	13000
X_3	$500	4500	14000	6000	8000	40000	20000	60000	6200	14000
X_4	$600	8000	10000	800	9000	1320	12000	58000	812	11000
X_5	$200	11000	6000	10000	10000	5800	17000	162000	10100	8200
X_6	$550	6000	7500	11000	6500	1121	7520	112000	11500	10000
X_7	$250	12000	9500	3000	16000	600	9200	85000	3050	12000
X_8	$340	14000	1000	3000	2100	8000	7800	95000	3100	3000
X_9	$700	8000	7200	12000	1000	1020	9100	450000	12500	8300
X_{10}	$900	7500	4500	7000	2000	9200	5200	35000	9000	5200
X_{11}	$100	900	12000	4000	12000	8400	7800	41000	4000	14000

* **Artificial Data**

The above example involves the use of 11 different magazines, X_1 to X_{11}, to promote tourism in Tasmania and is concerned with three main income groups. The objective is to promote travel within three different market segments D, E and F. To achieve this the advertising firm has identified two priority objectives. The first is to increase the total exposure level of people reached by the media and the second, to increase the rate of travel by persons who earn between $24,000 and $34,000 and those who earn above $35,000 each year (columns 10 and 11 in Table 4.3).

Strict constraints:As we are using an integer goal programming model, it is possible to allow for quantity discounts and varying charges for multiple insertions. This is achieved by the use of dummy variables. Assuming that medium vehicle X_9 is the only vehicle that has such discounts, then Table 4.3 above indicates that one insertion would cost $700. We further assume that the second and third insertions cost $620 and $520 respectively, and every additional insertion costs $500.

In order to account for multiple discounts, based on cost-per-thousand (see Appendix XI), for every discount associated with media vehicle X_9, the inequality is reduced by a thousand. The dummy variables X_{12}, X_{13} and X_{14} are the various stages of discounts arising from multiple insertions.

$$X_9 - 1000X_{12} \leq 0 \qquad (4.27)$$

$$X_9 - 1000X_{13} \leq 1 \qquad (4.28)$$

$$X_9 - 1000X_{14} \leq 2 \qquad (4.29)$$

These dummy variables would be included in all budget equations to be considered in the model with coefficients representing the premium above the base price ($500) paid for that insertion: $80 for X_{12}, $180 for X_{13} and $200 for X_{14}.

Priority ranking of goals

This model will be developed using the assumption that the firm knows its goals and has ranked them in their order of importance. The model begins with priority 1.

Priority 1: Budget overexpense goal: It is assumed that the first priority of the firm is to limit budget overexpense, so that the firm will meet other stated objectives. This implies, for example, that the firm may have a planned budget of $4,500 but will allow for an overrun of $300 to enable it to achieve other priority goals. From information given in table 4.3 this goal will be achieved by minimisation of positive deviation (d_i) in the following equation:

$$\begin{aligned} &300X_1 + 450X_2 + 500X_3 + 600X_4 + 200X_5 \\ &\quad + 550X_6 + 250X_7 + 340X_8 + 700X_9 \\ &\quad + 900X_{10} + 100X_{11} + 80X_{12} + 180X_{13} \\ &\quad + 200X_{14} + d_1^- - d_1^+ = 4{,}800 \end{aligned} \qquad (4.30)$$

Discounts for multiple insertion are checked through the use of dummy variables (X_{12}, X_{13}, X_{14}).

Priority 2: Desired exposure limits for media vehicles

A Maximum exposure level for individual media vehicles

In order to avoid exposure overlapping and audience duplication across the media, limits will be imposed on the number of insertions in certain media. For example, suppose the number of insertions in media 1 is limited to 3 at the most, in media 2 and 3 to 1, and in medium 4 to 2. This will be achieved by minimising the positive deviations in the equations below, as it is only through the minimisation of overachievement target goals that overlapping and duplication are also minimised.

$$X_1 + d_2^- - d_2^+ = 3 \qquad (4.31)$$

$$X_2 + d_3^- - d_3^+ = 1 \qquad (4.32)$$

$$X_3 + d_4^- - d_4^+ = 1 \qquad (4.33)$$

$$X_4 + d_5^- - d_5^+ = 2 \qquad (4.34)$$

B Miminum exposure level for individual vehicles:

To meet the desired optimal media mix there would be a minimum insertion level in some media vehicles. Let us suppose that the firm seeks to maintain a minimum insertion level in media 7 and 9 to 1 insertion. This will be accomplished by minimising the negative deviational variables in the two equations below:

$$X_7 + d_6^- - d_6^+ = 1 \qquad (4.35)$$

$$X_9 + d_7^- - d_7^+ = 1 \qquad (4.36)$$

C Maximum exposure level combinations for media vehicles

To overcome the problem of overlapping the firm may want to limit the combined number of insertions in media 2, 6 and 8 to 3 at most. This objective will be met by the

minimisation of d_8^+ in the equation below:

$$X_2 + X_6 + X_8 + d_8^- - d_8^+ = 3 \qquad (4.37)$$

D Minimum exposure level for combination of media

Suppose the firm wants to maintain a minimum of 3 insertions in media 1, 10 and 11. This objective will be achieved by the minimisation of d_9^- in the following equation:

$$X_1 + X_{10} + X_{11} + d_9^- - d_9^+ = 3 \qquad (4.38)$$

Priority 3: Desired exposure level for various income groups

Suppose one of the firm's objectives is to increase travel by the three income groups A, B and C so that these groups are the target audiences. The firm will seek a certain target exposure level for each of these three groups. The desired exposure levels could be 80,000, 65,000 and 40,000 respectively.

At this stage in the formulation of the model the decay effect of advertising will be incorporated through the use of dummy variables. This decay effect will be assumed to occur only in medium 9 and is limited to income group A. It is further assumed that the first two insertions will be weighted so as to provide 80,000 effective exposures for income group A, while the third insertion through to the fifth will each lose 15 per cent of impact due to repetition, but would account for 12,000 effective exposures. After the fifth insertion any other insertions that are made will have 65 per cent of the initial impact. This decrease in exposure level for group A will be 7,800 (65% of 12,000). In order to take account

of this decay effect two constraint dummy variables X_{15} and X_{16} are included in the model

$$X_9 - X_{15} \leqq 2 \qquad (4.39)$$

$$X_9 - X_{16} \leqq 5 \qquad (4.40)$$

X_{15} and X_{16} are included in the income group exposure level equation with coefficients of -1800 (15 per cent of 12,000, due to loss in impact of repeated exposure, from the third to the fifth insertions) and -4200 (35 per cent of 12,000 as a result of repeated exposure after the fifth insertion). By minimising d_{10}^- the desired exposure level for the different income groups will be achieved:

$$\begin{aligned} 13{,}000X_1 &+ 7{,}000X_2 + 4{,}500X_3 + 8{,}000X_4 + 11{,}000X_5 \\ &+ 6{,}000X_6 + 12{,}000X_7 + 14{,}000X_8 + 8{,}000X_9 \\ &+ 7{,}500X_{10} + 900X_{11} - 1{,}800X_{15} \\ &- 4{,}200X_{16} + d_{10}^- - d_{10}^+ = 80{,}000 \end{aligned} \qquad (4.41)$$

$$X_{15} + d_{11}^- - d_{11}^+ = 0 \qquad (4.42)$$

$$X_{16} + d_{12}^- - d_{12}^+ = 0 \qquad (4.43)$$

Equations (4.42) and (4.38) are included in the model at a lower priority level. The positive deviations d_{11}^+ and d_{12}^+ will be minimised so the X_{15} and X_{16} take on the minimum possible values.

The desired exposure levels for the other two income groups B and C will be attained by minimisation of d_{13}^- and d_{14}^- in equations (4.44) and (4.45) respectively.

$$4{,}000X_1 + 12{,}000X_2 + 14{,}000X_3 + 10{,}000X_4 + 6{,}500X_5 + 7{,}500X_6 + 9{,}500X_7 + 1{,}000X_8 + 7{,}200X_9 + 4{,}500X_{10} + 1{,}200X_{11} + d_{13}^- + d_{13}^+ = 65{,}000 \quad (4.44)$$

$$8{,}000X_1 + 3{,}000X_2 + 6{,}000X_3 + 800X_4 + 10{,}000X_5 + 11{,}000X_6 + 3{,}000X_7 + 3{,}000X_8 + 12{,}000X_9 + 7{,}000X_{10} + 4{,}000X_{11} + d_{14}^- - d_{14}^+ = 40{,}000 \quad (4.45)$$

Priority 4: Desired exposure level in the various market segments - D, E and F

In addition to segmenting the target audience into income groups, the firm has grouped persons within its market environment into three different market segments D, E and F according to their geographical location within the market environment. Let us assume that the target exposure levels for these three market segments be 95,000, 15,000 and 200,000 respectively. These exposure goals in the different market segments reflect the weighted importance attached by the firm to the three market segments. In order to achieve this objective d_{15} , d_{10} and d_{17} will have to be minimised.

For market segment D

$$20{,}000X_1 + 15{,}000X_2 + 8{,}000X_3 + 9{,}000X_4 + 10{,}000X_5 + 6{,}500X_6 + 16{,}000X_7 + 2{,}100X_8 + 1{,}000X_9 + 2{,}000X_{10} + 12{,}000X_{11} + d_{15}^- - d_{15}^+ = 95{,}000 \quad (4.46)$$

For market segment E

$$26{,}000X_1 + 30{,}000X_2 + 40{,}000X_3 + 1{,}320X_4 + 58{,}000X_5 + 1{,}121X_6 + 600X_7 + 8{,}000X_8 + 1{,}020X_9 + 9{,}200X_{10} + 8{,}400X_{11} + d_{16}^- - d_{16}^+ = 150{,}000 \quad \S(4.47)$$

For market segment F

$$6{,}000X_1 + 18{,}000X_2 + 20{,}000X_3 + 12{,}000X_4 + 17{,}000X_5 + 7{,}520X_6 + 9{,}200X_7 + 7{,}800X_8 + 9{,}100X_9 + 5{,}200X_{10} + 7{,}800X_{11} + d_{17}^- - d_{17}^+ = 200{,}000 \quad \S(4.48)$$

Priority 5: Budget limit

From priority 1 we know there is an absolute budget limit of $4,800 and a desired limit of $4,500. In the first priority the emphasis was on budget overrun but here the emphasis is on budget limit. The minimisation of d_{18}^+ corresponds to the achievement of this goal, that is, by minimising the amount by which actual amount exceeds targeted budget.

$$300X_1 + 450X_2 + 500X_3 + 600X_4 + 200X_5 + 550X_6 + 250X_7 + 240X_8 + 700X_9 + 900X_{10} + 100X_{11} + 80X_{12} + 180X_{13} + 200X_{14} + d_{18}^- - d_{18}^+ = 4{,}500 \quad (4.49)$$

Priority 6: Desired total exposure level

Besides reaching target audiences in the various income groups and market segments, us assume that the firm seeks an overall exposure level of 2,000,000 exposures. In order to meet this goal d_{19}^- will have to be minimised in the following equations:

$$145{,}000X_1 + 10{,}000X_2 + 60{,}000X_3 + 58{,}000X_4 + 162{,}000X_5 + 113{,}000X_6 + 85{,}000X_7 + 95{,}000X_8 + 450{,}000X_9 + 35{,}000X_{10} + 41{,}000X_{11} + d_{19}^- - d_{19}^+ = 2{,}000{,}000 \quad (4.50)$$

Priority 7: Desired exposure levels among the other two income groups (Persons with income $24,000-$34,000, and above $35,000)

In addition to the firm's objective in meeting desired exposures in the three income groups A, B and C, there is also the important relationship between higher income and travel, so the firm has two other market segments based on income. The segments consist of those persons with an annual income between $24,000 and $34,000, and those earning over $35,000. Let us suppose that the firm's desired levels of exposure among these two groups are 60,000 and 35,000 respectively. This goal will be achieved by the minimisation of d_{20}^- and d_{21}^- respectively in (4.51) and (4.52) below:

For income group G ($24,000-$34,000)

$$3{,}500X_1 + 3{,}200X_2 + 6{,}200X_3 + 812X_4 + 10{,}000X_5 + 11{,}500X_6 + 3{,}050X_7 + 3{,}100X_8 + 12{,}500X_9 + 9{,}000X_{10} + 4{,}000X_{11} + d_{20}^- - d_{20}^+ = 60{,}000 \quad (4.51)$$

For income group H ($35,000+)

$$5{,}600X_1 + 13{,}000X_2 + 14{,}000X_3 + 11{,}000X_4 + 8{,}200X_5 + 10{,}000X_6 + 12{,}000X_7 + 3{,}000X_8 + 83{,}000X_9 + 5{,}200X_{10} + 14{,}000X_{11} + d_{21}^- - d_{21}^+ = 35{,}000 \quad (4.52)$$

The objective function

Having considered the priorities given above, the objective function becomes:

$$\text{Min } Z = +P_1 d_1^+ + P_2 \left[\sum_{i=2}^{5} d_i^+ + \sum_{i=6}^{7} d_i^- + d_8^+ + d_9^- \right]$$

$$+ P_3 \left[d_{10}^- + \sum_{i=13}^{14} d_i^- \right] + P_4 \sum_{i=15}^{17} d_i^- + P_5 d_{18}^+$$

$$+ P_6 d_{19}^- + P_7 \sum_{i=20}^{21} d_i^- + P_8 \sum_{i=11}^{12} d_i^+$$

where the priorities are represented by[8]:
P_i and $P_i >>> P_{i+1} >>> P_{i+2}$, such that there is no number n large enough to make $nP_{i+1} \geq P_i$.

Conclusion

Integer goal programming as reviewed in this section does indicate the various aspects that the other three models reviewed could not handle. The integer goal model considered multiple goals, decay effects arising from repeated exposure, quantity discounts, and variable charges for multiple media insertion. The integer goal programming model is very conceptual and so has very limited practical application at the moment.

4.5 Programming Technique To Be Used

In determining the optimal media mix for promoting intrastate travel in Tasmania, linear programming technique will be used. The Linear Programming Fortran +

IV package, BGPP, will be used to determine the optimal media mix in each advertising market segment.

The program solves the problem of maximising and minimising a linear objective function of the form:

$$Z = \sum_{j=1}^{n} c_j X_j$$

subject to a set of constraints:

$$\sum_{j=1}^{n} a_{ij} X_j \{\leq \ , = \} \ b_i \text{ for } i = 1, 2, \ldots m$$

and to non-negative restrictions on the variables:

$$X_j \geq 0, \ j = 1, 2, \ldots n$$

Of the four programming techniques reviewed in Chapter 4, the linear programming technique was the only programming package available from the University Computer Centre during the course of this study. Attempts were made by the University and the author to get one of the other three programming packages from other institutions and establishments. These attempts resulted in very little success. The University Computer Centre was able to borrow a mixed integer programming package from the University of New England. This mixed integer program is to be used to overcome the problems associated with non-integer results of the linear programming package (BGPP).

References for Chapter 4

1. A daily newspaper in Tasmania.
2. A weekly newspaper in Tasmania.
3. A weekly television programme.
4. Brown, D.B. & Warshaw, M.R., "Media Selection by Linear Programming" in Journal of Marketing Research, February 1965, page 84.
5. The four target markets considered are not mutually exclusive. A potential reader of the magazine could belong to all four markets.
6. Zangwill, W.I. "Media Selection by Decision Programming" in Journal of Advertising, Vol. 5, September 1965.
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CHAPTER 5

5.1 Introduction

This chapter discusses the input data to be used in determining the optimal media mix for promoting Tasmanian intrastate tourism. These data come from the Australian Bureau of Statistics, the McNair Anderson Association, the Roy Morgan Research Centre, and the various media offices.

The data for this analysis are, in the main, objective data which have been obtained from surveys carried out by McNair Anderson on television and radio audiences in 1984 and the Roy Morgan Research Centre survey of the readership of daily and Sunday newspapers in Tasmania between April 1982 and March 1983. Other objective data were collected in interviews by the author during a tour of the various media offices in the state.

5.2 Nature of the Data

In any linear programming model the data input consists of the 'price' coefficients in the objective function, activity coefficients in the constraints, and 'bounds' imposed on the constraints. Each 'bound' will be a measure which is specifically related to the activity of its constraint and will have the same units of measure as does the activity. The constraint coefficient must be compatible, not only with these units of measure, but also with the nature of the associated variables. Thus, the activity coefficient a_{ij} must be compatible with both X_j and b_i, so that $a_{ij}X_j$ represents the amount of b_i taken

up by X_j units of variable j. The 'price' coefficients in the objective function must be compatible with their related variables as well as with the variable that is being optimised so that c_jX_j is a measure of the total effective exposure associated with X_j units of variable j. For these reasons a precise statement regarding the variables and the bounds is required, and this is to be found in section 3 of this chapter. The data input associated with the objective function are discussed in section 4, while those for the budget, employed persons and married persons constraints are outlined in sections 5, 6 and 7 respectively. Section 8 discusses the subjective data used in the models.

5.3 Variables in the Models

Precisely, there are nine variables in each of the southern and northern models and seven variables in the north-west model. These variables represent the advertising units for a particular medium over a specified time period or for some specified program to be used to carry the advertising message across to the target market.

In the southern advertising model X_1 denotes the number of day-time advertising units of television for a duration of sixty seconds; X_2 denotes the number of night-time television advertising units for a duration of sixty seconds; X_3 the number of half-page newspaper advertising units in one issue; X_4 represents the number of half-page weekly newspaper advertising units in one issue; X_5 the number of thirty seconds morning radio

(7HO) advertising units; X_6 the number of thirty seconds evening radio (7HO) advertising units; X_7 and X_8 are similar to X_5 and X_6 only they pertain to 7HT; and X_9 denotes the number of two-page direct advertising units, 20 cm by 18 cm each. All nine variables must be non-negative.

In the northern model the nine variables are identical except for the radio media. Here variables X_5 and X_6 relate to 7EX while X_7 and X_8 relate to 7LA. Only seven variables appear in the north-west case as there is no television station specifically associated with that region. Thus variables X_1 and X_2 do not play any role in this model, while the radio variables X_5 and X_6 relate to 7BU and radio variables X_7 and X_8 relate to 7QT. Details of all variables are set out in Table 5.1.

TABLE 5.1

Definition of variables

Variables	Southern segment	Northern segment	North-west segment
X_1	Television sixty seconds day time	Television sixty seconds day time	Not included
X_2	Television sixty seconds night time	Television sixty seconds night time	Not included
X_3	Daily paper half page one issue	Daily paper half page one issue	Daily paper half page one issue
X_4	Weekly paper half page one issue	Weekly paper half page one issue	Weekly paper half page one issue
X_5	Radio thirty seconds morning 7HO	Radio thirty seconds morning 7EX	Radio thirty seconds morning 7BU
X_6	Radio thirty seconds evening 7HO	Radio thirty seconds evening 7EX	Radio thirty seconds evening 7BU
X_7	Radio thirty seconds morning 7HT	Radio thirty seconds morning 7LA	Radio thirty seconds morning 7QT
X_8	Radio thirty seconds evening 7HT	Radio thirty seconds evening 7LA	Radio thirty seconds evening 7QT
X_9	Direct advertising two pages one issue	Direct advertising two pages one issue	Direct advertising two pages one issue

5.4 The Objective Function

From the model, the objective of the advertising campaign is to determine the optimal number of units of each advertising medium to be purchased so as to maximise total effective exposure in a particular segment. The objective function of the model represents the number of

exposures associated with each media type in any particular market segment. The objective function is:

To maximise $Z = N_1X_1 + N_2X_2 + . . . + N_nX_n$

where N_i is the number of persons exposed to medium i during a specified time or program.

The various media exposure levels are measured in different units. The television and radio audiences are measured in units of 'Average audience', newspaper readership in units of 'Average reader' and direct advertising exposure level is measured in units of total exposure. These concepts are discussed in the following section.

5.4.1 Definition of media exposure units:

(a) Average audience: (Television and radio)

This refers to the estimated audience during a period or program and is calculated as a simple arithmetic mean of all quarter-hour audience estimates within the morning, afternoon or evening time span.

(b) Average readership: (Daily and weekly papers)

The average readership is calculated on Monday to Friday basis. This is calculated by adding up the number of readers on Monday, Tuesday, Wednesday, Thursday and Friday, and dividing by 5.

(c) Total exposure: (Direct advertising)

Direct advertising exposure is assumed to be the total number of persons in each advertising market segment. Also incorporated in the objective function is the effective coefficient of each of the various media

vehicles. The effectiveness of media reflects the degree to which an advertising medium vehicle effectively reaches a target market with its message. As there is a significant difference in the degree to which the various media can effectively get an advertising message across to their target market, it is important that this phenomenon be taken into consideration when formulating the objective function. If N_i denotes the average audience exposure per time period or program for the ith medium and e_i is a measure which reflects the degree of effectiveness of each exposure of the ith medium, then, rather than maximising the number of audience exposure, the objective function can be designed to maximise the effectiveness of audience exposure. This is represented as follows:

$$\text{To maximise } Z = e_1N_1X_1 + e_2N_2X_2 + \ldots + e_nN_nX_n$$

In the absence of any evidence of the relative effectiveness of each of the media, initial attempts to formulate the objective function assume that television is twice as effective as both radio and direct advertising, one-and-two-thirds as effective as weekly newspaper and 25 per cent more effective than daily newspaper. These assumptions, when converted into a weighted average, generate the set of effectiveness coefficients in the table below.

TABLE 5.2

Media Effective Coefficients

Media	Effective coefficients
Television	0.294
Daily newspaper	0.235
Weekly newspaper	0.176
Radio	0.147
Direct advertising	0.147

It is intended that a sensitivity study will be carried out with respect to these effectiveness coefficients to determine how the model is affected by varying the figures in Table 5.2.

In order to gain some idea of possible values of e_i in the three advertising models a survey was conducted by the author among four advertising agencies in Tasmania to determine their ranking of media effectiveness in carrying out an advertising campaign for the Tourist Department. The result showed that three of these agencies - Leo Burnett, Banks Paton and Monohar Dayman Adam - ranked television as number one, followed by the daily newspaper, the weekly paper and finally radio and direct advertising. The Ogilvy and Mather advertising agency, however, ranked the print media first, with television and radio in the second position.

All four advertising agencies were reluctant to rank the media in terms of effectiveness. They argued that it was difficult to compare one medium with another, since audiences often overlap. They also pointed out that the cost of advertising varied significantly between media. However, for the purposes of this study the above

coefficients will be used as weights, with television being the most effective.

5.4.2 Data input in the objective function

The data which follow were inserted into the objective function of each of the three advertising models. Each objective function represents the number of effective exposures in an advertising market segment.

(a) The southern advertising segment

Table 5.3 below represents the various media types being considered for the state's domestic tourist promotional campaign and the number of persons exposed to the various media types.

TABLE 5.3

Total Exposure Estimates
(Southern market segment)

Media types	Number of persons	Effective exposure
Television morning time	16,700	4,910
Television evening time	105,400	30,988
Daily newspaper	127,000	29,845
Weekly newspaper	115,000	20,240
Radio morning session 7HO	19,500	2,867
Radio evening session 7HO	9,100	1,338
Radio morning session 7HT	8,100	1,191
Radio evening session 7HT	4,900	720
Direct advertising	201,060	29,556

(b) The northern advertising segment

The media types in the northern market segment and the number of persons exposed to each media type is represented in Table 5.4.

TABLE 5.4

Total Exposure Estimates
(Northern market segment)

Media types	Number of persons	Effective exposure
Television morning time	26,950	7,923
Television evening time	119,700	35,192
Daily newspaper	70,000	16,450
Weekly newspaper	68,000	11,968
Radio morning session 7EX	6,300	926
Radio evening session 7EX	3,000	441
Radio morning session 7LA	2,700	397
Radio evening session 7LA	1,300	191
Direct advertising	117,570	19,283

Table 5.5 represents the media types in the north-west advertising market segment and the number of readers or size of the audience.

TABLE 5.5

Total Exposure Estimates
(North-west segment)

Media types	Number of persons	Effective exposure
Television morning time	not included	not included
Television evening time	not included	not included
Daily newspaper	77,000	18,249
Weekly newspaper	62,000	10,912
Radio morning session 7BU	4,400	647
Radio evening session 7BU	1,200	176
Radio morning session 7QT	3,000	441
Radio evening session 7QT	1,000	146
Direct advertising	108,570	15,960

5.5 Data Input in the Budget Constraint

The budget constraint reflects the total advertising expenditure allocated to the various advertising market segments. All cost data, apart from those for direct advertising, were obtained from the various media offices.

It should be mentioned that the cost of one unit of direct advertising is arrived at by multiplying the cost of a single advertising brochure by the number of occupied dwellings in each market segment.

The advertising cost is the cost of running one advertisement only, that is the cost of inserting one advertisement. This becomes necessary as the model (linear programming) does not provide for discounts arising from multiple insertions.

The maximum available budget allowance is the sum allocated for the advertising campaign in each of the three advertising segments (b_1). The figures used have been based on subjective evaluations of the author and on suggestions obtained from media and marketing professionals.

5.5.1 Southern advertising segment

The media types in the southern segment and their respective single unit costs are represented in Table 5.6.

TABLE 5.6

Advertising Cost Per Unit For Media Vehicles (Southern Segment)

Media vehicles	Cost/single advert.
	$
TV 60 seconds spot, morning	52
TV 60 seconds spot, evening	45
Newspaper half page size, daily	1,042
Newspaper half page size, weekly	620
Radio 30 seconds spot, morning, 7HO	34
Radio 30 seconds spot, evening, 7HO	13
Radio 30 seconds spot, morning, 7HT	30
Radio 30 seconds spot, evening, 7HT	17
Direct advertising	19,040

5.5.2 Northern advertising segment

In the northern advertising market segment the various media types and their corresponding single unit costs are shown in Table 5.7.

TABLE 5.7

Advertising Cost Per Unit For Media Vehicles (Northern Segment)

Media vehicles	Cost/single advert.
	$
TV 60 seconds spot, morning	52
TV 60 seconds spot, evening	45
Newspaper half page size, daily	794
Newspaper half page size, weekly	443
Radio 30 seconds spot, morning, 7EX	22
Radio 30 seconds spot, evening, 7EX	14
Radio 30 seconds spot, morning, 7LA	16
Radio 30 seconds spot, evening, 7LA	9
Direct advertising	10,971

5.5.3 North-west advertising segment

The various media types in the nort-west region are represented in Table 5.8; also included in the table are the individual cost of running a single advertisement in each media type.

TABLE 5.8

Advertising Cost Per Unit For Media Vehicles (North-west segment)

Media vehicles	Cost/single advert.
	$
TV 60 seconds spot, morning	Not included
TV 60 seconds spot, evening	Not included
Newspaper half page size, daily	575
Newspaper half page size, weekly	354
Radio 30 seconds spot, morning, 7BU	11
Radio 30 seconds spot, evening, 7BU	7
Radio 30 seconds spot, morning, 7QT	10
Radio 30 seconds spot, evening, 7QT	9
Direct advertising	9,572

5.5.4 Three marketing regions

The data in Table 5.9 are associated with the budget allowance in the three advertising market segments. These data are subjective data and will be discussed in Section 5.8.

TABLE 5.9

Advertising Budget for the Three Marketing Regions

Advertising market segment	Advertising budget allowance ($)
South	64,800
North	26,640
North-west	26,640

5.6 Employed Constraints

The employed constraint in each model imposes the restriction that there should be a minimum number of employed persons exposed to the messages of the media vehicles over the campaign period.

Assuming that the structure of the sub-population served by each medium is representative of that for the population as a whole in each market segment, then the number of employed persons exposed to each medium can be derived quite readily.

The percentage of employed persons associated with the different media types has been derived from the ratio of employed persons in the various segments to the total population of each market segment.

From the census of population and housing conducted in 1981, the total Tasmanian population in June 1981 was

427,200. The population of the three advertising market segments was 201,060 for the south, 117,570 in the north and 108,570 in the north-west. The census also indicated that there were 170,402 persons employed in Tasmania, with 80,900 in the southern segment, 46,487 in the north and 42,577 in the north-west. From these data the percentage of employed persons in each segment was determined. It was found that 40.24 per cent of the southern population, 39.54 per cent of the northern population, and about 29.22 per cent of the north-west population were employed. These percentages have been used to determine the number of employed persons associated with each media type exposure level.

5.6.1 Southern segment

The number of employed persons who are exposed to the various media types in the southern advertising market segment is represented in Table 5.10.

TABLE 5.10

Number of Employed Persons Associated with the Various Media Types in the Southern Region

Media types	Number of employed persons	% of employed persons in the segment
Television morning session	6720	
Television evening session	42413	
Daily newspaper	51105	
Weekly newspaper	46276	
Radio morning session, 7HO	7847	
Radio evening session, 7HO	3662	40.24
Radio morning session, 7HT	3259	
Radio evening session, 7HT	1972	
Direct advertising	80907	

5.6.2 Northern segment

Employed persons exposed to the various media in the northern region are represented in Table 5.11.

TABLE 5.11

Number of Employed Persons Associated with the Various Media Types in the Northern Region

Media types	Number of employed persons	% of employed persons in the segment
Television morning session	10656	
Television evening session	47329	
Daily newspaper	27678	
Weekly newspaper	26887	
Radio morning session, 7EX	2491	
Radio evening session, 7EX	1186	39.54
Radio morning session, 7LA	1068	
Radio evening session, 7LA	514	
Direct advertising	46487	

5.6.3 North-west segment

Table 5.12 shows the various media types in the north-west segment and the number of employed individuals exposed to the various media types.

TABLE 5.12

Number of Employed Persons Associated with the Various Media Types in the North-West Segment

Media types	Number of employed persons	% of employed persons in the segment
Television morning session	Not included	
Television evening session	Not included	
Daily newspaper	30199	
Weekly newspaper	24316	
Radio morning session, 7BU	1726	
Radio evening session, 7BU	471	39.22
Radio morning session, 7QT	1177	
Radio evening session, 7QT	392	
Direct advertising	42577	

5.7 Married Constraint

Like the employed constraint, the married constraint in the various regions imposes a restriction on the minimum number of married persons exposed to the advertising message of the media vehicles.

Here it is assumed that the audience of each media is a representative of that for the three market segments; based on this assumption the number of married persons exposed to each medium can be derived.

The percentage of married individuals associated with each of the different media types has been derived from the ratio of married individuals in the various segments to the total population of each market segment. From the census of population and housing conducted in 1981, the population was 427,200. The population of married individuals in the south was 88,326, in the north it was 52,506 and 48,321 in the north-west segment. From these data the percentage of married persons in each segment was determined. It was found that 43.94 per cent of the southern population, 44.66 per cent of the northern population, and about 44.51 per cent of the north-west population were married. These percentages have been used to determine the number of married persons associated with each media type.

5.7.1 Southern segment

The numbers of married persons exposed to the 9 media types in the southern region are represented in Table 5.13.

TABLE 5.13

Number of Married Persons Associated with the Various Media Types in the Southern Segment

Media types	Number of married persons	% of married persons in the segment
Television morning session	7338	
Television evening session	46313	
Daily newspaper	55804	
Weekly newspaper	50531	
Radio morning session, 7HO	8568	
Radio evening session, 7HO	3999	43.95
Radio morning session, 7HT	3559	
Radio evening session, 7HT	2153	
Direct advertising	88346	

5.7.2 Northern segment

The various media types in the northern advertising market segment and the number of married persons associated with each media type are represented in Table 5.14.

TABLE 5.14

Number of Married Persons Associated with the Various Media Types in the Northern Segment

Media types	Number of married persons	% of married persons in the segment
Television morning session	12036	
Television evening session	53458	
Daily newspaper	31262	
Weekly newspaper	30328	
Radio morning session, 7EX	2810	
Radio evening session, 7EX	1338	44.60
Radio morning session, 7LA	1204	
Radio evening session, 7LA	580	
Direct advertising	52436	

5.7.3 The north-west

The numbers of married individuals exposed to the various media types under consideration in the north-west are represented in Table 5.15.

TABLE 5.15

Number of Married Persons Associated with the Various Media Types in the North-West Segment

Media types	Number of married persons	% of married persons in the segment
Television morning session	Not included	
Television evening session	Not included	
Daily newspaper	34273	
Weekly newspaper	27596	
Radio morning session, 7BU	1958	
Radio evening session, 7BU	534	44.51
Radio morning session, 7QT	1335	
Radio evening session, 7QT	445	
Direct advertising	48231	

5.8 Subjective Data

As pointed out in Section One of this chapter it was found necessary to include some subjective data in the models. Though crucial subjective evaluations have been made for some of the input data, these data are based primarily on the managerial judgement of experienced advertising agents and marketing organisations such as Leo Burnett and Banks Paton, while the author's own judgement has been used in modifying some of these subjective inputs.

The subjective data relate to the constraint bounds for each segment. These constitute the total budget allocation, the number of insertions for the various media types and the minimum number of exposures to be achieved among employed and married persons.

5.9 Advertising Budget

In determining the advertising budget for the various advertising market segments, the population of each segment and the cost of advertising in the various media types were taken into consideration. Another factor that was considered in fixing the advertising budget was the duration of the intrastate tourist campaign. This study assumes that the campaign is for a period of six months. (Budget allocation is in Table 5.9.)

5.9.1 Advertising insertions

In order to determine the number of insertions that should run on the various media types in the three market regions, the following were considered relevant: the effectiveness of the medium to reach its target audience, and the number of times (in the case of television) the program could be run within the campaign period. Insertion has been defined here as the maximum number of advertisements that could possibly be carried by the various media types, over the campaign period.

The upper limits of the various media types in the three advertising market segments are represented in Table 5.16.

TABLE 5.16

Number of Insertions in the Various Media Types in the Three Segments

Media Types	Southern segment	Northern segment	North-West segment
TV morning time	180 TVT6	180 TNT9	Not included
TV evening time	360 TVT6	360 TNT9	Not included
Daily newspaper	56 Mercury	56 Examiner	186 Advocate
Weekly newspaper	24 Tas.Mail	24 Tas.Mail	25 Tas.Mail
Radio morning	20 7HO	20 7EX	40 7BU
Radio evening	10 7HO	10 7EX	20 7BU
Radio morning	20 7HT	20 7LA	40 7QT
Radio evening	10 7HT	10 7LA	20 7QT
Direct advertising	3	3	3

5.9.2 Minimum exposure levels

From the models the constraint bounds of both the employed and married persons have been constrained to achieve at least a minimum number of exposures for the two target groups.

The minimum expected exposure levels of the two target groups (employed and married groups) are represented in Table 5.17.

TABLE 5.17

The Minimum Number of Exposures to be Achieved Among Employed and Married Groups

Segments	Minimum exposure to be achieved among employed persons	Minimum exposure to be achieved among married persons(M.E.L.)
South	5,000,000	6,000,000
North	2,500,000	3,000,000
North-West	1,000,000	1,000,000

CHAPTER 6

MEDIA MIX MODELS

6.1 Introduction

In order to determine the optimal media mix in promoting the Tasmanian tourist industry, the problem was formulated using linear programming and integer linear programming. Three models were investigated, one each for the southern, the northern and north-west market segments. Both the objective and subjective data reviewed in Chapter 5 are used in the model formulations.

6.2 Southern Segment

6.2.1 Objective function

The sum of the number of effective exposures associated with each of the nine media vehicles represents the total effective exposure levels. The nine media vehicles, or variables, in this model are defined in Table 5.1. Using the data outlined in Table 5.3 the objective function becomes:

To maximise

$$4{,}910X_1 + 30{,}988X_2 + 29{,}845X_3 + 20{,}240X_4 + 2{,}867X_5 + 1{,}338X_6 + 1{,}191X_7 + 720X_8 + 29{,}556X_9$$

6.2.2 Activity constraints

There are three activity constraints in the model:

the budget constraint, and those for employed and married groups.

(a) Budget constraint: At the most $64,800 will be spent on an advertising campaign in the southern market segments and using Table 5.6 we obtain:

$$52X_1 + 545X_2 + 1,042X_3 + 620X_4 + 34X_5 + 13X_6 + 30X_7 + 17X_8 + 1,904X_9 \leq 64,800 \quad (6.1)$$

(b) Employed constraint: At least 5,000,000 exposures are to be achieved among employed persons and from Table 5.7 we get:

$$6,720X_1 + 42,413X_2 + 51,105X_3 + 4,676X_4 + 7,848X_5 + 3,662X_6 + 3,259X_7 + 1,972X_8 + 80,907X_9 \geq 5,000,000 \quad (6.2)$$

(c) Married constraint: At least 6,000,000 exposures are to take place among married individuals, so using Table 5.17 we obtain:

$$7,338X_1 + 46,313X_2 + 55,804X_3 + 50,531X_4 + 8,568X_5 + 3,999X_6 + 3,559X_7 + 2,153X_8 + 88,346X_9 \geq 6,000,000 \quad (6.3)$$

(d) Upper bounds: In addition to the activity constraints there is a set of upper bounds imposed on the nine non-negative variables.

Insertions on morning television: No more than 180 insertions may be run on morning television during the campaign.

$$X_1 \leq 180 \quad (6.4)$$

Insertions on evening television: There should be no more than 360 insertions on evening television throughout the campaign period.

$$X_2 \leq 360 \qquad (6.5)$$

Insertions in daily newspaper: No more than 56 daily newspaper insertions will be purchased.

$$X_3 \leq 56 \qquad (6.6)$$

Insertions in weekly newspaper: No more than 24 units of weekly newspaper will be purchased.

$$X_4 \leq 24 \qquad (6.7)$$

Insertions on radio (7HO) morning session: No more than 20 units of morning radio will be run throughout the campaign.

$$X_5 \leq 20 \qquad (6.8)$$

Insertions on radio (7HO) evening session: No more than 10 units of evening radio will be purchased.

$$X_6 \leq 10 \qquad (6.9)$$

Insertions on radio (7HT) morning session: No more than 20 units of morning radio will be purchased.

$$X_7 \leq 20 \qquad (6.10)$$

Insertions on radio (7HT) evening session: No more than 10 units of evening radio will be run on radio 7HT.

$$X_8 \leq 10 \qquad (6.11)$$

Insertions on direct advertising: No more than 3 units of direct advertising may be purchased.

$$X_9 \leq 3 \qquad (6.12)$$

South Segment

Max.

$$4910X_1 + 30988X_2 + 29845X_3 + 20290X_4 + 2867X_5 + 1338X_6 + 1191X_7 + 720X_8 + 29556X_9$$

Subject to:

$$52X_1 + 545X_2 + 1042X_3 + 620X_4 + 34X_5 + 13X_6 + 30X_7 + 17X_8 + 19040X_9 \leq 64800$$

$$6720X_1 + 42413X_2 + 51105X_3 + 46275X_4 + 7847X_5 + 3662X_6 + 3259X_7 + 1972X_8 + 80907X_9 \geq 5000000$$

$$7338X_1 + 46313X_2 + 55804X_3 + 50531X_4 + 8568X_5 + 3999X_6 + 3559X_7 + 2153X_8 + 88346X_9 \geq 6000000$$

$$X_1 \leq 180$$

$$X_2 \leq 360$$

$$X_3 \leq 56$$

$$X_4 \leq 24$$

$$X_5 \leq 20$$

$$X_6 \leq 10$$

$$X_7 \leq 20$$

$$X_8 \leq 10$$

$$X_9 \leq 3$$

6.3 Northern Market Segment

There are also 9 media vehicles in this model (refer to Table 5.1), with the same three constraints and a similar set of upper bounds. Using information on Tables 5.4, 5.7, 5.9, 5.11, 5.14, 5.16 and 5.17 the model becomes:

North Segment

Max.

$$7923X_1 + 35192X_2 + 16450X_3 + 11968X_4 + 926X_5 + 441X_6 + 397X_7 + 191X_8 + 17283X_9$$

Subject to:

$$52X_1 + 3545X_2 + 794X_3 + 443X_4 + 22X_5 + 14X_6 + 16X_7 + 9X_8 + 10971X_9 \leq 26640$$

$$10656X_1 + 47329X_2 + 27678X_3 + 26887X_4 + 2491X_5 + 1186X_6 + 1086X_7 + 514X_8 + 46487X_9 \geq 2500000$$

$$12036X_1 + 53458X_2 + 31262X_3 + 30328X_4 + 2810X_5 + 1338X_6 + 1204X_7 + 580X_8 + 52936X_9 \geq 3000000$$

$$X_1 \leq 180$$

$$X_2 \leq 360$$

$$X_3 \leq 56$$

$$X_4 \leq 24$$

$$X_5 \leq 20$$

$$X_6 \leq 10$$

$$X_7 \leq 20$$

$$X_8 \leq 10$$

$$X_9 \leq 3$$

The following features distinguish this model from that for the southern market segment.

- Only $26,640 is available for advertising.
- There must be at least 2.5 million exposures of employed persons and 3 million married persons.
- Television advertisements are limited to 180 in the morning and 360 in the evening.
- There must be no more than 56 insertions in daily newspapers and 24 in weekly newspaper.
- Radio insertions on both 7EX and 7LA are limited to 20 in the morning and 10 in the evening.
- There is an upper limit of 3 units of direct advertising.

The coefficients in the objective function and in the three activity constraints come from Tables 5.4, 5.7, 5.9, 5.11, and 5.14.

6.4 North-West Segment

This model has only seven media vehicles. See Table 5.1. For reasons outlined in section 5.3, the two television media vehicles are not included. The model is as follows:

6.4.1 Objective function

The objective function data come from Table 5.5 and reflect the total effective exposures associated with the 7 media types. The objective function for this model becomes:

$$\text{To maximise } Z = 18,249X_3 + 10,912X_4 + 647X_5 + 176X_6 + 441X_7 + 147X_8 + 15,960X_9$$

6.4.2 Constraints activity

The constraints activity in the north-west segment is different from those of the southern and northern models; it is not a repetition of either model. As in the southern and northern models there are three activity constraints in the north-west model.

(a) Budget constraint: At the most a total of $26,640 will be allocated for the state's domestic travel promotion in the north-west segment. From Table 5.8 the budget constraint becomes:

$$575X_3 + 354X_4 + 11X_5 + 7X_6 + 10X_7 + 9X_8 + 9572X_9 \leq 26,640 \quad (6.13)$$

(b) Employed constraint: It is expected that at least one million exposures will be achieved among employed individuals in the segment, and from Table 5.12 the employed constraint is:

$$30,199X_3 + 24,316X_4 + 1,726X_5 + 471X_6 + 1,177X_7 + 392X_8 + 42,577X_9 \geq 1,000,000 \quad (6.14)$$

(c) Married constraint: The study assumes that a minimum of one million exposures will be reached in the segment. From Table 5.15 the married constraint gives this:

$$34,273X_3 + 27,596X_4 + 1,928X_5 + 534X_6 + 1,335X_7 + 445X_8 + 48,321X_9 \geq 1,000,000 \quad (6.15)$$

(d) Upper bounds: In the north-west segment the upper bound is higher than those of the two other segments (refer to Table 5.16).

Insertions in daily newspaper: No more than 186 insertions will be run on daily newspaper.

$$X_3 \leq 186 \qquad (6.16)$$

Insertions in weekly newspaper: No more than 24 units of weekly newspaper may be purchased.

$$X_4 \leq 24 \qquad (6.17)$$

Insertions on radio (7BU) morning session: No more than 40 units of morning radio will be purchased.

$$X_5 \leq 40 \qquad (6.18)$$

Insertions on radio (7BU) evening session: No more than 20 units of evening radio may be purchased.

$$X_6 \leq 20 \qquad (6.19)$$

Insertions on radio (7QT) morning session: No more than 40 units of morning radio will be purchased.

$$X_7 \leq 40 \qquad (6.20)$$

Insertion on radio (7QT) evening session: No more than 20 units of evening radio will be purchased.

$$X_8 \leq 20 \qquad (6.21)$$

Insertion on direct advertising: No more than 3 units of direct advertising may be purchased.

$$X_9 \leq 3 \qquad (6.22)$$

The Model: Based on the data from Tables 5.5, 5.8, 5.9, 5.12, 5.15, 5.16 and 5.17, the north-west model therefore becomes:

North-West Segment

Max.

$$18249X_3 + 10912X_4 + 647X_5 + 176X_6 + 441X_7 + 147X_8 + 15960X_9$$

Subject to:

$$\begin{aligned}
575X_3 + 354X_4 + 11X_5 + 7X_6 + 10X_7 + 9X_8 + 9572X_9 &\leq 26640 \\
30199X_3 + 24316X_4 + 1726X_5 + 471X_6 + 1177X_7 + 392X_8 + 42577X_9 &\geq 1000000 \\
34273X_3 + 27596X_4 + 1928X_5 + 534X_6 + 1335X_7 + 445X_8 + 48321X_9 &\geq 1000000 \\
X_3 &\leq 186 \\
X_4 &\leq 24 \\
X_5 &\leq 40 \\
X_6 &\leq 20 \\
X_7 &\leq 40 \\
X_8 &\leq 20 \\
X_9 &\leq 3
\end{aligned}$$

6.5 Linear Programming Results

6.5.1 Southern advertising model

The optimal solution for the linear programming estimation of the southern media mix problem generates a total of 4,060,712 effective exposures. The optimal basic media vehicles are morning and evening television, and morning and evening radio (7HO). The results are set out in Table 6.1 below.

TABLE 6.1

Optimal Number of Insertions
Basic Media Vehicles
(Southern Segment)

Basic media vehicles	Number of insertions
Morning television TVT6	180.0000
Evening television TVT6	100.2385
Radio morning session 7HO	20.0000
Radio evening session 7HO	10.0000

Table 6.1 indicates that during the six months campaign period it is assumed that morning television insertions will be run at an average of one insertion per day all through the campaign. Evening television will have an average of four insertions in a week.

Radio insertions will have to be run at an average rate of one insertion per week, so as to have an adequate and effective impact on the promotional campaign. Based on media advice from advertising experts, one insertion per week will achieve the desired back-up by the two radio vehicles.

The constraints which become ineffective in the model at optimality are exposure to employed and married

persons; insertions on evening television; maximum insertion on radio 7HT; insertions on the print media vehicles; and insertions on direct advertising. These results and the measures by which they are ineffective can be found in Table 6.2 below.

TABLE 6.2

Constraints	Total available (Bound)	Unused	Overused
Minimum exposures to employed individuals	5,000,000 exp	-	654,576 exp
Minimum exposures to married individuals	6,000,000 "	-	174,537 "
Maximum insertion on evening television	360 ins	260 ins	-
Maximum insertion on daily paper	56 "	56 "	-
Maximum insertion on weekly paper	24 "	24 "	-
Maximum insertion on morning radio 7HT	20 "	20 "	-
Maximum insertion on evening radio 7HT	10 "	10 "	-
Maximum insertion on direct advertising	3 "	3 "	-

The minimum exposure to employed and married persons have 654,576 and 174,537 surplus exposures per insertion. This shows that the minimum achievement exposures to both target groups are rather high, an achievement to target of 5,654,576 and 6,174,537 exposures for employed and married persons respectively would give the same results. Insertion on evening television has 260 unused insertions.

The budget constraint, insertions on morning television, and on 7HO, played effective roles in the southern model at optimality. The marginal value product of the budget resource is 56.8587 effective exposures, which implies that a unit increase in the advertising budget will increase the total number of effective exposures by 56.8587 in the southern region.

Morning television has a marginal value product of 1954 effective exposures, and the two 7HT radio vehicles,

morning and evening sessions, have a marginal value product of 934 and 599 effective exposures respectively. These results are shown in Table 6.3 below.

TABLE 6.3

Marginal Value Products of Effective Constraints (Southern Segment)

Fully Used Constraints	Marginal Value Product
Budget constraint	56.8587 exposures
Max. insertion on radio, morning (7HO)	934 exposures
Max. insertion on radio, evening (7HO)	599 "
Max. insertion on morning TV (TVT6)	1954 "

It is deduced from Table 6.3 above that an additional dollar insertion on radio 7HO morning and evening sessions would increase total effective exposures by 27.4706 and 46.0769 respectively. An additional dollar expended on morning television insertion would result in an increase of 37.5769 exposures to the value of the optimal effective exposure.

From these deductions it is apparent that two marginal value products that could be considered are those for the budget and evening radio insertion.

The media vehicles which did not enter the optimal solution are insertions in daily and weekly newspapers; advertising on 7HT; and direct advertising. In order to bring these non-basic media vehicles into the optimal solution their coefficients in the objective function would have to be increased by the value of their respective marginal opportunity costs. These are set out in Table 6.4.

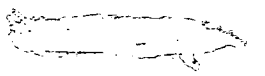

TABLE 6.4

Marginal Opportunity Cost
Non-Basic Media Vehicles
(Southern Segment)

Non-Basic Media Vehicles	Marginal Opportunity Cost
Newspaper (Mercury)	30,000 exposures
Weekly paper (Tasmanian Mail)	15,000 "
Radio morning session (7HT)	514 "
Radio evening session (7HT)	246 "
Direct advertising	1,053,033 "

As the marginal opportunity costs of the radio 7HT morning and evening sessions were relatively low in relation to the other three media vehicles in Table 6.4, the effective exposures of the two radio vehicles were increased by their corresponding marginal opportunity costs. The results showed that the number of insertions on morning and evening television fall to 123 and 105.2972 respectively. Morning radio 7HO insertions fall to 11. The only increase in the result was in the number of insertions on radio 7HO evening session, which increased by 10 insertions. The two new basic media vehicles 7HT morning and evening sessions had insertions 10 and 3 respectively. The value of the objective function at optimality was 334,194 exposures, showing a fall of 719,517 effective exposures. From these results it seems there is no justification for bringing any of the non-basic media vehicles into the optimal solution.

6.6 Mixed Integer Result

The optimal solution using mixed integer estimation for the southern media mix problem, as shown in Table 6.5, is almost identical to that using linear programming estimation.

TABLE 6.5

Mixed Integer Solution
(Southern Segment)

Media Vehicles	Number of Insertions
Morning television (TVT6)	180
Evening television (TVT6)	100
Daily newspaper (Mercury)	0
Weekly newspaper (Tasmanian Mail)	0
Radio morning session (7HO)	20
Radio evening session (7HO)	10
Radio morning session (7HT)	0
Radio evening session (7HT)	0
Direct advertising	0

Optimal value of the objective function:
4,060,711 effective exposures

The linear programming objective function was higher by a single exposure.

6.7 Implications of the Southern Model Results

From the results of the southern advertising model, it is apparent that, given the input data and the underlying assumptions, television is an important medium for an intrastate tourist promotional campaign in Tasmania.

The importance of television rests on its wide audience coverage, and in its cost effectiveness per thousand of audience reached. (Refer to Appendix XI.)

Radio 7HO entered the optimal solution, which reflects the fact that the two 7HO media vehicles have

larger audiences than those of 7HT. The cost per thousand audience reached by 7HO is lower than that of any other medium in the segment, apart from television.

Neither of the print media was accepted as an advertising vehicle in the southern segment. In order to bring the Mercury and Tasmanian Mail into the optimal solution in the southern region the effective exposures of the two newspapers would have to be increased by 29,401 and 15,012 exposures per insertion respectively.

Direct advertising also did not enter the optimal solution. This seems to have occurred because of the high cost per thousand of audience reached by direct advertising. To be able to use direct advertising for an intrastate campaign the effective exposure of direct marketing must be increased by 1,053,033 exposures per single insertion.

6.8 Linear Programming Result

6.8.1 Northern advertising model

Similar results to the southern model were obtained in the northern model, apart from the fact that the four radio vehicles were not selected for the campaign. The two television vehicles entered the optimal solution with 180 insertions on morning television and 31.71 insertions during the evening.

These basic media vehicles and their corresponding number of insertions are represented in Table 6.7.

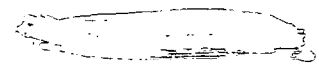

TABLE 6.7

Optimal Number of Insertions
Basic Media Vehicles
(Northern Segment)

Basic Media Vehicles	Number of Insertions
Morning television (TNT9)	180
Evening television (TNT9)	31.7004

From the number of insertions allocated to morning and evening television in Table 6.7 above, it is apparent that morning television will have an average of between 7 and 8 insertions per week for a period of six months; and evening television will run at an average of 1.32 insertions each week. Based on the fact that evening television has a wider audience coverage, a 1.32 insertion per week is considered inadequate. The objective function of the northern model was 2,541,952 effective exposures at optmal.

Only two basic media vehicles appeared in the optimal solution, and there was a significant number of ineffective constraints. The following resource bounds were either unused or over-used at optimality: minimum exposures to employed and married persons; maximum insertions on evening television; in the print media; the four radio vehicles; and on direct advertising. These results are represented in Table 6.8. Along side these bounds are the unused and overused quantities.

TABLE 6.8

Ineffective Constraints
(Northern Segment)

Constraints	Total available (Bounds)	Unused	Overused
Minimum exposure to employed persons	5,000,000 exp	-	918,713 exp
Minimum exposure to married persons	6,000,000 "	-	861,442 "
Maximum insertion on evening television	360 ins	328.2996	-
Maximum insertion on daily newspaper (Ex.)	56 "	56 ins	-
Maximum insertion on weekly paper (Tas Mail)	24 "	24 "	-
Maximum insertion on morning radio 7EX	20 "	20 "	-
Maximum insertion on evening radio 7EX	10 "	10 "	-
Maximum insertion on morning radio 7LA	20 "	20 "	-
Maximum insertion on evening radio 7LA	10 "	10 "	-
Maximum insertion on direct advertising	3 "	3 "	-

A total of 5,918,713 exposures were achieved among employed persons and 6,861,442 exposures among married individuals. These results indicate that at optimality a surplus of 918,713 and 861,442 exposures were generated among employed and married persons respectively. Evening television also recorded 328.2996 unused insertions with only 31.7004 insertions being effective in the model.

The budget constraint and the maximum insertions on morning television were fully utilised at optimality. Their respective marginal value products were 65 exposures for a dollar increase on the advertising budget, and 457 exposures for a single additional insertion on morning television in the northern region. This result is shown in Table 6.9 below.

TABLE 6.9

Marginal Value Products of Effective Constraints
(Northern Segment)

Fully Used Constraints	Marginal Value Product (MVP)
Budget constraints	65 exposures
Maximum insertion, morning TV	457 "

From Table 6.9 it can be deduced that an additional dollar increase to the advertising budget would increase the number of the effective exposures by 65, and given that a single insertion on morning television cost $52, it then follows that an additional dollar spent on morning insertions will increase effective exposures by 8.8.

This indicates that it is not worth running additional morning insertions on television, since this is far below the target of 37.5769 exposures achieved in the southern segment (refer to page 100). The marginal value product of the budget resource is very significant and this advantage should be put to use.

The non-basic media vehicles in the model were: daily and weekly papers; the four radio media vehicles; and direct advertising. These seven media vehicles are represented in Table 6.10 along with their respective marginal opportunity costs. The Examiner has a marginal opportunity cost of 34,821 exposures per insertion and the Tasmanian Mail has a marginal opportunity cost of 16,638 exposures.

In order to bring in direct marketing as one of the campaign vehicles, the effective exposure of direct advertising must be increased by 691,142 exposures per insertion.

TABLE 6.10

Marginal Opportunity Cost
Non-Basic Media Vehicles
(Northern Segment)

Non-Basic Media Vehicles	Marginal Opportunity Cost
Daily newspaper (Examiner)	34,821 exposures
Weekly paper (Tasmanian Mail)	16,639 "
Radio morning session (7EX)	495 "
Radio evening session (7EX)	463 "
Radio morning session (7LA)	636 "
Radio evening session (7LA)	396 "
Direct advertising	691,141 "

The effective exposures per insertion of the four radio vehicles were increased by their respective marginal opportunity costs to test the sensitivity of the solution. The result showed a fall in the number of evening television insertions to 29.8899, from 31.7004, while those on morning television remained unchanged at 180. The four radio media vehicles had 20 insertions for morning radio sessions and 10 insertions on evening radio sessions.

The optimal value of the objective function increased by 104 exposures. Based on these results it could be concluded that the inclusion of the four radio vehicles did not provide any significant change from the original results.

6.9 Mixed integer results

There is a significant difference between the linear programming and mixed integer results. Four basic media vehicles were selected, morning and evening television, radio 7EX and 7LA evening session. The optimal number of

insertions were 180 and 31 for morning and evening television respectively, 17 insertions on radio 7EX morning session, and 1 insertion on radio 7LA evening session. These mixed integer results for the northern model are represented in Table 6.11

TABLE 6.11

Mixed Integer Solution
(Northern Segment)

Media Vehicles	Number of insertions
Morning television (TNT9)	180
Evening television (TNT9)	31
Daily newspaper (Examiner)	0
Weekly paper (Tasmanian Mail)	0
Radio morning session (7EX)	17
Radio evening session (7EX)	0
Radio morning session (7LA)	0
Radio evening session (7LA)	1
Direct advertising	0

Optimal value of the objective function:
2,533,025 effective exposures

There is a fall of 8,927 effective exposures in the mixed integer objective function.

6.10 Implication of the northern model results

The results for the northern model are remarkably similar to those for the southern model. This implies that similar implications hold for the northern region, where television and radio vehicles should be selected because of the per-insertion cost effectiveness of their exposure coverage.

6.11 Linear Programming

6.11.1 North-west advertising model

Only 7 media vehicles were used in the north-west estimation (refer to Table 5.1) and a total of 861,197 effective exposures were achieved in the region at optimality.

The basic media vehicles were the Advocate newspaper, morning radio 7BU, and morning radio 7QT. The optimal results, as shown in Table 6.12, indicate that there should be 44.87 insertions in the Advocate, and 40 insertions in each of the two morning radio programs. The optimal solution for the linear programming estimation of the north-west model generated a total of 862,345 effective exposures.

TABLE 6.12

Optimal Number of Insertions
Basic Media Vehicles
(North-West Segment)

Basic Media Vehicles	Number of Insertions
Daily paper (Advocate)	44.87
Radio morning session (7BU)	40.00
Radio morning session (7QT)	40.00

Based on the result in Table 6.12, and given that the campaign is for 24 weeks the insertions on the three basic media vehicles should be run on an average of two insertions each week.

The constraints which were ineffective at optimality were: exposure to employed individuals; exposure to married persons; insertions in the Tasmanian Mail; on

radio stations 7BU and 7QT evening sessions, and on direct advertising. The unused and over-used bounds are represented in Table 6.13 below.

TABLE 6.13

Ineffective Constraints
(North-West Segment)

Constraints	Total available (Bound)	Unused	Overused
Minimum exposure to employed individuals	1,000,000 exp	-	471,136 exp
Minimum exposure to married individuals	1,000,000 "	-	669,534 "
Maximum insertion on daily paper,Advocate	180 ins	141.1304 ins	-
Maximum insertion on weekly paper,TasMail	24 "	24 ins	-
Maximum insertion on evening radio 7BU	20 "	20 "	-
Maximum insertion on evening radio 7QT	20 "	20 "	-
Maximum insertion on direct advertising	3 "	3 "	-

Based on the subjective data (refer to section 5.8) the optimal exposures to employed and married persons registered surpluses of 471,136 and 669,534 respectively, so that the actual aquired exposures achieved in these target groups are 1,471,136 exposures to employed persons and 1,669,534 exposures among married persons. From Table 6.13 about 44 daily paper insertions were used, and over 141 insertions were unused at optimality.

The budget resource and the maximum available insertions on morning radio stations 7BU and 7QT were fully used at optimality. The budget resource in the north-west model has a marginal value product of 32 effective exposures.

Insertions on morning radio sessios 7BU and 7QT have marginal value products of 298 and 124 exposures respectively. In Table 6.14 can be found the three fully effective constraints at optimality, together with the

marginal value products of their respective resources.

TABLE 6.14

Marginal Value Products of Effective Constraints
(North-West Segment)

Fully Used Constraint	Marginal Value Product
Budget constraint	32 exposures
Insertion on morning radio (7BU)	298 "
Insertion on morning radio (7QT)	124 "

Given that a single insertion on morning radio station 7BU cost $11, it then follows that an additional dollar spent on a morning insertion would increase the total effective exposure by 27. An equivalent additional insertion on radio 7QT would increase total exposures by 12.4 per dollar insertion. It is apparent that the marginal value product of these three basic media vehicles are low, and this implies that any additional increase in the advertising budget or insertions on radios 7BU and 7QT would not be of any marked significance.

At optimality the media vehicles which were not selected were: Tasmanian Mail; evening radio stations 7BU and 7QT; and direct advertising. In order to bring these non-basic media vehicles into the optimal solution their respective effective exposures would have to be increased by at least their corresponding marginal opportunity costs. For the Tasmanian Mail to enter the optimal solution in the north-west model, its effective coverage must increase by at least 323 exposures per issue. In the case of direct advertising its effective exposure must increase by 287,830 exposures per issue. These results are represented in Table 6.15.

TABLE 6.15

Marginal Opportunity Cost
Non-Basic Media Vehicles
(North-West Segment)

Non-Basic Media Vehicles	Marginal Opportunity Cost
Weekly paper (Tasmanian Mail)	323 exposures
Radio evening session (7BU)	46 "
Radio evening session (7QT)	138 "
Direct advertising	287,830 "

As a sensitivity study, the effective exposures of the Tasmanian Mail (north-west), evening radio stations 7BU and 7QT were increased by their respective marginal opportunity costs. The two evening radio sessions were increased first, then the Tasmanian Mail was included. The results showed that by introducing radio stations 7BU and 7QT evening sessions into the optimal solution, the total effective exposures increased by 144. With the introduction of all three media vehicles the optimal effective exposures went up by 23.

This implies that the inclusion of the Tasmanian Mail in the optimal solution would not increase the level of effective exposures to a degree that would justify the cost of direct advertisement (refer to Table 5.8). A single direct advertising insertion in the north-west costs $9,572.

6.12 Mixed Integer Results

The basic media vehicles selected in the mixed integer results were the Advocate, and radio stations 7BU and 7QT. These results are shown below in Table 6.16.

TABLE 6.16

Mixed Integer Solution
(North-West Segment)

Media Vehicles	Number of Insertions
Morning television	Not included
Evening television	Not included
Daily newspaper (Advocate)	45
Weekly paper (Tasmanian Mail)	0
Radio morning session (7BU)	40
Radio evening session (7BU)	0
Radio morning session (7QT)	32
Radio evening session (7QT)	0
Direct advertising	0

Optimal value of the objective function:
861,197 effective exposures

The objective function of the mixed integer estimation recorded a fall of 1,148 effective exposures.

The mixed integer solution indicated that 45 insertions should be run in the daily newspaper (Advocate), 40 insertions on morning radio station 7BU, and 32 insertions on the Queenstown (7QT).

There is a significant difference between the linear programming results and the mixed integer results. The 7QT morning session has 40 insertions in the linear programming solution, this was reduced to 32 in the mixed integer solution. The Advocate has 45 insertions in the mixed integer results, and 44.87 insertions in the linear programming solution. The number of insertions on morning radio 7BU remained the same, on 40 insertions.

6.13 Implication of the North-West Model Results

In this model television was not considered; this was in an effort to reduce overlapping of audiences between segments. The media vehicles considered were the newspaper

media, radio and direct advertising.

From the north-west results, the Advocate was selected as a basic media vehicle but the Tasmanian Mail did not enter the optimal solution. This could be attributed to the difference in the size of their respective average audiences. The Advocate has an average total readership reach of about 77,000, with a unit cost of $575 per half page. On the other hand the Tasmanian Mail has an average readership of 62,000, with a unit cost of $354 per half page. In order to bring the Tasmanian Mail into the optimal solution in the north-west model its coefficient in the objective function would need to increase by 323 effective exposures.

Radio stations 7BU and 7QT were both selected as basic media vehicles. The radio result in the north-west differs significantly from those in the other two regions. This may be attributed to the exclusion of television from this segment.

CHAPTER 7

CONCLUSION

One of the difficulties in media selection problems is that the technique is still largely intuitive. Media planners are guided by their previous experiences, their knowledge and personal preferences. No matter which selection technique is to be considered, it cannot avoid the subjective nature of some input data. Subjective data often expose the assumptions being made about the relative coverage, effectiveness of the various media, different market segments at which the various print media are positioned, and the constraint on the number of insertions in the various media vehicles.

In an attempt to find an explicit model for media selection for promoting intrastate travel in Tasmania, four possible models were reviewed:

1. Linear programming.
2. Decision programming.
3. Dynamic programming.
4. Integer goal programming.

These models provided various perspectives to the problem of media mix selection analysis, but the last three models were not appropriate for the Tasmanian tourist problem. They were conceptual models and had limited practical use.

The Optimal Media Mix Result

As the nature of media selection problems is such

that both objective and subjective data are required the resultant optimal mix solution is also prone to subjective evaluations.

From the results of the three media problem estimations it is apparent that the optimal solutions of the southern and northern segments are similar. The optimal media mix in these two segments consists of television and radio media vehicles. For the north-west segment the optimal media mix comprises the print media (The Advocate) and the radio media vehicles as well.

These results indicate the optimal frequencies or number of insertions are in each media vehicle over the campaign period. This again depends on the duration of the campaign, the budget allocation for advertising in each market segment and on the media vehicles available.

This study is viewed by the author as a marketing strategy that the Tasmanian Tourist Department could apply in optimal allocation of sales and advertising efforts for promoting the Tasmanian domestic tourist market. Like any single market strategy it is not an end in itself, but a means by which the stated goals might be achieved.

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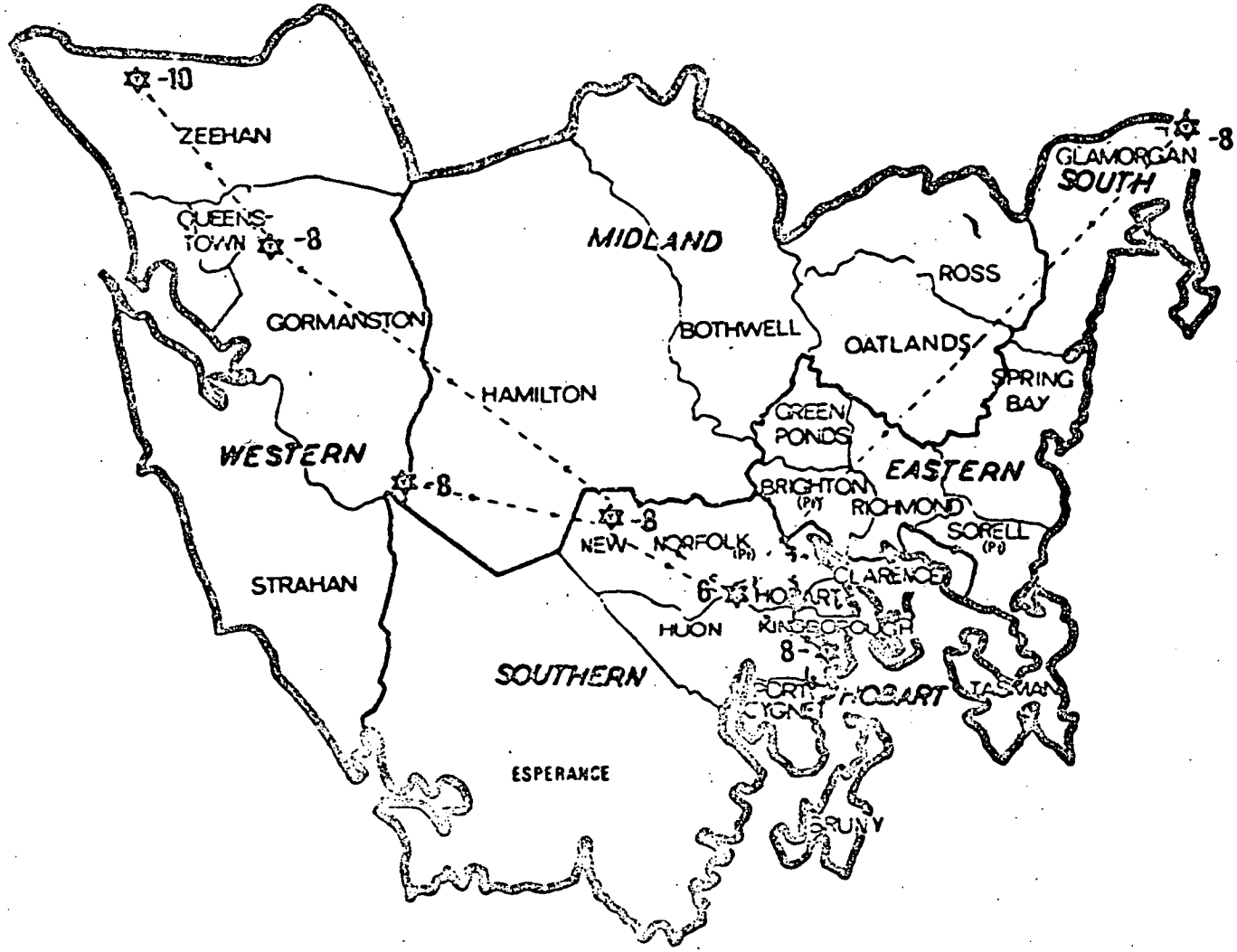
The Advocate advertising rates card.

The Examiner advertising rates card.

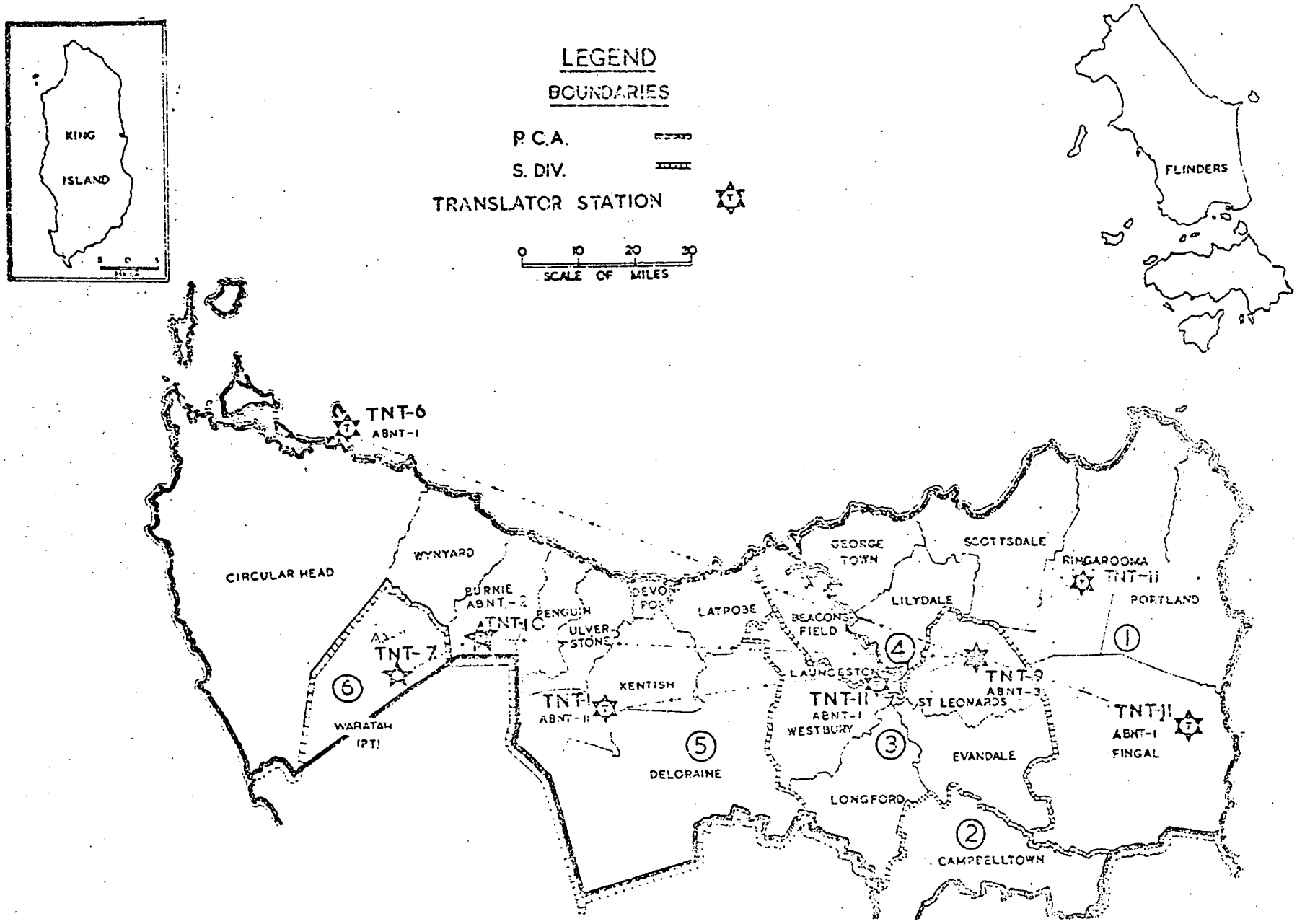
The Mercury advertising rates card.

The Tasmanian Mail advertising rates card.

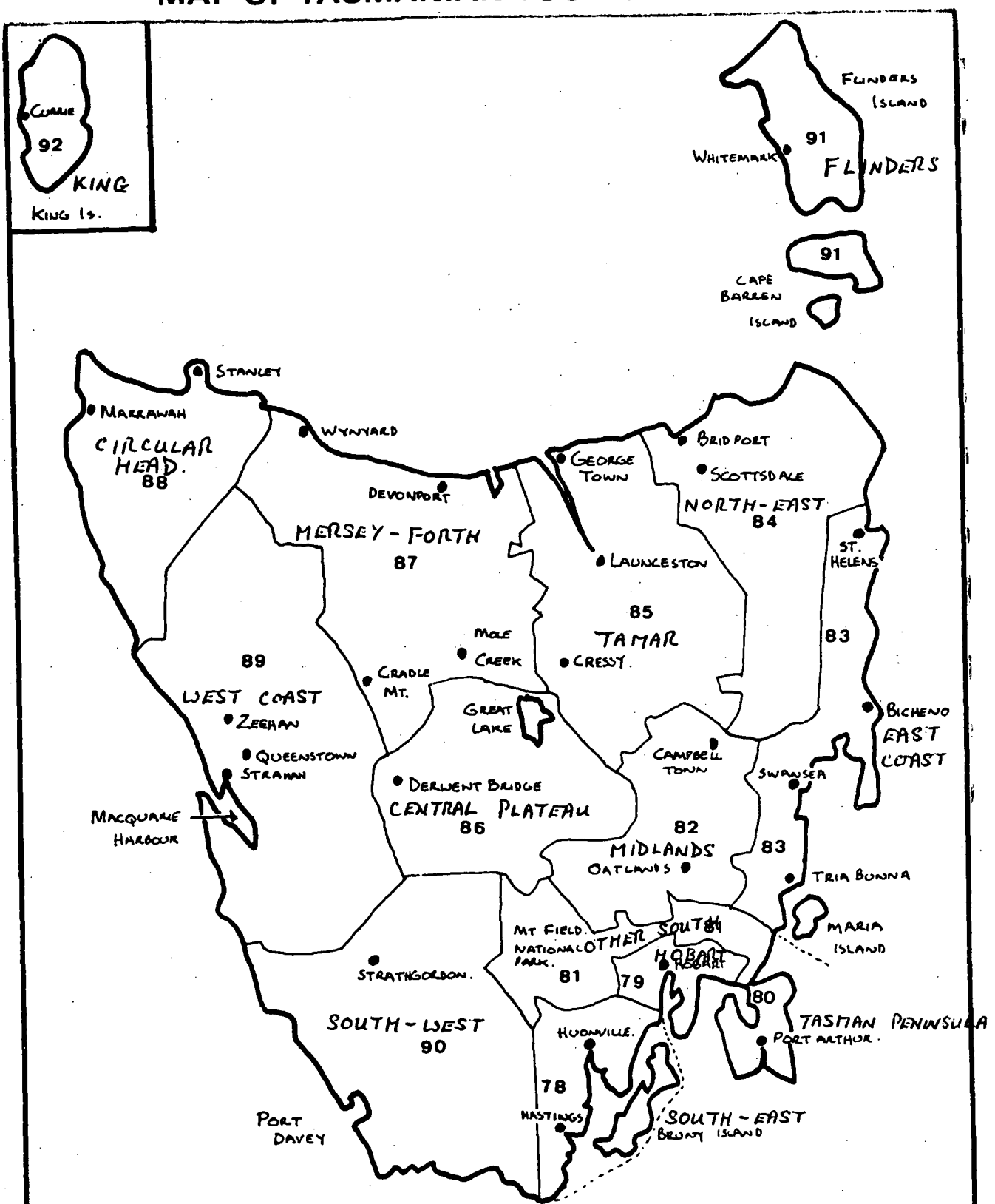
MAP OF TVT-6 PRIMARY COVERAGE AREA APPENDIX I



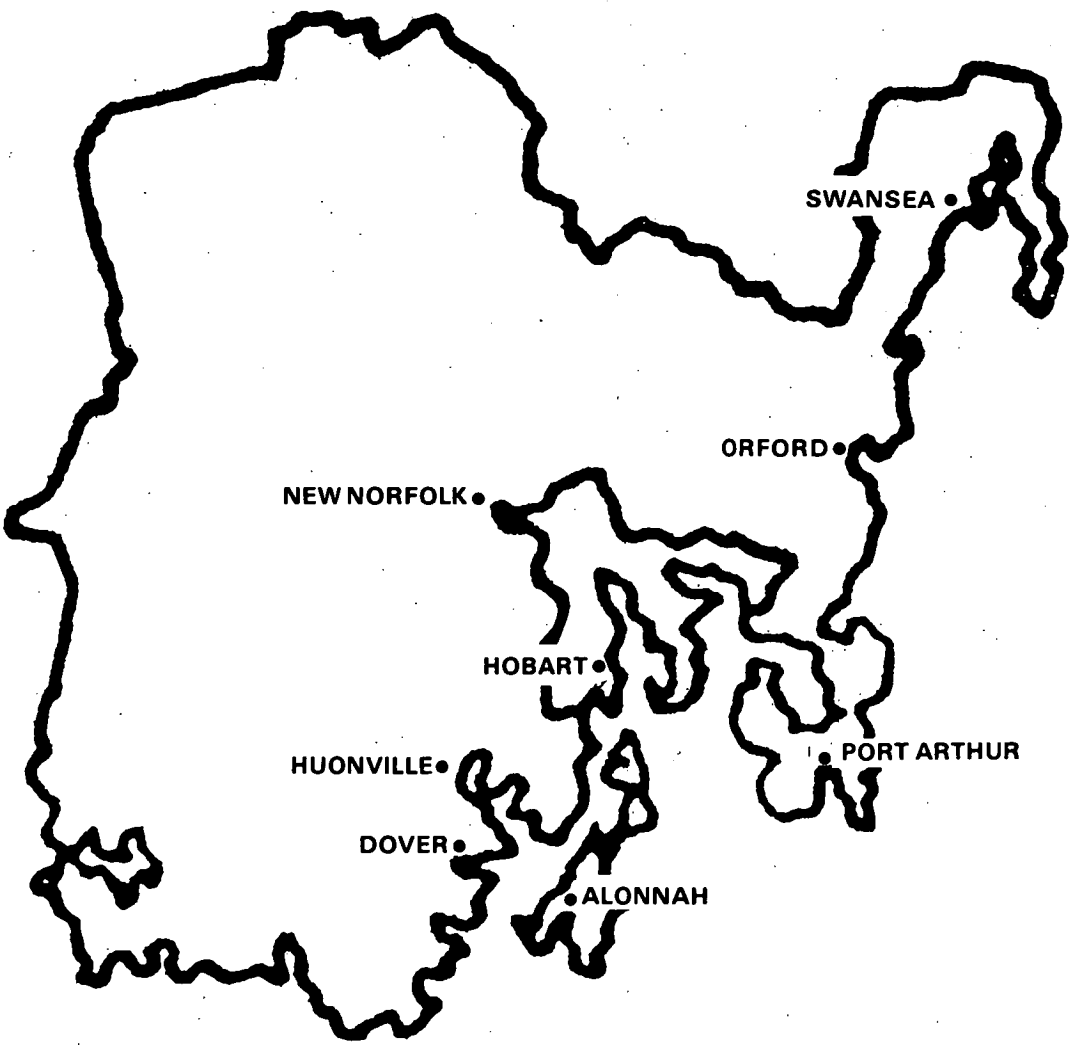
MAP OF TNT-9 PRIMARY COVERAGE AREA APPENDIX II



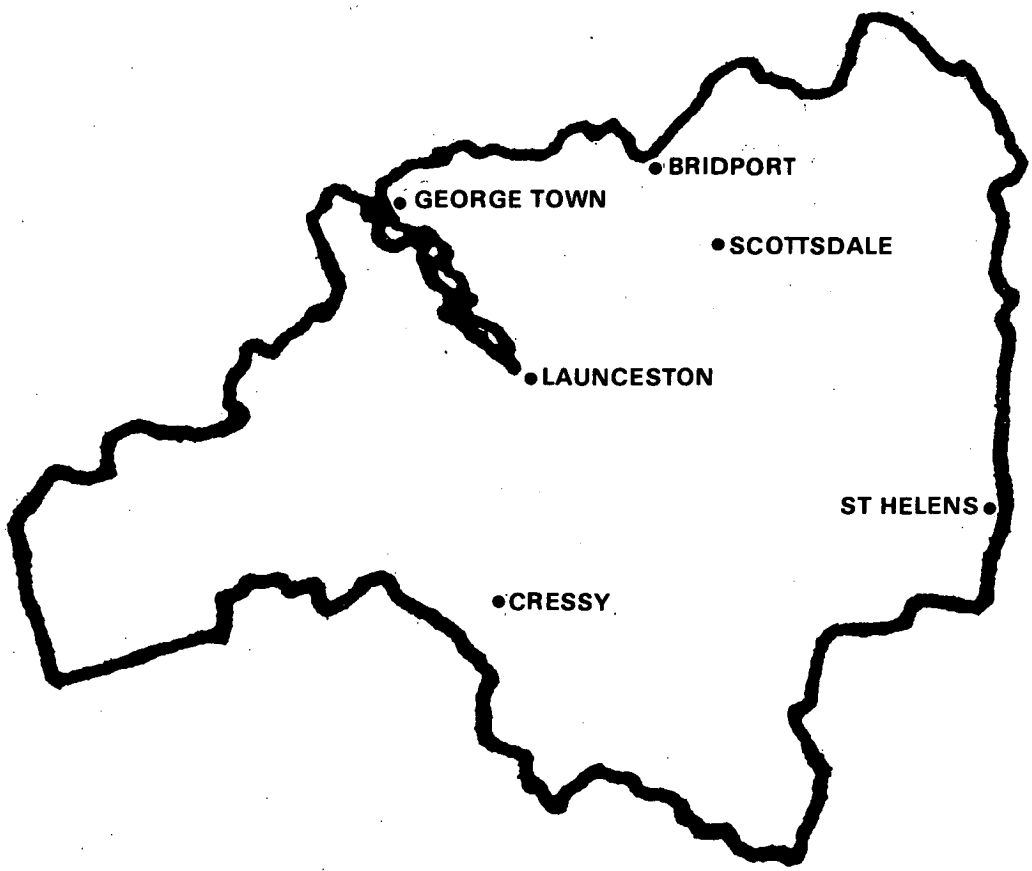
APPENDIX III
MAP OF TASMANIAN TOURISM REGIONS



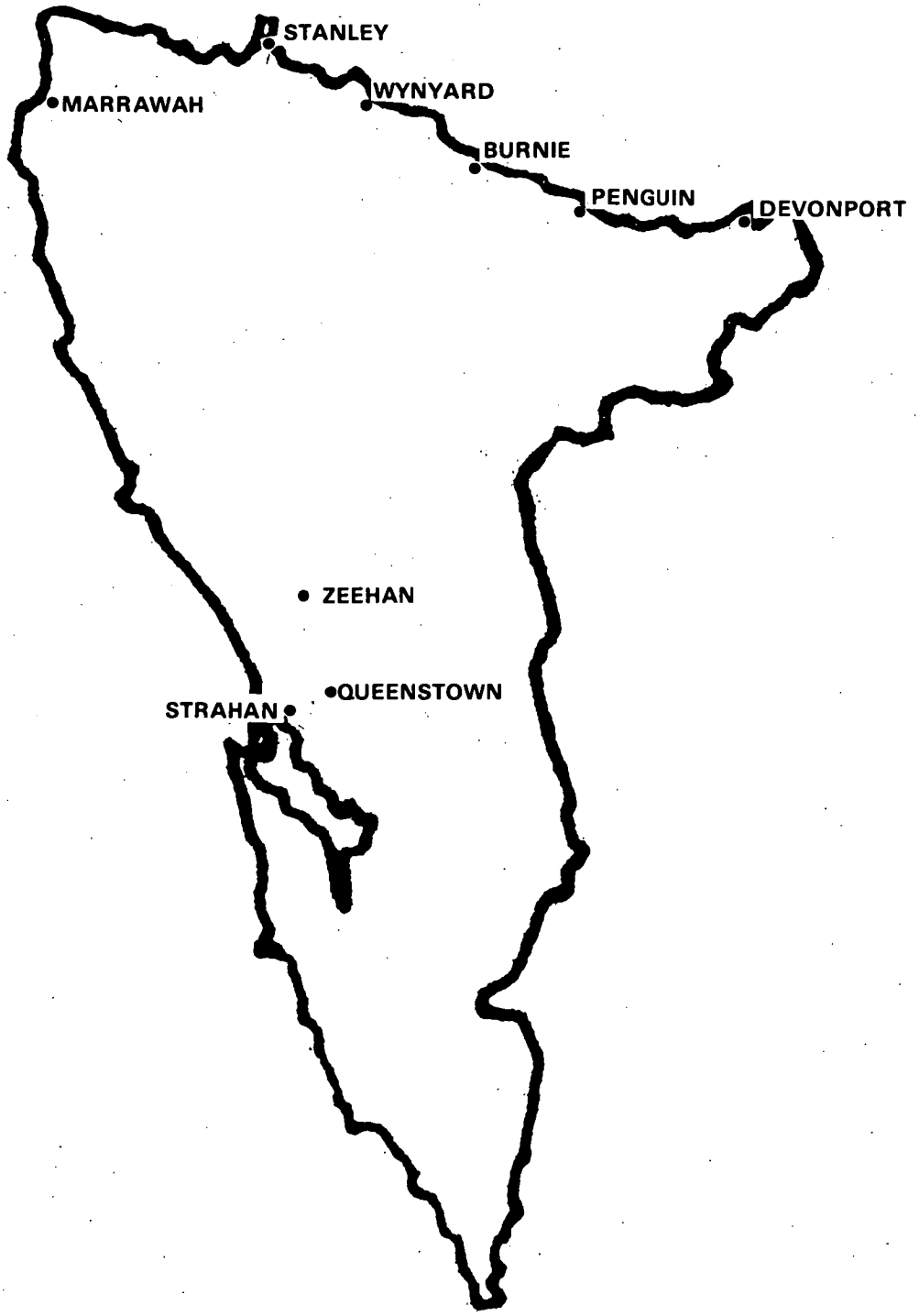
APPENDIX IV
MAP OF THE SOUTHERN ADVERTISING MARKET SEGMENT



APPENDIX V
MAP OF THE NORTHERN ADVERTISING MARKET SEGMENT



APPENDIX VI
MAP OF THE NORTH-WEST ADVERTISING MARKET SEGMENT



Appendix VII

Leading programmes by total persons (Tasmania television)

Ranking	Programmes	Total persons
1	60 Minutes	2251
2	Movies	2091
3	New Faces	2028
4	News, Sport and Weather	1993
5	Perfect Match	1978
6	Sale of the Century	1920
7	A Country Practice	1851
8	Sons and Daughters	1787
9	Knight Rider	1712
10	Movies	1700
11	The A Team	1685
12	Wonderful World of Disney	1653
13	The Big Event	1619
14	Movies	1606
15	Benny Hill Special	1586
16	Dateline Thursday	1473
17	Little House	1435
18	Young Talent Time	1427
19	Dallas	1411
20	The New Price Is Right	1398

These twenty leading programmes are ranked according to the highest quarter-hour audience in hundreds obtained over an average of the two surveyed weeks.

Source: Television audience survey
McNair Anderson, 1984.

Appendix VIII

Leading programmes - By total persons (TNT 9)

Ranking	Programmes	Total persons
1	60 Minutes	1197
2	Ford New Faces	1142
3	Perfect Match	1094
4	Sale of the Century	1064
5	News, Sport and Weather	1064
6	Movie of the Week	1061
7	A Country Practice	997
8	Sons and Daughters	976
9	The A-Team	904
10	Knight Rider	895
11	Movies	885
12	Wonderful World of Disney	861
13	The Big Event	858
14	Benny Hill	855
15	Midweek Movie	816
16	Dateline Thursday	801
17	The New Price Is Right	791
18	Little House - A new Beginning	783
19	Young Talent Time	763
20	Dallas	746

These twenty leading programmes are ranked according to the highest quarter-hour audience in hundreds obtained over an average of the two surveyed weeks.

Source: Television audience survey
McNair Anderson, 1984.

Appendix IX

State-wide readership of newspaper - All people by region

Newspapers	Regions	Persons reached	% population
Mercury	South	127,000	82.1
Examiner	North	70,000	70.0
Advocate	North-west	7,700	92.2
Tasmanian Mail	South	115,000	74.3
Tasmanian Mail	North	68,000	83.0
Tasmanian Mail	North-west	62,000	74.3

Source: Roy Morgan Research Centre
Australia-wide survey of readership of daily and Sunday papers in Tasmania. April 1982- March 1983.

Appendix X

Average audience reach of radio stations

Stations	Reach (a.m.)	Reach (p.m.)
7HO	19,500	9,100
7HT	8,100	4,900
7EX	6,300	3,000
7LA	2,700	1,300
7BU	4,400	1,200
7QT	3,000	1,000

Source: Radio survey by McNair Anderson, 1984.

Appendix XI

Technical appendix

AVERAGE AUDIENCE: Average audience is the number of people who listen (view or read) a particular station for an average quarter-hour during the session period shown, for example during a session of say 3 hours (12 quarter-hours). The audience for each quarter-hour is added and the total divided by 12 to arrive at an average quarter-hour figure.

COST-PER-THOUSAND: Advertising cost is computed on the basis of cost-per-thousand.
For print media cost-per-thousand (C.P.M.) is defined:

$$\text{C.P.M.} = \frac{\text{cost of 1 page x 1000}}{\text{number of prospects reached}}$$

For broadcast media C.P.M. is defined:

$$\text{C.P.M.} = \frac{\text{cost of 1 unit time x 1000}}{\text{Number of prospects reached by given program}}$$

CUMULATIVE AUDIENCE (OR REACH): Cumulative audience is the number of different people who listened to (viewed or read) at least one quarter-hour during the session period concerned, for example if a person listened to a particular station for one quarter-hour of a 3 hour session, that person is counted once in the same way as a person who may have listened for all 12 quarter-hours.

MEDIA APPROPRIATENESS: The qualitative factor of a given medium.

MEDIA EFFECTIVENESS: This refers to the optimum frequency of exposure for a given vehicle reach.

MEDIA EXPOSURE: This is the number of individuals either reading, viewing or listening to a particular advertisement within the given time.

MEDIA RATING: Media rating is a survey estimate of the size of an audience expressed as a percentage of the total group sample.

MEDIA REACH: This is a measure of message dispersion, indicating how widely the message will be received in a target universe.

MEDIA SCHEDULE: A listing of the media vehicles to be used, the size or length of the advertising and the exact time at which they can be shown.

MEDIA SELECTION: The process of choosing from all the alternative media vehicles available.

TARGET POPULATION: The group of individuals the advertiser wishes to reach with his/her advertisements.

Appendix XII

Department of Tourism promotional expenditure and passenger arrivals since 1948

Year	Passenger arrival	Promotional expenditure ($)
1948-49	115,836	7,799
1949-50	118,972	7,956
1950-51	127,118	8,162
1951-52	140,725	10,022
1952-53	127,278	6,740
1953-54	127,696	10,170
1954-55	133,536	14,470
1955-56	137,911	16,000
1956-57	147,995	21,300
1957-58	142,119	25,000
1958-59	147,868	26,494
1959-60	174,093	34,000
1960-61	178,514	39,500
1961-62	179,688	57,000
1962-63	187,909	58,496
1963-64	205,231	65,998
1964-65	225,803	72,998
1965-66	241,731	83,998
1966-67	259,671	88,897
1967-68	261,834	94,997
1968-69	279,464	99,999
1969-70	303,769	147,979
1970-71	331,415	169,998
1971-72	344,429	148,020
1972-73	398,250	158,500
1973-74	485,981	174,995
1974-75	512,686	270,000
1975-76	514,864	450,000
1976-77	509,728	580,000
1977-78	548,985	693,000
1978-79	570,272	890,000
1979-80	589,154	1,174,000
1980-81	589,451	1,344,000
1981-82	596,572	2,000,000
1982-83	562,758	2,000,000

Source: Department of Tourism, Hobart.

Appendix XIII

Intrastate trips and intrastate nights (July 1982-June 1983)

Main Destination	Intrastate trips '000	Intrastate nights '000
New South Wales	14,874	54,482
Australian Capital Territory	-	-
Victoria	11,289	33,714
Queensland	7,936	2,971
South Australia	3,185	15,966
Western Australia	3,840	15,966
Tasmania	1,556	4,521
Northern Territory	261	865

Source: Domestic travels in Australia, July 1982-June 1983.

Survey conducted by Roy Morgan Research Centre Pty Ltd, on behalf of the Australian Standing Committee on Tourism (ASCOT).

APPENDIX XIV

Advertising media alternatives for promoting travel within Tasmania in the southern segment

Advertising media "units"	Cost per single advert. $	Number of individuals exposed			No.of adverts Maximum no. of adverts
		Total exposure of medium	Exposure to employed individuals	Exposure to married individuals	
Morning TV 60 sec. TVT6	52	16,700	6,720	7,338	180
Evening TV 60 sec. TVT6	545	105,400	42,413	46,313	360
Newspaper ½page Mercury	1,042	127,000	51,105	55,804	56
Newspaper ½ page Tasmania Mail	620	115,000	46,276	50,531	24
Morning radio 30 sec. 7HO	34	19,500	7,847	8,568	20
Evening radio 30 sec. 7HO	13	7,100	3,662	3.999	10
Morning radio 30 sec. 7HT	30	8,100	3,259	3,559	20
Evening radio 30 sec. 7HT	17	4,900	1,972	2,153	10
Direct mail * size:20cm x 18cm 2 pages	19,040	201,060	80,907	88,346	3

* cost per unit of 63467 booklets at 30¢ each

APPENDIX XV

Advertising media alternatives for promoting travel within Tasmania in the northern segment

Advertising media "units"	Cost per single advert. $	Number of individuals exposed			No. of adverts Maximum no. of adverts
		Total exposure of medium	Exposure to employed individuals	Exposure to married individuals	
Morning TV 60 sec. TNT9	52	26,950	10,656	12,036	180
Evening TV 60 sec. TNT9	545	119,700	47,329	53,458	360
Newspaper ½ page Examiner	794	70,000	27,678	31,262	56
Newspaper ½ page Tasmanian Mail	443	68,000	26,887	30,328	24
Morning radio 30 sec. 7EX	22	6,300	2,491	2,810	20
Evening radio 30 sec. 7EX	14	3,106	1,186	1,338	10
Morning radio 30 sec. 7LA	16	2,700	1,068	1,204	20
Evening radio 30 sec. 7LA	9	1,300	514	580	10
Direct mail * size:20cm x 18 cm 2 pages	10,971	117,570	46,487	52,436	3

* cost per unit of 36571 booklets at 30¢ each

APPENDIX XVI

Advertising media alternatives for promoting travel within Tasmania in the north-west segment

Advertising media "units"	Cost per single advert. $	Number of individuals exposed: Total exposure	Exposure to employed	Exposure to married	No. of adverts Maximum no. of adverts
Morning TV 60 sec.	N O T I N C L U D E D				
Evening TV 60 sec.	N O T I N C L U D E D				
Newspaper ½ page Advocate	575	77,000	30,199	34,273	186
Newspaper ½ page Tasmanian Mail	354	62,000	24,316	27,596	24
Morning radio 30 sec. 7BU	11	4,400	1,726	1,958	40
Evening radio 30 sec. 7BU	7	1,200	471	534	20
Morning radio 30 sec. 7QT	10	3,000	1,177	1,335	40
Evening radio 30 sec. 7QT	9	1,000	392	445	20
Direct mail * size:20cm x 18cm 2 pages	9,572	108,570	42,577	48,321	3

* cost per unit of 31906 booklets at 30¢ each